DOCUMENT

51

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

DATE: January 5, 2015

TO: Bob Mosher

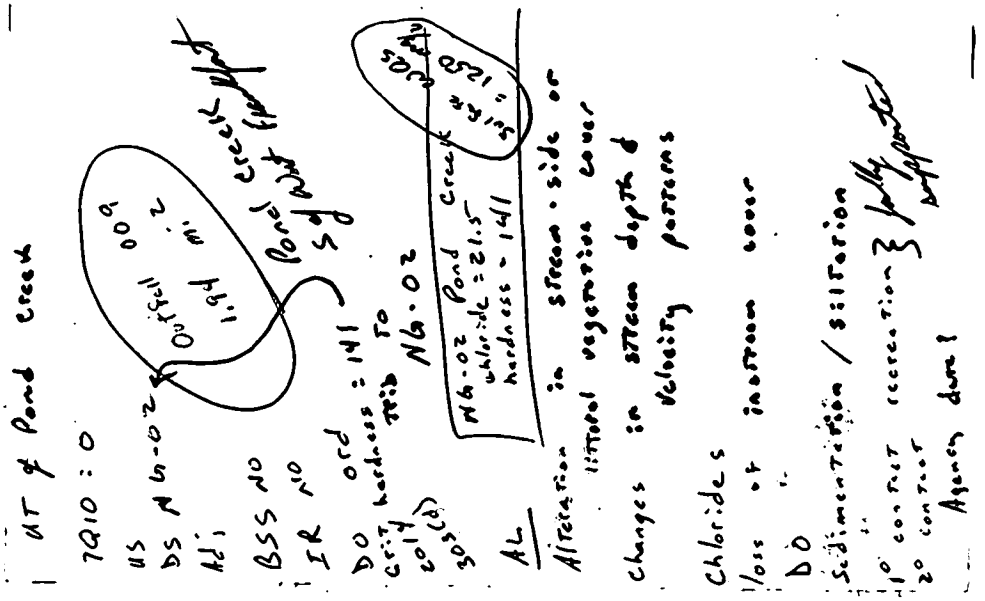
FROM: Joe Stitely

SUBJECT: Williamson Energy, LLC – Pond Creek Mine No. 1
NPDES Permit No. IL0077666
Information from IDNR/OMM Permit No. 417 Application

Attached please find a copy of information from the application for OMM Permit No. 417. This application is for Coal Refuse Disposal Area No. 3. Please consider the attached information as a request for an Anti-degradation Assessment and WQBEL Memo from your Section regarding this proposed operation and the requested discharge. If addition information is needed you may obtain such information directly from the Applicant. The Applicant's name and address is included in the attached documentation.

Thank you.

RECEIVED
JAN - 7 2015
Watershed Management Section



Schedule A

NG-02
-05
-04
} downstream

Assessed 3/3/2010

Discharge of Slurry Water

Anti-deg

Simon Stepp
217/710-7713

Williamson Co.
NE of Marion
Pond Creek

Williamson Energy, LLC

Pond Creek Mine No. 1

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part I, Pages 3 through 4

Contact Information

Permit Area Location

Type of Disturbance

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS PERMIT - UNDERGROUND OPERATIONS UCM-1

PART 1

(Application to be submitted 120 days (180 days for NPDES) prior to the desired effective date of the permit)

DATE: November 17, 2014

NOTICE

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill. Rev. Stat. 1989, ch. 96 1/2, par. 7901 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(I) ~~(We)~~ (The) Williamson Energy, LLC
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 300, Johnston City, IL 62951 (618) 983-3020
(Address) (Telephone Number)

hereby submit application # 417 for a permit to mine during a permit term of 5 years.

Type of Application:

[X] Underground Mining
[ ] Revision No. _____ to Permit No. _____
[ ] Shadow Area Addition
[ ] Renewal No._____ to Permit No. _____
[ ] Transfer of Permit No. _____
[ ] Acres to be added under renewal

Applicant's Social Security No. ____ (Voluntary) and/or Federal Employer Identification No. 20-0888529.

Name of Mine Pond Creek 1 Coal Refuse Disposal Facility No. 3,

List the Mine Safety and Health Administration (MSHA) number(s) for all mine associated structures that require MSHA approval.

RESPONSE: IL08-03141-03

I, Mark Schuerger [signature] Authorized Agent
Name Signature Title

under penalties of perjury declare that I have examined this application, including accompanying statements and documents and to the best of my knowledge it is true, and correct. (Signee must be at least a vice president or duly authorized representative for NPDES 35 Ill. Adm. Code 309.103(e)

This application is also to be used to apply for a:

IEPA Subtitle D (State) Permit Yes ___X___ No _____ NPDES Yes ___X___ No _____

New ___X___

Renewal No. _____ Date: _____

Renewal No. _____ Date: _____

Modification No. _____ Date: _____

Modification No. _____ Date: _____

If this is an application for a NPDES permit, the Consolidated Permits Program - Application Form 2C (renewal), Form 2D (new), or Form 2E (sanitary) must be completed.

B) I _____
(vice president or his duly authorized representative)

hereby waive my right of the 90-day permit issuance deadline as required by the Illinois Environmental Protection Act, Section 39(a)(4) and the Illinois Pollution Control Board Rules and Regulations, 35 Ill. Adm. Code 309.225(c).

C) Who will be the operator of the permit site?

Name **Mach Mining, LLC**

Pursuant to 62 Ill. Adm. Code 1701.5 an operator is any person engaged in coal mining who removes or intends to remove more than 250 tons of coal.

If the operator is different from the applicant, provide the following information.

1) Operator's address **P.O. Box 300**
Johnston City, IL 62951
2) Operator's telephone No. **(618) 983-3020**
3) Operator's Social Security No. _____
(voluntary) and/or Federal Employer Identification No. **73-1734826**

D) Who will extract coal under this permit?

Name **Mach Mining, LLC**

If different from applicant or operator provide the following:

1) Address **P. O. Box 300**
Johnston City, IL 62951

2) Telephone No. **(618) 983-3020**

3) Social Security No. (Voluntary) and/or federal employer identification No.
_____

E) Who will pay abandoned mine land reclamation fees?

Name **Williamson Energy, LLC**

If the person paying the abandoned mine land reclamation fee is different from the applicant, provide the following information.

1) Address _____

_____

_____

2) Telephone No. _____

3) Payee's Social Security No. _____

(voluntary) and/or Federal Employer Identification No. _____

F) The permittee requests a permit on the following area as shown on the permit map.

Mine Address	Pit No. or Name	Acres to be Permitted	Sec.	Twp.	Range	County
16468 Liberty School Road, Marion IL 62959	**Refuse Disposal Facility No. 3**	**2.61**	**12**	**T8S**	**R3E**	**Williamson**
	Refuse Disposal Facility No. 3	**227.17**	**7**	**T8S**	**R4E**	**Williamson**

Total Acres **229.78**

G) Indicate the type of disturbance and associated acreage.

Acres		Type of Disturbance
0.00		Deep Mine Entries, Ventilation, Air Shafts
203.87		Mine Waste Areas
0.00		Processing Areas & Support Facilities
0.00		Access, Haul Roads, & Transport Facilities
0.00		Soil Storage Areas
25.91		Diversions
0.00		Other
0.00		Not to be Disturbed

H) For each phase (permit) of the proposed surface coal mining and reclamation operation over the life of the mine provide the anticipated or actual starting and termination date and the anticipated number of acres to be affected. Designate the boundaries of each phase on the pre-mining land use map or other designated map.

Phases (Permits)	Starting Date	Termination Date	Acres to be Affected
Stage 1	**Feb., 2013**	**May, 2014**	**229.78**
Stage 2	**May, 2014**	**Aug. 2015**	**229.78**

Stage 3	Aug. 2015	July, 2022	229.78
Stage 4	July, 2022	Nov., 2025	229.78
Abandonment	Oct., 2029	Oct., 2034	229.78

2) A) Provide name and address of every legal or equitable owner of record of the permit area, and the mineral property to be mined.

RESPONSE: Refer to Attachment I.2.A

B) Provide name and address of the owner of record for all surface and subsurface areas contiguous to any part of the proposed permit area.

RESPONSE: Refer to Attachment I.2.B

C) Show location of owners of record of those lands, both surface and subsurface, included in or contiguous to the permit area on premining land use map or another map, if necessary.

RESPONSE: Refer to Map 2, Identification of Interest

3) A) Provide name and address of any holder of record of leasehold interest for the permit area, and the mineral property to be mined.

RESPONSE: No holder of record of leasehold interest and no mineral removal is proposed to be mined in this application.

B) Provide a statement of all lands, interest in lands, options or pending bids on interest held or made by the applicant for lands which are contiguous to the permit area.

RESPONSE: N/A

4) Provide name and address of any purchaser of record under a real estate contract of the property for the permit area.

RESPONSE: N/A

5) A) The applicant is: ____X__ corporation, _____ partnership, _____ single proprietorship, _____ association or other business entity.

B) For the resident agent who will accept service of process for the applicant provide the following information.

1) Name of resident agent **Illinois Corporation Service Company**

2) Address **801 Adlai Stevenson Drive, Springfield, IL 62703**

3) Telephone No. **(800) 877-2556**

4) Social Security No. _____ (voluntary) and/or Federal Employer Identification No. **81-0669143**.

6) OWNERSHIP AND CONTROL INFORMATION

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part III, Pages 1 through 5

Chemical Analysis of

Overburden Discussion

Part III

HYDROGEOLOGIC INFORMATION

1) Regional Hydrogeologic Characteristics
As described in Illinois State Geological Survey Circulars 192, 198, 207, 212, 222, 225, 232, 248, Coop 1, etc., other sources or personal knowledge provide the following required hydrogeologic information.

A) Describe the major and minor surficial aquifers of the permit area and adjacent areas.

RESPONSE: **Major surficial aquifers – None**
Minor surficial aquifers - Scattered sand and gravel in the Saline River and Big Muddy River valleys and their larger tributaries.

B) List the major and minor drift, bedrock valley, and buried bedrock valley aquifers of the area.

RESPONSE: **Major drift aquifers - None.**
Minor drift aquifers - Drift filled valleys associated with the Saline River and Big Muddy Rivers and their larger tributaries; and isolated sand and gravel lenses contained within glacial till.
Major bedrock valley aquifers - None.
Minor bedrock valley aquifers – None.
Major buried bedrock valley aquifers – None.
Minor buried bedrock valley aquifers - Big Muddy River Buried Valley system.

C) List the major and minor bedrock aquifers in the area.

RESPONSE: **Major bedrock aquifers - None.**
Minor bedrock aquifers - Pennsylvanian age coal seams, limestones and sandstones; and Mississippian age limestones.

D) List the generalized water yield, supply, and potential use of these aquifers.

RESPONSE: **Proposed Coal Refuse Disposal Facility No. 3 is located in the glaciated upland area of northern Williamson County. It is situated at the headwaters of the major drainage systems of the region. In this area, no specific geologic unit has been identified as a major surficial aquifer. According to Illinois State Geological Survey (ISGS) Circular 212, "the best potential sources of large supplies of water are sand and gravel deposits in the major valley systems. Unfavorable conditions generally prevail elsewhere because water yielding sand and gravel is absent, the bedrock formations are tight, or the available groundwater is of poor quality". No major aquifers exist in the permit or adjacent area. However, minor surficial aquifers associated with a few drift-filled valleys north and west of the permit area may, in some instances, be capable of supplying enough water for relatively small commercial, industrial, municipal or irrigation purposes. Sand and gravel aquifers, where present, generally yield 20 gallons per minute or more. The Pennsylvanian and Mississippian age bedrock aquifers can usually provide only enough water for individual domestic supplies. Yields from wells completed in these formations are usually less than 10 gallons per minute with yields less than 5 gallons per minute common. The low permeabilities of the Pennsylvanian System rocks cause the water in the deeper formations to be highly mineralized. Therefore, some deeper bedrock aquifers may contain water whose quality is unsatisfactory without expensive treatment and, generally, are not developed. Recharge to these bedrock aquifers is primarily from precipitation which percolates into and through the overlying unconsolidated materials. Recharge primarily takes place at outcrop areas for the various bedrock units.**

2) Area Specific Hydrogeologic Characteristics

A) 1) Provide a description of the areal and structural geology of the permit, shadow area and adjacent areas for the deeper of either the stratum immediately below the lowest coal seam to be mined, or any aquifer below the lowest coal seam to be mined which may be adversely impacted by mining. Provide logs showing the lithologic characteristics including physical properties and thickness of each stratum and the location of groundwater where encountered. Provide location and elevations of test borings or core samplings on pre-mining land use map or other designated map.

RESPONSE: **A network of twenty (20) borings, some of which were associated with the installation of groundwater monitoring wells, have been completed at the Proposed Coal Refuse Disposal Facility No. 3 and used for characterizing the horizontal and vertical distribution of the clay till at that location. These borings are denoted as BH-4, BH-5, BH-6, GW-7A, GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14, GW-28, B-1, B-2, B-3, B-4, B-5, B-7, C-1, C-2, and D-1. This cumulative network of 20 borings/wells has been used to develop a series of six (6) geologic cross sections, denoted as sections I - I′ through N - N′ (Drawing Nos. B12-271-M17 through B12-271-M22). The location of each well/boring and also the specific locations of the aforementioned geologic cross sections are illustrated on the Geologic Cross Sections Location Map (Drawing No. B12-271-E1).**

As depicted on the Geologic Cross Sections Location Map, the Proposed Coal Refuse Disposal Facility No. 3 area is proposed to be constructed by adding on to the existing refuse facility. The floor elevations have been illustrated upon the geologic cross sections at pertinent locations. This methodology allows a visual depiction of the subsurface geology relative to the proposed cuts and facility floor elevations.

Upon reviewing the geologic cross sections, it is readily apparent that the deposit of thick clay till earlier identified beneath the site of nearby Coal Refuse Disposal Facility No. 2 also immediately underlies the Proposed Coal Refuse Disposal Facility No. 3 area. All six (6) of the geologic cross sections demonstrate this clay till unit to be laterally continuous across the entire expanse of the proposed permit area. The north end (floor El. 430) of the propose refuse area is transected by geologic cross sections J - J′, L - L′, M - M′ and N - N′. The south end of the Proposed Coal Refuse Disposal Facility No. 3 area is transected by geologic cross sections K - K′, L - L′ and M - M′. Geologic cross sections M - M′, N - N′ and L - L′, have had floor elevations projected into those sections.

In order to evaluate the clay till unit's permeability at the Proposed Coal Refuse Disposal Facility No. 3 area, samples of this material were recently tested by Holcomb Foundation Engineering Co., Inc. (Holcomb). In addition to the permeability data already existing from earlier testing of this unit at boring/well GW-7A located at the site containing Coal Refuse Disposal Facility Nos. 1 and 2 on Permit 375, an additional four (4) samples were tested by Holcomb during July 2009. These till samples originated from Shelby tube samples obtained during recent drilling of borings/wells BH-4, BH-5, BH-6, GW-12, GW-13 and GW-14 at the Proposed Coal Refuse Disposal Facility No. 3 area.

The Shelby tube samples tested are all from the clay till, at depths which are equal to or lower than the proposed floor cut elevations at the facility. The specific locations/depths from which these Shelby tube samples were collected are delineated on the geologic cross sections. For purposes of comparing the in-situ (undisturbed Shelby tube sample) material's permeability values to those acquired through remolding the clay till at 95%

Standard Proctor dry density, two (2) samples by each of these methodologies were tested by Holcomb. The representative in-situ samples came from borings BH-5 and BH-4. Holcomb reported the permeability testing results as 3 x 10^{-8} cm./sec. and 2 x 10^{-7} cm./sec. respectively for those samples.

Composite samples were generated for the remolded material testing, and one composite was made by combining one Shelby tube sample from GW-12 with two (2) Shelby tube sample intervals from GW-13. Holcomb reported the permeability test value as 1 x 10^{-7} cm./sec. for this sample, which had been remolded at 95% Standard Proctor dry density. The second composite was prepared by combining one Shelby tube sample from each of GW-14 and BH-6, and then remolding at 95% Standard Proctor dry density. Holcomb reported the permeability test value for this sample as 1 x 10^{-7} cm./sec. as well.

2) Provide chemical analyses of each stratum down to and including the deeper of either the stratum immediately below the lowest coal seam to be mined or any aquifer below the lowest coal seam to be mined which may be adversely impacted by mining.

The analyses shall identify those strata that may contain acid or toxic-forming or alkalinity-producing materials and determine their content.

RESPONSE: Acid base accounting has been provided in Attachment III.2.A.2.

3) Provide coal seam(s) name and number and an analysis of the coal seam(s) as to total sulfur and pyritic sulfur. On the pre-mining land use, operation, or other designated map show all coal crop lines and the strike and dip of the coal to be mined.

RESPONSE: The sulfur forms for the Herrin No. 6 coal seam are contained in Attachment No. III.2.A.3. The strike and dip are shown on Drawing No. B12-271-E1.

4) For room and pillar mining operations, the thickness and engineering properties of clay or soft rocks such as clayshale, if any, in the stratum immediately above and below each coal seam to be mined.

RESPONSE: N/A

5) Applicants may request that the Department waive in whole or in part the information required under questions 2 thru 4 above. Waiver requests should be submitted to the Department for review prior to submission of an application. Applications containing unapproved waiver requests may result in prolonging the application review or in application denial.

RESPONSE: N/A

B) Ground Water Information

1) Provide the location on the hydrologic map or other designated map, and ownership of existing wells, springs, and other ground water resources for the permit area and adjacent area.

RESPONSE: **Refer to Map 2 – Identification of Interests (Drawing No. B12-271-E7) and Map 4 – Hydrogeologic Map (Drawing No. B12-271-M23). Hydrologic Information for information regarding the location and ownership of existing wells and other ground water supplies.**

2) Provide a description of seasonal ground water quality including at a minimum the following:
   - pH
   - total dissolved solids
   - hardness
   - alkalinity
   - acidity
   - sulfates
   - total iron
   - total manganese
   - total chlorides

RESPONSE: Refer to Attachment III.2.B.2 for the ground water quality data. Groundwater quality sampling and laboratory analysis has been performed for seven (7) groundwater monitoring wells (GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28) located at/near proposed RDA No. 3. The location of each of these wells is presented upon the Geologic Cross Sections Location Map (Drawing No. B12-271-E1). Submitted are laboratory analytical reports for these samples, which were collected on a quarterly basis spanning the third and fourth calendar quarters of 2013 and the first and second quarters of 2014. Excepting only GW-8R which was dry during the third and fourth quarter 2013 sampling events, all other wells were recorded as having water present for sampling during the year.

Based upon this suite of groundwater analyses, the pH of these wells was characteristically circum-neutral, with the highest pH in the data set measuring 7.5 and the lowest 6.6. As would be expected from that pH range, the groundwater has considerably higher alkalinity in comparison to acidity. Alkalinity ranged from a high of 800 to a low of 190 mg/L; and, acidity spanned from < 10 up to 150 mg/L. Hardness is very high in all samples, with a low of 292 and high of 3800 mg/L. Total dissolved solids (TDS) and sulfates were also characteristically high to very high, with TDS spanning between a low of 638 and high of 5736 mg/L and sulfates between a low of 284 and high of 3730 mg/L. Total iron was variable even on an intrawell basis, with same-well concentration ranging from below the method detection limit to a high of 3.072 mg/L in GW-14 during the year. Other wells too exhibited notable iron concentration fluctuations. Total manganese likewise exhibited variable intrawell concentration, along with considerable variability between wells. Both the sampling events where water was present in well GW-8R exhibited high total manganese, with reporting of 7.107 and 9.124 mg/L. In the other wells, total manganese values spanned from below the method detection limit up to 8.630 mg/L. In collective consideration of the aforementioned parameters and concentrations, the existing shallow groundwater quality on/near proposed RDA No. 3 is regarded to be poor.

3) Provide a description of seasonal ground water quantity including at a minimum the appropriate rates of discharge or usage and the elevation of potentiometric surface of the coal to be mined, and in each water-bearing stratum above the coal to be mined, and in each water-bearing stratum below the coal to be mined which may be potentially impacted.

RESPONSE: **Groundwater usage and rates of discharge are regarded as nominal on/near RDA No. 3. No domestic groundwater users have been identified in the area. Surface watercourses in this local area characteristically exhibit significant periods of no flow, which is indicative of no to only very limited timeline groundwater contribution to surface water flow at/near RDA No. 3. Clayey till is deposited across the RDA No. 3 area, and the till is characteristically underlain by shale. This geologic setting impedes productive groundwater recharge, and inherently provides a hydrogeologic setting where both horizontal and vertical permeabilities are low/very low. To further demonstrate the geology and hydrogeology of this area, Geologic Cross Section AA - AA' (Drawing No. B12-271-E15) has been prepared. That drawing exhibits the available field sampling and corresponding laboratory testing of the till across the currently permitted RDA Nos. 1 and 2, as well as proposed RDA No. 3. The drawing also exhibits permeability data acquired during slug testing of some of the groundwater monitoring wells in the area, along with the monitoring (i.e. screened) interval within those wells. As evident on the drawing, the monitoring interval within some of the slug tested wells includes the top of bedrock underlying the till. Regardless, all results from both slug testing as well as laboratory testing of till consistently demonstrate remarkably low permeability values, which documents that there is nominal to no potential for any appreciable quantity of groundwater to be transported by these hydrostratigraphic horizons across the proposed RDA No. 3 area. As an added measure of hydrogeologic evaluation, the same sandstone unit that was reviewed on the RDA Nos. 1 and 2 locations was also reviewed at the proposed RDA No. 3 site. The drawing titled Sandstone Unit Isopach Map (Drawing No. B12-271-E14) depicts this sandstone's thickness as well as the layout/location of Geologic Cross Section AA-AA'. As evident upon viewing the isopach map, this sandstone unit is laterally discontinuous and the vast majority of RDA Nos. 1, 2 and 3 either have the unit absent beneath them or else it characteristically is at a thickness of 3 feet or less.**

Groundwater elevation measurements recorded on February 27, 2014 for monitoring wells GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28 were used to generate a Potentiometric Surface/Water Table Map (Drawing No. B12-271-E17) for the shallow water bearing zone. The groundwater surface contours were constructed on a 5-foot elevation contour interval. The map illustrates that the groundwater flow direction is in a northerly direction across the site. The calculated hydraulic gradient based on those contours is 0.007 ft./ft.

C) Surface Water Information

1) Provide the name, location, ownership, and description of all surface water bodies, lakes, streams, impoundments, and springs within and adjacent to the proposed permit and shadow areas. Provide the location of any discharge or drainage into any surface water bodies listed above.

RESPONSE: **There are no surface water bodies, lakes or impoundments or springs within or adjacent to the permit area. There are six surface water sampling points designated as PC 1, PC 2, PC 3, PC4 , C 1 and C 2. PC 1 is Pond Creek Below Unnamed Tributary PC 1. PC 2 is PC 2 Pond Creek Below Unnamed Tributary from Plan Area. PC 3 is PC 3 Pond Creek Above Unnamed Tributary PC 4. PC 4 is PC 4 Unnamed Southeast Corner Upstream of RR Spur. C 1 is C 1 – East Unnamed Tributary Upstream of Corinth Road. C 2 is C 2 – West Unnamed Tributary Upstream of Corinth Road. The project area will directly impact two stream channels that were identified as intermittent with the Corps of Engineers; however, neither of these channels meets the definition found in IL 62 1701 which defines an intermittent stream as ""Intermittent stream" A stream or reach of a**

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part III, Pages 5 through 11

Stream Information

And

Sampling Results

Attachment III (2)(C)(2)

RESPONSE: **Groundwater usage and rates of discharge are regarded as nominal on/near RDA No. 3. No domestic groundwater users have been identified in the area. Surface watercourses in this local area characteristically exhibit significant periods of no flow, which is indicative of no to only very limited timeline groundwater contribution to surface water flow at/near RDA No. 3. Clayey till is deposited across the RDA No. 3 area, and the till is characteristically underlain by shale. This geologic setting impedes productive groundwater recharge, and inherently provides a hydrogeologic setting where both horizontal and vertical permeabilities are low/very low. To further demonstrate the geology and hydrogeology of this area, Geologic Cross Section AA - AA' (Drawing No. B12-271-E15) has been prepared. That drawing exhibits the available field sampling and corresponding laboratory testing of the till across the currently permitted RDA Nos. 1 and 2, as well as proposed RDA No. 3. The drawing also exhibits permeability data acquired during slug testing of some of the groundwater monitoring wells in the area, along with the monitoring (i.e. screened) interval within those wells. As evident on the drawing, the monitoring interval within some of the slug tested wells includes the top of bedrock underlying the till. Regardless, all results from both slug testing as well as laboratory testing of till consistently demonstrate remarkably low permeability values, which documents that there is nominal to no potential for any appreciable quantity of groundwater to be transported by these hydrostratigraphic horizons across the proposed RDA No. 3 area. As an added measure of hydrogeologic evaluation, the same sandstone unit that was reviewed on the RDA Nos. 1 and 2 locations was also reviewed at the proposed RDA No. 3 site. The drawing titled Sandstone Unit Isopach Map (Drawing No. B12-271-E14) depicts this sandstone's thickness as well as the layout/location of Geologic Cross Section AA-AA'. As evident upon viewing the isopach map, this sandstone unit is laterally discontinuous and the vast majority of RDA Nos. 1, 2 and 3 either have the unit absent beneath them or else it characteristically is at a thickness of 3 feet or less.**

Groundwater elevation measurements recorded on February 27, 2014 for monitoring wells GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28 were used to generate a Potentiometric Surface/Water Table Map (Drawing No. B12-271-E17) for the shallow water bearing zone. The groundwater surface contours were constructed on a 5-foot elevation contour interval. The map illustrates that the groundwater flow direction is in a northerly direction across the site. The calculated hydraulic gradient based on those contours is 0.007 ft./ft.

C) Surface Water Information

1) Provide the name, location, ownership, and description of all surface water bodies, lakes, streams, impoundments, and springs within and adjacent to the proposed permit and shadow areas. Provide the location of any discharge or drainage into any surface water bodies listed above.

RESPONSE: **There are no surface water bodies, lakes or impoundments or springs within or adjacent to the permit area. There are six surface water sampling points designated as PC 1, PC 2, PC 3, PC4 , C 1 and C 2. PC 1 is Pond Creek Below Unnamed Tributary PC 1. PC 2 is PC 2 Pond Creek Below Unnamed Tributary from Plan Area. PC 3 is PC 3 Pond Creek Above Unnamed Tributary PC 4. PC 4 is PC 4 Unnamed Southeast Corner Upstream of RR Spur. C 1 is C 1 – East Unnamed Tributary Upstream of Corinth Road. C 2 is C 2 – West Unnamed Tributary Upstream of Corinth Road. The project area will directly impact two stream channels that were identified as intermittent with the Corps of Engineers; however, neither of these channels meets the definition found in IL 62 1701 which defines an intermittent stream as ""Intermittent stream" A stream or reach of a**

stream that drains a watershed of at least one square mile; or a stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge." These two channels have a drainage area of approximately 40.58 acres (cumulatively) or 0.06 square miles at the downstream end. Additionally, no groundwater influence can be observed within these channels. One area of affect will occur within the buffer zone of an intermittent or perennial stream along the north portion of the project area. The stream resources within the project area are shown on Drawing No. B08-467-E20 contained within Attachment II.9 and riparian buffer zone with areas of encroachment has been shown on Map 6 SF. This area of intrusion into the buffer zone must occur in order to allow for drainage from Pond No. 9 into offsite drainage features.

The surface water sampling sites are the approved NPDES outfalls for the NPDES Permit No. IL0077666. This NPDES permit is for the adjacent permit which is used to dispose of the same refuse which is proposed to be disposed of at this site. Therefore, the water quality is assumed to be similar to that which will occur at this site.

2) Provide for surface water bodies listed under 2)(c)(1) above information on surface water quality and quantity sufficient to demonstrate seasonal variation and water usage.

a) Water quality description shall include at a minimum, baseline information as follows:

pH
total suspended solids
total dissolved solids
alkalinity
acidity
sulfates
total iron
total manganese
total chlorides

RESPONSE: See Attachment III.2.C.2. for baseline monitoring information of surface water streams in the permit area.

b) Water quantity description shall include at a minimum base information on seasonal flow rates.

RESPONSE: See Attachment III.2.C.2. for information on flow rates during the monitoring period. The data reflect significant periods of "no flow" that are typical of ephemeral headwater steams in the area. Most of the streams only flow in direct response to rainfall. Thus, the flow rates vary depending on the size of the watershed, antecedent moisture conditions and the amount of precipitation.

D) Protection of Hydrologic Balance

1) The applicant shall provide a determination of the probable hydrologic consequences, (PHC) on the proposed permit area, proposed shadow area, and adjacent areas with respect to the hydrologic regime and water quality and quantity in surface and ground

water systems under all seasonal conditions. The determination of PHC shall include findings on the following:

a) Will the proposed operation have adverse impacts to the hydrologic balance;

RESPONSE: **Construction of the proposed Coal Refuse Disposal Facility No. 3 will disturb the land surface and will inevitably result in some changes to the surface water and ground water systems due to changes in drainage patterns and storm water runoff characteristics. However, the proposed surface facility has been designed to minimize potential changes to the prevailing hydrologic balance within the permit and adjacent area.**

Existing surface water runoff from the permit area is primarily in a northerly direction through unnamed tributaries of Pond Creek and then westwardly to the Big Muddy River. Surface water will be directed through a constructed sedimentation structure which surrounds the refuse facility to an unnamed tributary of Pond Creek. This structure is designed to provide stormwater and sediment control for the entire refuse disposal facility.

The effects on surface water quality are expected to be negligible in part because the impoundment comprises a large portion of the permit area and provides additional stormwater and sediment control during its operation (approximately 86 acres of the 263.44 permitted acres or 32.6%). This will minimize the contribution of suspended solids into surface water. The remaining area, which is primarily the outslopes of the dam will be directed to the sedimentation structure prior to off-site discharge. Impoundment construction activities will expose coal refuse to oxygen and surface water, which may increase the total dissolved solids in surface runoff. However, the coarse coal refuse is continuously being deposited and is being compacted as it is placed which minimizes the contact time with oxygen and water. During site reclamation, coal refuse is to be covered with soil to minimize contact with precipitation, surface water runoff and oxygen. Should runoff from the refuse disposal area develop acidic characteristics, the runoff will be neutralized to meet water quality standards prior to discharge from the sediment control system.

The potential development of acidic conditions is to be monitored through the routine sampling and analyses of discharge from Outlet 009 in accordance with the facility's NPDES permit. Should a trend indicating declining pH values become apparent, a treatment plan will be developed which may include one or a combination of the following actions:

- **Addition of alkalinity to coarse refuse by application and incorporation of agricultural or ground limestone or hydrated lime at an appropriate rate to neutralize the acidity.**

- **Addition of sodium hydroxide or hydrated lime to the sediment control structure at appropriate rates sufficient to neutralize the acidity.**

During refuse disposal and reclamation activities, erosion and sediment control measures are to be utilized in disturbed areas in order to minimize potential contamination of surface water runoff. During refuse disposal operations, sediment loading could improve over pre-mining conditions as a result of utilizing best management practices such as establishing and maintaining vegetative cover in areas that are currently cropland, construction of sedimentation structures, and decreasing peak flows and velocities by

retaining storm water runoff in the impoundment. As a result of the increased mineralization discussed above, which tends to cause fine suspended particles to coalesce and settle, suspended solids may be lowered as a result of the proposed activities. Flocculants or coagulants may be used if necessary. Runoff from within the permit area which has the potential to come into contact with coal refuse will pass through the approved sedimentation control structure prior to release from the permit area.

Surface Facility Impacts to Groundwater

Facility design includes the construction of maintaining a minimum of 4 feet of in situ clay in the coal refuse disposal area and the sedimentation control structure that receives runoff from the coal refuse disposal area. This clay will minimize vertical percolation of precipitation and surface water which comes into contact with coal refuse and consequently minimize impacts to groundwater. The thickness of the clay, proposed grades for construction of Refuse Area No. 3, and permeability of the in situ clays are shown on Drawing No. B12-271-E15 entitled, "Geologic Cross Section AA-AA'", Drawing No. B12-271-M17 entitled, "Geologic Cross Section I-I'", Drawing No. B12-271-M18 entitled, Geologic Cross Section J-J'", and Drawing No. B12-271-M19 entitled, "Geologic Cross Section K-K'". Although sandstone exists in the permit area, it is discontinuous and generally less than 10 feet in thickness in areas where it exists. Drawing No. B12-271-E14 entitled, "Sandstone Unit Isopach Map" exhibits that unit's thickness. Groundwater in the permit area flows primarily to the north as shown on Drawing No. B12-271-E17 entitled, "Potentiometric Surface/Water Table Map for Groundwater Levels Recorded on February 27, 2014".

During final reclamation of the site, coal refuse is to be covered with clean soil which will minimize infiltration and consequently minimize impacts to groundwater resources (refer to Part V for details).

Existing Groundwater Quality

Groundwater quality sampling and laboratory analysis has been performed for seven (7) groundwater monitoring wells (GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28) located at/near proposed RDA No. 1. The location of each of these wells is presented upon the Geologic Cross Sections Location Map (Drawing No. B12-271-E1). Submitted are laboratory analytical reports for these samples, which were collected on a quarterly basis spanning the third and fourth calendar quarters of 2013 and the first and second quarters of 2014. Excepting only GW-8R which was dry during the third and fourth quarter 2013 sampling events, all other wells were recorded as having water present for sampling during the year.

Based upon this suite of groundwater analyses, the pH of these wells was characteristically circum-neutral, with the highest pH in the data set measuring 7.5 and the lowest 6.6. As would be expected from that pH range, the groundwater has considerably higher alkalinity in comparison to acidity. Alkalinity ranged from a high of 800 to a low of 190 mg/L; and, acidity spanned from <10 up to 150 mg/L. Hardness is very high in all samples, with a low of 292 and high of 3800 mg/L. Total dissolved solids (TDS) and sulfates were also characteristically high to very high, with TDS spanning between a low of 638 and high of 5736 mg/L and sulfates between a low of 284 and high of 3730 mg/L. Total iron was variable even on an intrawell basis, with same-well concentration ranging from below the method detection limit to a high of 3.072 mg/L in GW-14 during the year. Other wells too exhibited notable iron concentration fluctuations. Total manganese likewise exhibited variable intrawell concentration, along with considerable variability between wells. Both the sampling events where water was present in well GW-8R

exhibited high total manganese, with reporting of 7.107 and 9.124 mg/L. In the other wells, total manganese values spanned from below the method detection limit up to 8.630 mg/L. In collective consideration of the aforementioned parameters and concentrations, the existing shallow groundwater quality on/near proposed RDA No. 3 is regarded to be poor.

A groundwater monitoring program will be in place during facility operations and following closure of the facility. This system of monitoring wells is intended to detect facility impacts on the uppermost aquifer. Detection and confirmation of potential facility impact will promulgate an investigation and assessment of the impact. If facility operations are confirmed to be the cause of the impact, operations are to be modified and/or remediation is to occur, if warranted.

Cumulative Hydrogeologic Impact Areas – The cumulative impact area (CIA) is defined as the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface and groundwater systems. The cumulative impact areas as described below have been identified on a topographic map presented on Drawing No. B12-271-E16.

The receiving streams for the proposed permit area and adjacent, currently permitted area are unnamed tributaries of Pond Creek.

Discharge into the Pond Creek is approximately 0.5 miles downstream of the permit area. The drainage basin for Pond Creek is estimated to be approximately 8,036.34 acres above the confluence of the unnamed tributary containing the discharge of Outlet 009. Considering a total proposed permit area of 679.49 acres, the permit area represents approximately 11.2% of the Pond Creek drainage basin to the point of discharge, and less than 1% of the entire Pond Creek drainage area (65,475 acres) to the Big Muddy River. The sediment control structure outlet and the drainage areas have been shown on Drawing No. B12-271-E16 entitled, "Cumulative Impact Areas".

Groundwater recharge for the shallow aquifer within the permit area is primarily through surface water percolation. Piezometric mapping suggests groundwater flow within the upper aquifer generally conforms to topographic conditions, and as such shallow groundwater flow in the permit area, and adjacent areas is expected to generally conform to surface drainage conditions. Accordingly, the groundwater CIA for the Pond Creek Mine permit area is established to coincide with the drainage area associated with the watersheds of the unnamed tributaries associated with the permit areas.

No other active mining operations are known to exist within the CIA, and no future mining operations within the CIA are known to be proposed.

Descriptions of hydrogeologic and hydrologic conditions within the cumulative impact areas, characterization of surface water and groundwater systems, material damage criteria, and discussions of designs to prevent material damage have been presented in other sections of this permit application.

b) Are acid forming or toxic forming materials present that could result in contamination of surface and/or ground water supplies;

RESPONSE: Potentially acid-forming strata consist of the refuse produced as a result of the coal cleaning process. Results of acid base accounting for the coarse and fine coal refuse are

contained in Attachment III.2.A.2. The coarse coal refuse has a slight deficiency and the fine coal refuse has an excess calcium carbonate equivalency. The fine coal refuse has a high pH and the coarse coal refuse has a slight deficiency.

c) Will the proposed operation result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for legitimate purposes; and

RESPONSE: As stated in Part III.2.D.1.a. and b. above, the proposed operation is not expected to contaminate, reduce, or interrupt any underground or surface source of water of anyone within the permit or adjacent areas.

d) What impact(s) will the proposed operation have on including, but not limited to the following parameters:

RESPONSE: The following discussions generally address impacts associated with the proposed coal refuse disposal facility.

i) Sediment yield from the disturbed area;

RESPONSE: Sediment yield will increase somewhat from the disturbed area during construction of the facilities and during the ongoing mining and reclamation activities. However, sediment control structure will limit the off-site sediment movement to an acceptable amount. The sediment control structure will be constructed and maintained to insure the effluent standards will be met. Within a few years after the operation has ceased and reclamation is completed, sediment yield is expected to return to approximate pre-mining levels.

ii) Acidity;

RESPONSE: Acidity levels are expected to be only slightly increased by the proposed mining operation.

iii) Total suspended solids;

RESPONSE: Total suspended solids, like sediment yields, will increase somewhat during mining and early reclamation activities. However, drainage from disturbed areas will be passed through a sediment control structure to insure effluent standards will be met. Within a few years after mining has ceased and reclamation is completed, total suspended solids should return to approximate pre-mining levels. Post-mining suspended solids concentrations may actually be lower due to the conversion of some pre-mining cropland areas to other land uses that are less susceptible to erosion.

iv) Total dissolved solids;

RESPONSE: Total dissolved solids will increase in both groundwater and surface water. Major ions will be calcium, magnesium, bicarbonate and sulfate. While slight increases may be experienced, the water quality is expected to meet the applicable surface and/or groundwater quality standards.

v) Flooding or stream flow alterations;

RESPONSE: Proposed activities should not cause or aggravate downstream flooding. A relatively small portion of the total Unnamed Tributary of Pond Creek watershed will be affected. The

facility has been laid out and designed to minimize impacts to stream flows.

vi) Availability of surface and ground water; and

RESPONSE: The proposed operation is not expected to alter the availability of surface or ground water.

2) The Department will review permit revision applications to determine whether a new or updated PHC determination will be needed. Prior to submission of a permit revision application, applicants must contact the Department for this determination. Sufficient information on the proposed revision must be submitted with the request for the PHC determination to allow the Department to make its determination.

RESPONSE: This application is for a revision of an existing permit.

3) Surface Water Monitoring Program

a) Has an N.P.D.E.S. permit been applied for? Yes __X__ No _____

RESPONSE: NPDES permit application will be submitted to IEPA for review.

b) 1) Has an N.P.D.E.S. permit been obtained? Yes_____ No _X_____

If yes, give the permit number, the date issued, the expiration date, and the number of discharge points monitored. If additional discharge points are proposed by this application, list discharge numbers. Locate on the Water Monitoring Map and number all discharge points for the proposed permit area.

2) In accordance with 35 Ill. Adm. Code 406.101(b), is the applicant requesting that monitoring and reporting be on the basis of grab samples?

Yes __X_____ No _____

c) Are N.P.D.E.S. reports to be submitted to satisfy the reporting requirements?

Yes __X_____ No _____

If yes, provide the NPDES monitoring program including sampling method, sampling frequency and parameters to be analyzed. If not, submit a proposed monitoring and reporting program. Discharge information sheet is given in Schedule A and/or form 2C or 2D. Schedule A should be completed for all proposed discharge points. An estimate of the expected discharge concentration for each listed parameter must be indicated (or marked N/A) and a basis for that estimation provided.

RESPONSE: Refer to Schedule A for the expected discharge concentrations for each listed parameter.

If ammonia is to be utilized in wastewater treatment, indicate the discharge(s) resulting from this treatment and provide an estimate of the expected concentration (mg/l) of ammonia nitrogen (as N) from the discharge(s).

RESPONSE: N/A. Ammonia will not be used for the treatment of wastewater.

ATTACHMENT III.2.C.2

SURFACE WATER MONITORING DATA

SURFACE WATER DATA SUMMARY SHEET

POND ID	SAMPLE DATE	Hardness (as CaCO3) (mg/L)	Ph	Alkalinity, total (as CaCO3) (mg/L)	Acidity, total (as CaCO3) (mg/L)	Solids, total dissolved (mg/L)	Solids, total suspended (mg/L)	Chloride (as Cl) (mg/L)	Sulfate, total (as SO4) (mg/L)	Iron, total (as Fe) (mg/L)	Manganese, total (as Mn) (mg/L)
PC 1 Pond Creek Below Unnamed Tributary PC 1											
PC 1	11/7/2013	176	7.7	68	10	222	5	28	260	0.34	0.26
PC 1	2/27/2014	232	7.7	60	10	392	13	64	296	0.46	0.46
PC 1	5/30/2014	260	7.6	120	<10	564	10	43	333	0.258	0.36
PC 2 Pond Creek Below Unnamed Tributary from Plant Area											
PC 2	11/7/2013	136	7.9	84	12	208	4	28	169	0.43	0.22
PC 2	2/27/2014	348	7.6	124	10	1272	6	400	668	0.31	0.68
PC 2	5/30/2014	260	7.6	110	<10	1884	5	470	750	0.279	0.14
PC 3 Pond Creek Above Unnamed Tributary PC 4											
PC 3	8/15/2013	180	7.4	82	<10	282	6	11	176	0.14	0.03
PC 3	2/27/2014	264	7.7	70	<10	512	5	56	380	0.48	0.37
PC 3	5/30/2014	260	7.5	94	10	520	6	34	306	0.355	0.31
PC 4 Unnamed Southeast Corner Upstream of RR Spur											
PC 4	8/15/2013	257	7.1	117	16	334	2	10	180	0.15	0.52
PC 4	2/27/2014	160	7.5	50	<10	228	5	24	209	0.77	1.28
PC 4	5/30/2014	340	7.2	94	<10	536	15	9	370	0.381	5.21
C 1 - East Unnamed Tributary Upstream of Corinth Road											
C 1	8/15/2013	345	7.3	262	<10	440	5	16	144	0.07	0.23
C 1	11/7/2013	344	7.4	360	12	530	14	40	230	0.18	1.1
C 1	2/27/2014	280	7.5	160	10	484	2	44	252	0.15	0.23
C 1	5/30/2014	170	7.4	172	<10	304	147	22	110	1.312	0.73
C 2 - West Unnamed Tributary Upstream of Corinth Road											
C 2	8/15/2013	233	7	63	10	342	<1	10	268	0.06	0.07
C 2	2/27/2014	280	7.7	40	<10	392	11	28	325	0.15	0.03
C 2	5/30/2014	100	7.5	62	<10	160	260	11	80	1.735	0.31

R08835

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part III, Pages 11 through 14

Surface Water (NPDES) Monitoring

Discussion

Schedule A

facility has been laid out and designed to minimize impacts to stream flows.

vi) Availability of surface and ground water; and

RESPONSE: The proposed operation is not expected to alter the availability of surface or ground water.

2) The Department will review permit revision applications to determine whether a new or updated PHC determination will be needed. Prior to submission of a permit revision application, applicants must contact the Department for this determination. Sufficient information on the proposed revision must be submitted with the request for the PHC determination to allow the Department to make its determination.

RESPONSE: This application is for a revision of an existing permit.

3) Surface Water Monitoring Program

a) Has an N.P.D.E.S. permit been applied for? Yes __X__ No ____

RESPONSE: NPDES permit application will be submitted to IEPA for review.

b) 1) Has an N.P.D.E.S. permit been obtained? Yes_____ No _X_____

If yes, give the permit number, the date issued, the expiration date, and the number of discharge points monitored. If additional discharge points are proposed by this application, list discharge numbers. Locate on the Water Monitoring Map and number all discharge points for the proposed permit area.

2) In accordance with 35 Ill. Adm. Code 406.101(b), is the applicant requesting that monitoring and reporting be on the basis of grab samples?

Yes __X_____ No _____

c) Are N.P.D.E.S. reports to be submitted to satisfy the reporting requirements?

Yes __X_____ No _____

If yes, provide the NPDES monitoring program including sampling method, sampling frequency and parameters to be analyzed. If not, submit a proposed monitoring and reporting program. Discharge information sheet is given in Schedule A and/or form 2C or 2D. Schedule A should be completed for all proposed discharge points. An estimate of the expected discharge concentration for each listed parameter must be indicated (or marked N/A) and a basis for that estimation provided.

RESPONSE: Refer to Schedule A for the expected discharge concentrations for each listed parameter.

If ammonia is to be utilized in wastewater treatment, indicate the discharge(s) resulting from this treatment and provide an estimate of the expected concentration (mg/1) of ammonia nitrogen (as N) from the discharge(s).

RESPONSE: N/A. Ammonia will not be used for the treatment of wastewater.

d) Give a brief description of the water sampling and flow measurement equipment which will be used to monitor the discharges.

RESPONSE: **Water samples will be grab samples. Discharge rates will be estimated from observations of flow depth and velocity at the discharge tubes, outflow channels, or other structures at the time of sampling.**

e) List the name and address of the laboratories which will perform the effluent and ground water sampling analyses.

RESPONSE: **Summit Environmental Services, Inc.**
17650 Route 37
West Frankfort, IL 62896

f) Discuss the expected impact this mining operation will have on surface water flows and quality and the effect this will have on downstream water uses.

RESPONSE: **There are no known downstream water users on Pond Creek. However, during construction of the refuse facility, the operation is expected to have an attenuating effect on the peak discharges of surface water flows in streams downstream of the mine due to the retention of surface water runoff in sedimentation ditches. The effects on water quality will be negligible because the percentage of the watershed to be disturbed by the mining operation is small compared to the total watershed of receiving stream. Erosion and sediment control measures will be applied to minimize contamination of surface runoff. Sediment loading in wet weather may actually improve over pre-mining conditions as a result of good management practices by establishing and maintaining vegetative cover in areas that are currently cropland, construction of sedimentation ditches, and decreasing peak flows and velocities by intercepting and retaining storm water runoff. Runoff from disturbed areas will pass through properly designed and approved sediment ditches before release and will meet appropriate quality criteria (NPDES). Therefore, downstream water uses should not be adversely impacted.**

g) Is this proposed mining area covered by existing IEPA Subtitle D permits?
Yes _____ No _X_____

If yes,
1) List the permit number(s)

_____

_____

_____

2) Do the proposed mining boundaries exactly coincide with IEPA permitted boundaries?

Yes _____ No _____

(If no, delineate the IEPA Subtitle D permitted boundaries on the Water Monitoring Map).

h) Are the TDS related conditions requested under 35 Ill. Adm. Code 406.203 (from water quality requirements of Subtitle 3 for the discharge of total dissolved solids, chloride, sulfate, iron and manganese)?

Yes ___X___ No ____

If yes, provide the following:

1) Show that the discharge(s) will not cause an adverse effect on the environment in and around the receiving stream, by either:

RESPONSE: Information and demonstrations will be submitted as required by IEPA.

a) Demonstrating that the discharge will contain a concentration less than or equal to 3,500 mg/1 sulfate and 1,000 mg/1 chloride; or,

RESPONSE: By utilizing sound engineering and mining practices, no adverse effects on the environment or in the vicinity of the receiving stream should occur. There are no public water supplies near the proposed Coal Refuse Disposal Facility No. 3; therefore no adverse effects are anticipated. By complying with the effluent limitations, the minimization of total dissolved solids, chloride, sulfate, iron and manganese will be achieved.

b) through actual stream studies.

2) Show that the discharge(s) will not adversely affect any public water supply.

RESPONSE: There no known public water supplies located near the refuse disposal facility. The public water supply for this area originates from Rend Lake, over 10 miles to the northwest.

3) Provide a detailed discussion of how you intend to comply with the good mining practices of 35 Ill. Adm. Code 406.204.

RESPONSE: The Proposed Coal Refuse Disposal Facility No. 3 has been designed so that all surface runoff from the refuse area will be collected and routed to a sediment control structure for treatment prior to release. Water quality will be monitored to insure that all discharges from the refuse area comply with the NPDES effluent limitations prior to discharge. Covering the refuse disposal area with soil material will protect the refuse material from the effects of oxidation and erosion, which will minimize the potential for impacts to surface and ground water resources.

DISCHARGE LOCATION AND CHARACTERISTICS FOR NEW AND EXISTING MINES
SCHEDULE A *

Discharge # **	009				
Quarter Section	NW				
SECTION	7				
Township	T8S				
Range	R4E				
County	Williamson				
Average Flow (gpd) if discharge does not result from precipitation.	Precipitation				
Max Flow (gpd) if discharge does not result from precipitation.	Precipitation				
Source of Discharge (e.g. pit pumpage, processing plant circuit, surface runoff, etc.)	Surface Runoff				
Sampling Method (24 hr. composite, grab, est., etc.)	Grab				
Acidity (mg/l)	30-905				
Alkalinity (mg/l)	200				
Lead (mg/l)	0.5				
Iron (mg/l)	3 - 6				
Manganese (mg/l)	4				
pH (range)	6 - 9				
Zinc (mg/l)	0.5 – 1.0				
Fluoride (mg/l)	1.0				
Total Suspended Solids (mg/l)	35 - 70				
Sulfate (mg/l)	2100				
Total Dissolved Solids (mg/l)	3500				
Chloride (mg/l)	1000				
Receiving Stream	Unnamed				
Tributary to	Pond Creek				
Tributary to	Big Muddy River				
Tributary to	Mississippi River				

* If application is for NPDES permit USEPA form 2C or 2D may also be required.

** Discharge # should correspond with NPDES discharge number and shall be shown on the mine operations map.

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part IV, Pages 1 through 3

Discussion of Mining Operations Plan

PART IV

OPERATIONS PLAN

1) Proposed Operational Procedures and Methods for the Mine Over Its Projected Life

Describe the type and method of mining procedures and proposed engineering techniques to be employed in the operation of the proposed mine. Describe the major equipment to be employed and how such equipment will be used in the different aspects of the mining operation. Provide an estimation of the anticipated annual coal production and anticipated coal production by tonnage once the mine is at full operational capacity.

RESPONSE: This application is for the development of a coal refuse disposal facility. No surface and/or underground mining is proposed. Equipment to be used could include conveyor belts, excavators, dozers and/or trucks, and pumps for the transport, placement and compaction of coal refuse. The mine is currently operating at full capacity under Permit No. 375 at a rate of 7 million tons of clean coal per year.

2) Mining Operations Plan for the Proposed Permit Area

RESPONSE: Refer to Volume 2 for information concerning development of a coal refuse disposal area within the permit area. An impoundment will be constructed for the disposal of fine and coarse coal refuse. A sediment control structure will be constructed around the perimeter of the impoundment. Cleanings from the sediment control structure will be placed in the impoundment.

Describe the proposed mining operations plan for the permit area in terms of the mining sequence, the employment of facilities, establishment and maintenance of erosion control facilities, air pollution control facilities, coal storage, cleaning and loading areas, location and placement of topsoil, spoil, coal waste, or other storage facilities.

A) 1) Describe how each type of overburden (soil horizons, glacial drift and consolidated material) will be handled with regards to shaft excavations.

RESPONSE: N/A

2) If toxic materials have been identified as occurring in the overburden, describe how these materials will be handled to insure proper disposal.

RESPONSE: N/A

B) 1) Locate on the operations map all soil horizon storage areas and/or root medium stockpiles. Identify each storage area as to its content.

RESPONSE: Topsoil and subsoil will be stored on adjacent Permit No. 375. There is an existing stockpile area south of the refuse area that has not been filled to capacity. There is an area west of the existing stockpile that is currently being permitted. Also, there is an area currently permitted east of the current stockpile which is a potential topsoil/subsoil storage area. There is also an airshaft/storage area due north of the area which could be used to store soil. The locations have been identified on Drawing No. B12-271-M24.

2) Describe measures to be employed to prevent or minimize exposure of soil stockpiles to excessive water and wind erosion, unnecessary compaction and contamination by undesirable materials.

RESPONSE: Stockpiles will be revegetated as soon as practical after all of the soil has been placed. This should minimize exposure to excessive water and wind erosion, and contamination by undesirable material. Outer slopes will not be over compacted by mining.

3) Describe methods and treatment measures to be used on exposed areas where topsoil has been removed to prevent excess air and water pollution.

RESPONSE: Seeding with small grain or grass cover crops and applying straw or hay mulch will be used where practicable and the installation of sediment basins will be used as a means of controlling suspended solids from exposed areas where topsoil has been remove. If necessary to control air pollution on such exposed areas, surface water will be applied utilizing suitable equipment.

C) The permit map and plans shall show the lands proposed to be affected within the proposed permit through the operation, according to the sequence of mining and reclamation and any change in a facility or feature to be caused by the proposed operations if the facility or feature was shown under 62 Ill. Adm. Code Sections 1783.24 through 1783.25.

RESPONSE: See Map 6 S.F., Operations Plan Map.

D) Show on the permit map or other designated map each area of land for which a performance bond will be posted under 62 Ill. Adm. Code 1800.

RESPONSE: See Map 6 S.F., Operations Plan Map.

E) Mining Operations Plan for the Proposed Shadow Area

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

1) Provide a map at a scale of 1 inch to 1,000 feet or other scales as approved by the Department identifying the limits of the proposed shadow area (area from which coal is proposed to be extracted by underground mining methods).

2) Within the limits of the proposed shadow area identify all areas projected to be mined, at a minimum, during the term of the permit showing the proposed size, sequence and yearly projections for the development of underground workings.

3) Subsidence Control Plan

A) General Requirements

2) Within the permit, shadow and adjacent areas are there structures or renewable resource lands?

Yes _____ No _____

If yes, on the shadow area map described in 2.E. above, or other designated map, provide survey information which identifies all structures and renewable resource lands. Include all topographic features at a maximum contour interval of 10 feet. Identify all surface and subsurface man made features within, passing through, or passing over the area in which underground mining operations are located or will be projected to be located. Such features shall include but are not limited to all buildings, facilities, roads, bridges, major electric transmission lines, pipelines, agricultural drainage tile fields, gas and oil wells and water wells.

If no, provide evidence and support documentation that no structures or renewable resource lands exist as a result of a survey conducted within these areas.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

2) Within the proposed permit, shadow or adjacent areas does the applicant intend to adopt mining technologies which provide for planned subsidence in a predictable and controlled manner?

Yes _____ No _____

If yes, provide information requested under "Planned Subsidence", Subsection B.
If no, provide information requested under "Subsidence Unplanned", Subsection C.
If the applicant intends to conduct both planned and unplanned subsidence mining operations both subsections B and C must be addressed.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Part IV, Pages 13 through 24

Coal Refuse Disposal Discussion

Surface Drainage Control Discussion

And

Sedimentation Basin Designs

3) For all transportation facilities to be constructed, provide construction details for all sediment control facilities to be constructed to prevent additional contributions of suspended solids to streamflow or to runoff outside the permit area.

RESPONSE: Transportation facilities to be constructed consist of a road around the perimeter of the impoundment which will be infrequently used and a conveyor belt to transport refuse. An access road from abandoned Dwina Road to the refuse facility will be constructed. The sediment ditch around the perimeter of the refuse pile and proposed sediment pond will provide sediment control for all of the transportation facilities.

4) Discuss the revegetation of ditch and borrow areas involved in construction.

RESPONSE: Borrow areas, cut and fill slopes, roadside ditches, and other disturbed areas are to be mulched and seeded following construction activities within the respective areas. Other best management practices may also be used in these areas prior to establishment of the vegetative cover and/or to supplement erosion and sediment control practices in these areas.

5) Discuss the estimated life of each facility and how materials will be removed when the facility becomes inactive.

RESPONSE: The life of the refuse facility proposed in this application is approximately fifteen (15) years.

6) Provide a report of appropriate geo-technical analysis where approval from the Department is required for alternative specifications or steep cut slopes under 62 Ill. Adm. Code 1817.150.

RESPONSE: N/A

7) Provide a description of measures to be taken to protect the inlet end of a ditch relief culvert, other than use of a rock headwall, and for alteration or relocation of a natural drainageway for approval by the Department under 62 Ill. Adm. Code 1817.150.

RESPONSE: Information for protecting the inlet end of culverts is shown on Drawing Nos. B12-271-B3 and B12-271-B4.

6) Waste Material

A) Identify the nature of all waste material including shaft excavation material and non-coal waste to be disposed of within the permit area. Give the net neutralization potential.

RESPONSE: Coarse and fine refuse generated from coal processing will be disposed of in the permit area. Sources of coal refuse are primarily roof and floor lithologies associated with the coal seam. Therefore, the refuse is expected to be primarily composed of gray to black shale and underclay or claystone. Acid base accounting is contained in Attachment IV.6.A.

B) Coal processing waste bank dams shall be designed to comply with requirements of 62 Ill. Adm. Code 1817.81 through 1817.84. For coal processing waste dams and embankments each plan shall comply with the requirements of MSHA, 30 CFR 77.216-1 and 77.216-2, and shall contain the results of a geo-technical investigation as prescribed under 62 Ill. Adm. Code 1784.16(e).

RESPONSE: Refer to the Engineering Design and Report contained in Volume 2.

C) Indicate location of all areas in which such materials including shaft excavation material and non-coal waste (including those under Subtitle C of RCRA) are to be disposed of on the mining operations map. Indicate all streams, creeks, and surface water impoundments within such areas or which receive runoff from such areas. Provide acreage of disposal area and borrow areas. Indicate location of borrow area on mining operations map.

RESPONSE: The location of the area where coal refuse will be placed is shown on the "Operation Plan Map", Drawing No. B12-271-M24.

D) Provide construction details for all impoundments and structures to contain such waste material. Provide typical cross-sections of all proposed levees, dams and excavations.

RESPONSE: Refer to Volume 2.

E) Indicate location and provide details for diversions as necessary to divert surface water around such areas on the mining operations map.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

F) Provide details of diversions or other devices designed to collect surface runoff from waste disposal sites and transport same to appropriate treatment facility.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

G) Provide details of such treatment facilities and identify points of discharge.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map and Volume 2.

H) For disposal areas explain measures to be taken to avoid pollution of surface or groundwater due to leaching through levees or dams and through underlying soil.

RESPONSE: During mining and reclamation activities, erosion and sediment control measures will be applied to disturbed areas to minimize contamination of surface runoff.

Soil material shall be rolled and compacted to 95% beneath the Coal Refuse Disposal Area No. 3 Facility. Coal processing wastes will be placed in the refuse disposal areas and covered with soil materials to minimize contact with surface runoff. Runoff from disposal areas will pass through approved sediment control structures for treatment before release and will meet appropriate NPDES effluent criteria. Should runoff from the refuse disposal area develop acidic characteristics, the runoff will be collected and neutralized to meet water quality standards. The fine-grained soil materials underlying the refuse disposal area exhibit very low permeability that will inhibit infiltration and percolation of leachate from the refuse material into the ground water system. Covering the refuse material with four feet of soil will protect the material from the effects of oxidation and erosion as well as minimize the potential for impacts to ground water resources by minimizing leachate production. Earthen materials used in the construction of dams and levees will be compacted to reduce permeability and minimize the potential for flow through the structures. Therefore, it is unlikely the proposed disposal operations will adversely impact the quantity or quality of surface and ground water in the permit or adjacent area.

I) Describe estimated life of each area.

RESPONSE: Refer to Volume 2.

J) Coal preparation:

1) Give a general description of the coal processing operation at this facility.

RESPONSE: N/A

2) Describe the fresh water (makeup) and slurry circuits for this operation and indicate if a discharge occurs. If a discharge does occur, it should be included on Schedule A. If a discharge does not occur, a detailed description of how this will be accomplished must be submitted.

RESPONSE: Raw water is distributed to the different circuits within the adjacent preparation plant. Water is recirculated within the circuits from dewatering processes and refuse fines are accumulated in the thickener. From the thickener, clarified water is returned to the circuits and the underflow is pumped to the refuse impoundment to separate the fines from the liquid.

Clarified water from the proposed slurry cell will be pumped into the sediment ditches and will discharge into Sediment Structure No. 9 and/or to the approved water circuit system for Permit 375.

3) What safeguards are provided to prevent the discharge of slurry fines and untreated slurry water during emergency situations (e.g. power outages, mechanical equipment breakdown, plant shutdowns, etc.)? Also indicate where the slurry would go by gravity flow in the event of an emergency discharge, and the environmental impact this would have.

RESPONSE: If a power outage or mechanical equipment breakdown occurs, the fine coal refuse would be contained inside the adjacent preparation plant pipelines and equipment or emptied into the thickener. Fine coal refuse could be temporarily placed in sediment control structures where it could potentially flow by gravity. If so, Williamson Energy maintains pumps, which are powered by diesel generators. These pumps can be used to pump the fine coal refuse into the impoundment.

7) Surface Drainage Control

A) 1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems. Show drainage patterns of all affected mining areas.

RESPONSE: Refer to Map 6 S.F. Operations Plan Map.

2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the permit area?

Yes __X__ No _____

If yes, delineate how and where surface drainage will be collected and treated, and list permit numbers and type of permit that the drainage control systems are operated under. If above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of Section 1817.46(e).

RESPONSE: A sediment pond and sediment ditch structures will be constructed around the perimeter of the coal refuse disposal facility.

B) Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes_____ No __X____

If no, please discuss.

RESPONSE: A sediment pond and sediment ditch structures will be constructed around the perimeter of the coal refuse disposal facility.

C) Describe the timing in which all construction of the sediment ponds and surface drainage control structures will be complete. Include a discussion of the vegetation stabilization of these structures.

RESPONSE: Adequate drainage control in the form of temporary and/or permanent sediment control structure(s) will be in place before any other mine related disturbance occurs in the watershed. Upon completion of construction of the drainage control structures, areas disturbed during the construction, including embankments, cut and fill slopes, and soil stockpiles, will be mulched and seeded with a permanent grass species to stabilize the exposed areas. Depending on the season, a cover crop will be used to provide temporary protection until a permanent cover could be established. Temporary drainage structures will be installed as embankment construction progresses until the permanent structures are installed.

D) Overland Flow Diversions

For all diversions of overland flow, shallow groundwater flow, and ephemeral streams which divert surface water around the mining area, and all collection drains that transport affected area runoff into water-treatment facilities, provide the following:

1) Typical cross sections bottom width, side slopes and depth.

2) Proposed flow line slopes.

3) Runoff and diversion capacity calculations.

4) Details of proposed erosion and sediment control measures to be employed.

RESPONSE: N/A

For permanent diversion also include:

5) Watershed limits upstream from the diversions.

RESPONSE: N/A

6) Plan profile drawings of the proposed diversion showing existing gradeline, proposed diversion bottom gradeline and water surface at design storm.

RESPONSE: N/A

E) Sediment pond Design:
NPDES
MSHA#
Total Drainage Area (Acres)
Total Disturbed Drainage Area (Acres)
Total Calculated Inflow From Design Storm (AC-FT)
Sediment Storage Volume (AC- FT)
Total Volume Below Primary Spillway Elevation (AC-FT)
Total Volume Below Emerg. Spillway Elevation (AC-FT)

NPDES	MSHA #	Total Drainage Area (ac.)	Total Disturbed Area (ac.)	Total Calculated Inflow from Design Storm (ac-ft)	Sediment Storage Volume (ac-ft)	Total Volume Below Primary Spillway (ac-ft)	Total Volume Below Emergency Spillway (ac-ft)	Embankment Height from Upstream Toe to Emergency Spillway (ft)
009	N/A	265.10	265.10	1.98	24.60	23.89	34.67 *	1.0 **

*** - Basin has single, open-channel spillway.**
**** - Embankment height is from U/S toe to open-channel spillway.**

F) 1) Discuss the design basis for the sediment pond(s) calculations.

Submit calculations used in spillway designs and determination of inflow volume and pond volume.

RESPONSE: Refer to the calculations contained in Appendix B of Volume 2.

2) Submit a typical section of the embankment(s), details of the principal and emergency spillways and a plan view of each pond at a scale of 1 inch = 200 ft. or larger showing pond bottom contours and points of inflow.

RESPONSE: Refer to the Plan View and Details for Sediment Pond No. 9 (Drawing No. B12-271-E2) in Volume 2.

3) For all sedimentation ponds provide design information showing compliance with the requirements of 62 Ill. Adm. Code 1817.46. Each plan shall, at minimum, comply with the requirements of MSHA, 30 CFR 77.216-1 and 77.216-2.

RESPONSE: Refer to the Plan View and Details for Sediment Pond No. 9 (Drawing No. B12-271-E4) in Volume 2 and Appendix B.

G) If sediment removal becomes necessary, explain how the sediment will be removed, where it will be disposed of, and what disposal methods will be used.

RESPONSE: The sediment basins have been designed to provide adequate sediment storage volume, with routine maintenance. If removal of sediment from basins becomes necessary, the following procedure is to be followed. The pool level within the basin is to be lowered by pumping to the lowest possible level. After the pool level is sufficiently lowered, appropriate equipment will be used to remove sediment from the basin. The sediment removed from the structures will be placed in the impoundment.

H) Will pH adjustment be necessary on any of the discharges in order to meet the applicable State and Federal Standards?

Yes _____ No ___**X**___

If yes, a discussion of the situation is necessary, along with a detailed basis of design. The basis should include a detailed description of the proposed treatment facilities, process flow diagrams, and design calculations.

RESPONSE: Treatment of discharges to adjust pH is not anticipated. However, should treatment become necessary, a plan to insure applicable water quality

standards are met will be developed. If pH control should be required in the future it could be done with a liquid sodium hydroxide solution dispensed by gravity from a portable tank or, hydrated lime (dry or slurry) and/or, soda ash could be easily and quickly applied.

I) Does a perennial or intermittent stream occur within the proposed permit area?

Yes ___**X**___ No _____

If yes, is an exception to the 100 foot buffer zone being requested or is a stream diversion being proposed. For exception to the 100 foot buffer zone, indicate how compliance with Section 1817.57 will be assured. For a stream diversion, complete Part V 6) of the application form.

RESPONSE: **The discharge channel from Pond No. 9 is inside the 100 foot buffer zone. If required, an exception to the 100 foot buffer zone is being requested, as allowed under Section 1817.57, based on the following information.**

Water Quality – Water quality will not be adversely affected. The disturbance is temporary and consists of a spillway. Once the spillway is constructed, the area will be seeded in accordance to the approved permit.

Water Quantity – Water quantity will not be adversely affected. The applicant does not propose to alter the watershed of the stream, therefore, water quantity should remain unchanged as a result of the operation.

Other Environmental Resources of the Stream - The fish and invertebrate communities in the stream represent a biological community subject to frequent dry channel conditions and which have been subjected to the effects of intense rowcrop agriculture for decades. As such the organisms found here are environmentally tolerant species (i.e. not sensitive). No adverse impacts to this community are anticipated.

Restoration of Channel and Riparian Vegetation – Woody riparian vegetation will be established along the constructed spillway based on pre-disturbance species and quantities.

Based on the above, the applicant requests the exception to the 100 foot buffer zone to the extent required by 1817.57 and in accordance with the provisions of Section 1817.57.

J) Permanent and Temporary Impoundments, Ponds, Banks, Dams and Embankments

1) All temporary and permanent impoundments must meet the requirements of 62 Ill. Adm. Code 1817.49. Will the mining operation involve the construction of any impoundments other than those waste retention?

Yes _____ No ___X___

If yes, include the following information:

a) Locate on mining operations map all impoundments, dam locations, and watershed limits, indicate which impoundments are proposed to be permanent and complete Part V 3)D) of the application.

RESPONSE: N/A

b) Provide construction and maintenance details of dams, spillways, seepage control measures, and erosion control measures for inlets and outlets. Employ maps and cross sections where necessary. Where design plans for proposed structures are not provided, submit a certification statement providing a schedule for submission of detailed design plans for each structure.

RESPONSE: Refer to Volume 2.

2) Describe proposed reclamation plans for each structure, including a time table and plans for removal and disposal of material. Each plan shall:

a) Be prepared by or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) contain a description, map, and cross-section of the structure and its location,

c) contain preliminary hydrologic and geologic information required to assess the hydrologic impact of the structure,

d) if underground mining has occurred, the plan shall contain a survey describing the potential effect on the structure from subsidence of the subsurface strata resulting from the post underground mining operations,

e) for structures where the detailed design plans are not submitted to the Department with the general plan, the plan shall contain a certification

statement which includes a schedule setting forth the dates that detailed design plans are to be submitted. For these structures, the detailed design plans must be submitted to the Department and approved in writing prior to the beginning of construction.

RESPONSE: The sediment control structure is proposed to be retained as permanent structure as indicated on Map 7 SF, Reclamation Plan Map. There will be no excess material to be disposed. The impoundment will be reclaimed by covering the final slurry surface with coarse refuse or other appropriate fill material to prevent future impoundment of water or slurry. The coarse refuse will be reclaimed by covering with soil material and vegetated to a wildlife land use.

No significant impacts from this structure is anticipated on surface or groundwater, see Part III.

Underground mining has already occurred within the permit area.

3) For each structure that meets or exceeds the size or other criteria of MSHA, 30 CFR 77.216(a), the detailed design plan shall:

a) Be prepared by or under the direction of and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) include any design and construction requirements for the structure, including any required geo-technical information,

c) describe the operation and maintenance requirements for each structure, and

d) describe the timetable and plans for removal of each structure if appropriate.

RESPONSE: Refer to Volume 2.

4) For each structure that does not meet or exceed the size or other criteria of MSHA, 30 CFR 77.216(a), the detailed plan shall:

a) Be prepared by or under the direction of and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) include any design and construction requirements for the structure, including any required geo-technical information,

c) describe the operation and maintenance requirements for each structure, and d) describe the timetable and plans for removal of each structure if appropriate.

RESPONSE: Refer to Volume 2.

K) If any of the following questions are answered yes, a permit may be needed from Illinois Department of Natural Resources, Office of Water Resource Management.

1) Will the mining operation involve the construction of any levees, dikes, haul roads or other similar structures or the placement of any fill along or in the flood plain of any stream serving a drainage area of ten (10) square miles or greater at the point of construction?

Yes _____ No ___X___

2) Will the mining operation involve any relocation or diversion of or any construction activity in, over, under or along the banks of any stream serving a drainage area of ten (10) square miles or greater at the point of construction?

Yes _____ No ___X___

3) Is there any urban development (residential, commercial or industrial uses) in the areas immediately surrounding the mining operation?

Yes _____ No ___X___

(If yes, please re-answer questions 1 and 2 above applying a one (1) square mile drainage area limit.)

4) Will the mining operation involve the construction, major modification, or removal of any dam which in the event of failure would have probability for loss of life or additional economic loss in excess of that which would occur downstream of the dam in the absence of the dam?

Yes___X___ No _____

5) Will the mining operation involve the construction, major modification, or removal of any dam 25 feet or more in height?

Yes__X____ No _____

6) Will the mining operation involve construction, major modification, or removal of any dam which would have an impounding capacity of 50 acre feet or more?

Yes __X____ No _____

RESPONSE: The proposed Coal Refuse Disposal Facility No. 3 plans will exceed the Office of Water Resources requirements for dams.

8) Provide a plan detailing fugitive dust control practices to be employed during proposed surface coal mining and reclamation operations as required under 62 Ill. Adm. Code 1817.95.

RESPONSE: Fugitive particulate emissions will be controlled by applying water or other IEPA approved dust suppressants on an as-needed basis. All construction areas will be stabilized with permanent vegetative species, graded stone and/or paving material. Haul roads and other unpaved roads will be sprinkled with water to control fugitive dust. Conveyor transfer points will be provided with enclosed hoods over the discharge roller. Conveyor transfer points and the railcar load-out will employ chutes and be enclosed to control emissions.

Log No. 3001-15

NPDES Permit No. IL0077666

Application for OMM Permit No. 417

Hydrogeologic Map

Operations Map

Reclamation Map

Maps were forwarded to Groundwater Section

Please Contact Groundwater Section

DOCUMENT

52

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829

BRUCE RAUNER, GOVERNOR LISA BONNETT, DIRECTOR

R08860

February 13, 2015

618/993-7200

Mr. Scott Fowler
Illinois Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resource Way
Springfield, Illinois 62702-1271

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: JMR

Re: Williamson Energy, LLC
Pond Creek Mine No. 1
IDNR/OMM Permit No. 417 Application
IEPA Log No. 3001-15

Dear Mr. Fowler:

The Illinois Environmental Protection Agency has completed its review of the above referenced project and finds that additional information and/or clarification is needed as follows:

1. The response to Part III(2)(D)(1)(a), Page 8, first (1st) paragraph under "Existing Groundwater Quality" references proposed RDA No. 3 as RDA No. 1 which appears to be an error and should be corrected and/or clarified.

2. The Schedule A provided in response to Part III(2)(D)(3)(c) includes an "estimate" for pH that reflects the allowable range in accordance with the Subtitle D regulations. The Applicant should revise the Schedule A based on nearby similar operations and/or onsite data to provide an actual estimate of the anticipated pH values rather than the extreme limits allowed in accordance with 35 Ill. Adm. Code 406.106. Information regarding the basis for such estimations should be provided.

3. As an accurate location of all outfalls is required for the NPDES Permit, the Applicant should provide accurate coordinates (longitude and latitude) of Outfall 009. This information may be included on the required Schedule A if the Applicant elects to do so.

4. The reference in Part (IV)(6)(A) of the application to Attachment IV.6.A appears to be in error as the reference material seems to be located in Attachment III.A.2.A. The Applicant should correct and/or clarify this reference as necessary.

5. Part (IV)(6)(D) of the application refers to Volume 2, "MSHA Submittal Plan" which contains a brief discussion of the proposed four (4) foot compacted clay liner. However, to ensure an adequate response, the Applicant should provide a more detailed description of the liner system in Part (IV)(6)(D).

6. Volume 2 "MSHA Submittal Plan", Part 6.1 Site Preparation of the application proposes a four (4) foot compacted clay liner under the Refuse Disposal Area No. 3, Sedimentation Pond No. 9 and sedimentation ditches. The Applicant should modify Volume 1 of the application, to reference the four (4) foot compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/s or a synthetic liner capable of providing an equivalent level of groundwater protection.

7. The Applicant should provide construction details and specifications as well as a Quality Assurance/Quality Control (QA/QC) Plan for the proposed four (4) foot compacted clay liners or equivalent synthetic liner. The QA/QC Plan should include at a minimum:

   a. The loose soil thickness of each lift;
   b. The methodology for replacing soft areas encountered during construction;
   c. Frequency of permeability testing; and
   d. Means of protecting the constructed liner from damage.

8. The final cover for the refuse disposal facility must be designed and constructed to limit the amount of water (rainfall) that can infiltrate to a quantity or volume that is not in excess of the amount of water which can infiltrate through the liner constructed for the base of the proposed disposal facility. It is noted that the low permeability final cover may consist of compacted clay, synthetic HDPE, or a composite liner comprised of both of these materials. The Applicant should provide detailed design information for a low permeability cap or cover for the refuse disposal facility demonstrating the ability of the cover to limit infiltration as described.

9. The response to Part (IV)(6)(J)(2) states that clarified water from the slurry disposal operation will be reused in the preparation plant located in the adjacent permitted area. The Applicant should provide a more detailed discussion including pumping rates and volume of the water balance for the coal preparation circuit as this is pertinent to this application.

10. Also, Part IV(6)(J)(2) of the Application indicates that clarified water from the proposed slurry cell will be pumped into the sediment ditches and will discharge into Sedimentation Structure No. 9 and/or to the approved water circuit system for OMM Permit No. 375. As this clarified water may contain elevated dissolved solids, the Applicant should re-evaluate the proposal to possibly direct this water only to the closed circuit water system for OMM Permit No. 375 Area.

11. Since discharges from a flooded sedimentation pond would likely not meet permit effluent limits, the pond and discharge should be located outside the limits of the flood plain area or otherwise protected from flood waters entering the basin to the extent possible. The 100 year flood plain should be plotted on an appropriate map and Part IV(7)(F)(1) of the application should be revised to provide a discussion of the affects a 100-year storm event may have on the sedimentation basin and outfall.

12. In Volume 2 "MSHA Submittal Plan" of the application, Figure No. 4 (Drawing No. B12-271-M5) and Figure No. 7 (Drawing No. B12-271-M13), appears to depict Pond No. 9 as Pond No.1. The Applicant should correct and/or clarify this discrepancy.

13. It appears the locations of existing wells GW-11, GW-12, GW-13 and GW-28 are acceptable in accordance with the requirements of the 620 Groundwater Quality Standards regulations. However, to ensure adequate groundwater monitoring of Refuse Disposal Area No. 3 in accordance with 62 Ill. Adm. Code 1784(h), an additional monitoring well should be installed near the center of the south side of Refuse Disposal Area No. 3 and screened in the first water bearing zone below the bottom of the disposal facility. The Applicant should delay installation of this additional well until such time that the location of the well is approved by both IDNR/OMM and the Illinois EPA.

The mine related activities, as proposed, are required to be permitted in accordance with 35 Ill. Adm. Code: Subtitle D of the Illinois Pollution Control Board Rules and Regulations. Since this application is considered to be an application for such permit from this Agency, please notify us of any action taken by your Office.

A review letter is being sent to the Applicant concerning the above items as they pertain to Agency requirements. A copy of this letter will be sent to your Office.

Should you have any questions or comments regarding the above, or need any additional information concerning Agency requirements, please contact Environmental Protection Engineer, Dora Maschhoff at 618/993-7200 or

Illinois Environmental Protection Agency
Mine Pollution Control Program, Permit Section
2309 West Main Street, Suite 116
Marion, Illinois 62959

Sincerely,

Joseph D. Stitely, P.E.
Acting Manager, Permit Section
Mine Pollution Control Program
Bureau of Water

JDS:DM:cs/6990c/2-11-15

cc: Mike Diedrichsen - IDNR
Steve Chard - DOA
BOW/MPCP/FOS/Marion ✓

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
BRUCE RAUNER, GOVERNOR LISA BONNETT, DIRECTOR

R08863

February 13, 2015 618/993-7200

Williamson Energy, LLC
P.O. Box 300
Johnston City, IL 62951

Re: Williamson Energy, LLC
Pond Creek Mine No. 1
IDNR/OMM Permit No. 417 Application
NPDES Permit No. IL0077666 (Modification)
IEPA Log. No. 3001-15

Gentlemen:

We received the information concerning the above referenced project, dated November 17, 2014, on January 2, 2015. This information has been reviewed by the Permit Section Staff, and based upon that review, the following items are offered for your consideration and appropriate action:

1. The response to Part III(2)(D)(1)(a), Page 8, first (1st) paragraph under "Existing Groundwater Quality" references proposed RDA No. 3 as RDA No. 1 which appears to be an error and should be corrected and/or clarified.

2. The Schedule A provided in response to Part III(2)(D)(3)(c) includes an "estimate" for pH that reflects the allowable range in accordance with the Subtitle D regulations. Please revise the Schedule A based on nearby similar operations and/or onsite data to provide an actual estimate of the anticipated pH values rather than the extreme limits allowed in accordance with 35 Ill. Adm. Code 406.106. Information regarding the basis for such estimations should be provided.

3. As an accurate location of all outfalls is required for the NPDES Permit, please provide accurate coordinates (longitude and latitude) of Outfall 009. This information may be included on the required Schedule A if you elect to do so.

4. The reference in Part (IV)(6)(A) of the application to Attachment IV.6.A appears to be in error as the reference material seems to be located in Attachment III.A.2.A. Please correct and/or clarify this reference.

5. Part (IV)(6)(D) of the application refers to Volume 2, "MSHA Submittal Plan" which contains a brief discussion of the proposed four (4) foot compacted clay liner. However, to ensure an adequate response please provide a more detailed description of the liner system in Part (IV)(6)(D).

6. Volume 2 "MSHA Submittal Plan", Part 6.1 Site Preparation of the application proposes a four (4) foot compacted clay liner under the Refuse Disposal Area No. 3, Sedimentation Pond No. 9 and sedimentation ditches. Please modify Volume 1 of the application, to reference the four (4) foot compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/s or a synthetic liner capable of providing an equivalent level of groundwater protection.

7. Please provide construction details and specifications as well as a Quality Assurance/Quality Control (QA/QC) Plan for the proposed four (4) foot compacted clay liners or equivalent synthetic liner. The QA/QC Plan should include at a minimum:

   a. The loose soil thickness of each lift;
   b. The methodology for replacing soft areas encountered during construction;
   c. Frequency of permeability testing; and
   d. Means of protecting the constructed liner from damage.

8. The final cover for the refuse disposal facility must be designed and constructed to limit the amount of water (rainfall) that can infiltrate to a quantity or volume that is not in excess of the amount of water which can infiltrate through the liner constructed for the base of the proposed disposal facility. It is noted that the low permeability final cover may consist of compacted clay, synthetic HDPE, or a composite liner comprised of both of these materials. Please provide detailed design information for a low permeability cap or cover for the refuse disposal facility demonstrating the ability of the cover to limit infiltration as described.

9. The response to Part (IV)(6)(J)(2) states that clarified water from the slurry disposal operation will be reused in the preparation plant located in the adjacent permitted area. Please provide a more detailed discussion including pumping rates and volume of the water balance for the coal preparation circuit as this is pertinent to this application.

10. Also, Part IV(6)(J)(2) of the Application indicates that clarified water from the proposed slurry cell will be pumped into the sediment ditches and will discharge into Sedimentation Structure No. 9 and/or to the approved water circuit system for OMM Permit No. 375. As this clarified water may contain elevated dissolved solids, please re-evaluate the proposal to possibly direct this water to the closed circuit water system for OMM Permit No. 375 Area.

11. Since discharges from a flooded sedimentation pond would likely not meet permit effluent limits, the pond and discharge should be located outside the limits of the flood plain area or otherwise protected from flood waters entering the basin to the extent possible. The 100 year flood plain should be plotted on an appropriate map and Part IV(7)(F)(1) of the application should be revised to provide a discussion of the affects a 100-year storm event may have on the sedimentation basin and outfall.

12. In Volume 2 "MSHA Submittal Plan" of the application, Figure No. 4 (Drawing No. B12-271-M5) and Figure No. 7 (Drawing No. B12-271-M13), appears to depict Pond No. 9 as Pond No.1. Please correct and/or clarify this discrepancy.

13. It appears the locations of existing wells GW-11, GW-12, GW-13 and GW-28 are acceptable in accordance with the requirements of the 620 Groundwater Quality Standards regulations. However, to ensure adequate groundwater monitoring of Refuse Disposal Area No. 3 in accordance with 62 Ill. Adm. Code 1784(h), an additional monitoring well should be installed near the center of the south side of Refuse Disposal Area No. 3 and screened in the first water bearing zone below the bottom of the disposal facility. Please delay installation of this additional well until such time that the location of the well is approved by both IDNR/OMM and the Illinois EPA.

14. An emissions permit from the Illinois EPA, Division of Air Pollution Control, may be needed for the proposed facilities. The Permit Section of this Division should be contacted concerning these requirements at the above indicated address; phone number 217/782-7326.

Should you have any questions or comments regarding the above, or need any additional information concerning Agency requirements, please contact Environmental Protection Engineer, Dora Maschhoff at 618/993-7200 or the Marion address listed below.

Sincerely,

Joseph D. Stitely, P.E.
Acting Manager, Permit Section
Mine Pollution Control Program
Bureau of Water

JDS:DM:cs/6991c/2-11-15

cc: IDNR/Office of Mines and Minerals
BOW/MPCP/FOS/Marion

3001-/15
Due date: 2/8/15
R08866

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Pat Quinn, Governor
Marc Miller, Director

MEMORANDUM

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: JMR

To: Steve Chard, Department of Agriculture
Bryan Fitch, NRCS
US Fish & Wildlife, Marion IL

From: Scott K. Fowler, Supervisor
Land Reclamation Division

Date: January 5, 2015

Re: Surface Mining Application Review Committee

Enclosed is a 229.78-acre application for a surface coal mining and reclamation operations permit submitted by Williamson Energy, LLC for their Pond Creek mine under the Surface Coal Mining Land Conservation and Reclamation Act. The application number for this submittal is No. 417 and revision No. 10 to permit No. 375. The enclosed application is considered to be complete and is being forwarded for your consideration and review.

Under the above listed Act, application review committee members are provided up to 45 days in which to review and submit their comments on the application. Upon receipt, the comments will be forwarded to the County Clerk of Williamson County to be incorporated into the public record.

Enclosures

cc: B. Schoeppel
M. Parrish
A. Rice
P. Malone, OREP
H. Hassen, OREP
L. Crislip, IEPA ✓

RECEIVED
JAN 08 2015
IL Environmental Protection Agency
MARION REGIONAL OFFICE

12181128.docx

3001 5
R08867

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

RESPONSE TO IDNR COMPLETENESS REVIEW DATED OCTOBER 24, 2014

PROPOSED PERMIT NO. 417

VOLUME 1 OF 2
(PROPOSED PERMIT NO. 417, PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 - PARTS I & II)

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: JMR

ALLIANCE PROJECT NO. B12-271-1413
NOVEMBER 2014

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Dr., Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

3001-/15 Box 1 of 2
Due date 2-11-15
R08868

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

Transmittal Letter

To: Mr. Larry Crislip
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
2309 West Main
Marion, IL 62959

Project No.: B12-271-1413

Date: December 29, 2014

If enclosures are not as noted, please inform us immediately

We Transmit:

☒ Herewith ☐ Under Separate Cover

For Your:

☒ Approval ☐ Record

☐ Review & Comment

☐ Use

The Following:

☐ Drawings ☐ Laboratory Data

☐ Specifications ☐ Field Data

☒ Other

Copies	Date	No.	Description
2	--	--	Copies of Permit 417 (Coal Refuse Disposal Facility No. 3)

Remarks: Please find enclosed two copies of the above referenced document. Should you require any additional information, please do not hesitate to contact us.

By: Steve Sutphin Steve Sutphin

Copies To: File

RECEIVED
JAN 02 2015
IL Environmental Protection Agency
MARION REGIONAL OFFICE

124 Philpott Lane, Beaver, WV 25813
848 Northside Drive, Summersville, WV 26651
3 Four Coins Drive, Ste. 100, Canonsburg, PA 15317

Telephone: 304 / 255-0491
Telephone: 304 / 883-2360
Telephone: 724 / 745-3630

Fax: 304 / 255-4232
Fax: 304 / 883-2361
Fax: 724 / 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

IEPA - DIVISION OF RECORDS MANAGEMENT
RELEASABLE

AUG 02 2019

REVIEWER: JMR

November 17, 2014

Project No. B12-271-1413

Mr. Scott Fowler
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

RECEIVED
JAN 02 2015
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Response to Comments
Permit Application Permit No. 417
Williamson Energy, LLC
Coal Refuse Disposal Facility No. 3
Williamson County, Illinois

Dear Mr. Fowler:

This letter describes our response to your comments dated October 24, 2014 (copy attached) to the document described above. The responses to your comments are as follows:

Response to Comment No. 1 – The operator will be Mach Mining, LLC. Pursuant to 62 Ill Adm. Code 1773.5 b)2), an operator is presumed to constitute ownership or control unless a person can demonstrate that the person subject to the presumption does not in fact have the authority directly or indirectly to determine the manner in which the relevant surface coal mining operation is conducted. In this case, Mach Mining, LLC is a contractor to Williamson Energy, the permit holder. Mach is a contractor without an ownership or control relationship to Williamson or any of its affiliates. It is under the direction and control of Williamson and does not have direct or indirect authority to determine the manner in which the operation is conducted.

Response to Comment No. 2 – New River Royalty, LLC sold the property to Williamson Energy, LLC.

Response to Comment No. 3 – An organizational chart is provided in Attachment I.6.

Response to Comment No. 4 – The ownership and control information is contained in Attachment I.6.

Response to Comment No. 5 – The violation history is contained in Attachment I.9.A.

Response to Comment No. 6 – An updated insurance certificate has been included in Attachment I.10.A. The applicant owns all of the surface to be permitted. Surface ownership information has been corrected on Attachment I.2.A.

Response to Comment No. 7 – Dwina Road between Permit No. 375 and 417 no longer exists. It has completely been removed from the area being permitted. The road has been removed from Drawing Nos. B12-271-E7, B12-271-M2, B12-271-M5, B12-271-M7, B12-271-M8, B12-271-M13, B12-271-M16, B12-271-M24, and B12-271-M25.

Response to Comment No. 8 – Dwina Road has been removed from the area to be permitted. It is no longer in existence from the intersection of Dean Road south to the railroad tracks. However, area is being permitted within 100 feet of Dwina at its intersection of Dean Road. Attachment I.12.C has been revised to reflect this.

Response to Comment No. 9 – The Public Notice, Part I Attachment I.11 has been revised to reflect Dwina Road being within 100 feet of the permit area.

Response to Comment No. 10 – Holcomb Foundation Engineering Co., Inc. measured topsoil thickness. A letter report dated November 12, 2014 with the measurements and a "Boring Location Diagram" are included in Attachment II.13.D. Soil information for productivity and capability are contained in the soil resource report contained in Attachment II.13.A. The Topsoil Thickness Report and location map are contained in Attachment II.13.D. The Map 5 format is 1" = 200 feet rather than 1" = 400 feet for clarity purposes. A replacement thickness for topsoil of 6 inches has been added to II(13)(D).

Response to Comment No. 11 – A prime farmland exemption has been requested in Section V(2)(B)(2).

Response to Comment No. 12 – There are two primary areas for subsoil removal, sediment control structures and incised holes inside the impoundment. The average cut depth for the sediment control structure is 11.95 feet and the average cut depth inside the impoundment is 9.36 feet. This has been included in Part II(13)(E).

Response to Comment No. 13 – An archaeological survey dated October 30, 2014 has been included for the 10 acre tract previously not covered.

Response to Comment No. 14 – There are two primary areas for subsoil removal, sediment control structures and incised holes inside the impoundment. The average cut depth for the sediment control structure is 11.95 feet and the average cut depth inside the impoundment is 9.36 feet. This has been included in Part II(13)(E).

Response to Comment No. 15 – Please refer to the revised threatened and endangered species assessment contained within Attachment II-8 of the application. Additionally, please note that protection and enhancement plans for species that could potentially occur have also been included within this section.

Response To Comment No. 16 – Attachment II.9 has been revised to include additional site specific information regarding existing vegetation on the permit area. Methodologies used to

collect the data are described within the Biological Survey contained within Attachment II.8. The study was prepared by Jennifer Arp-Bazzie Project Scientist with Alliance Consulting. Mrs. Arp Bazzie's resume has been included within Attachment II.8 as well.

Response to Comment No 17 – Parts II.8 and II.9 have been updated as discussed above. Protection and Enhancement Plans have been developed for species that may potentially inhabit the project and adjacent area. A discussion concerning limitations of restoration and the restorative options available for use in reclamation for wildlife has been included within the protection and enhancement plans. Refer to the protection and enhancement plans contained within Attachment II.8.

Response to Comment No. 18 – Refer to Map 6 S.F., Operations Plan Map (Drawing No. B12-271-M24), the Threatened and Endangered Species Survey Map (Drawing No. B12-271-D1), contained in Attachment II.8 and Map 4, HydroGeologic Map (Drawing No. B12-271-M23) for water well locations

Response to Comment No. 19 – The project area will directly impact two stream channels that were identified as intermittent with the Corps of Engineers, however neither of these channels meets the definition found in IL 62 1701 defines an intermittent stream as a stream or reach of a stream that drains a watershed of at least one square mile; or A stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge. These two channels have a drainage area of approximately 40.58 acres (cumulatively) or 0.06 square miles at the downstream end. Additionally no groundwater influence can be observed within these channels. Therefore, they meet the ILDNR definition of intermittent and are considered ephemeral per IL 62 1701. One area of affect that will occur within the buffer zone of an intermittent or perennial stream along the northeast portion of the project area. The stream resources within the project area are shown on drawing B08-467-E20 contained within Attachment II.9 and the riparian buffer zone with areas of encroachment have been shown on Map 6SF. This area of intrusion into the buffer zone must occur in order to allow for drainage from Pond No. 9 into offsite drainage features.

Response to Comment No 20 – Part V 1(A) has been revised to address the application of lime to the coarse refuse before the placement of soil material.

Response to Comment No. 21 – Part V 1(D)(1), 1(D)(2), 1(D)(3) and the Reclamation Map (Drawing No. B12-271-M25) have been revised per your comment. Information has been provided for temporary vegetation, fish & wildlife herbaceous cool seasons planting, fish & wildlife herbaceous warm seasons planting, fish & wildlife woody planting and fish & wildlife water.

Response to Comment No. 22 – The reference to an attachment in Part V-2(B)(4) has been removed and a chart has been inserted listing the pre-mining and post mining acreage.

Response to Comment No. 23 – Refer to the revised response for Part V-3(A)(2) and the revised Reclamation Map (Drawing No. B12-271-M25)



Response to comment No. 24 – In accordance with the 2013 FWS Indiana Bat Protection and Enhancement Plan guidelines the applicant determined the following:

1) Is there suitable IN Bat summer habitat – Yes
2) Will the proposed mining activity impact this habitat – Yes
3) Is it within a known IN Bat Habitat – No
4) Can you justify no adverse effect or take –No
5) Do you wish to assume presence –No
6) Action – Conduct Summer Survey
7) Were IN bats determined to be present – No
8) No additional summer habitat/assessment or surveys required.

Accordingly the applicant conducted a summer mist net survey for Indiana bats within the project area (contained within Attachment II.8). The results of this survey indicate the probable absence of the species from the project area. Therefore a protection and enhancement plan or timber cut period is not required as outlined within the 2013 guidelines. Additionally, this has been documented in the Threatened and Endangered Species Project Assessment within Attachment II.8.

Response to Comment No. 25 – As per your request the applicant has prepared the following response to address the Northern Long-eared bat in accordance with the 2013 FWS Indiana Bat Protection and Enhancement Plan guidelines the applicant determined the following:

1) Is there suitable IN Bat summer habitat – Yes
2) Will the proposed mining activity impact this habitat – Yes
3) Is it within a known IN Bat Habitat – No
4) Can you justify no adverse effect or take –No
5) Do you wish to assume presence –No
6) Action – Conduct Summer Survey
7) Were IN bats determined to be present – No
8) No additional summer habitat/assessment or surveys required.

Accordingly the applicant conducted a summer mist net survey for Northern Long-eared bats within the project area which is contained within Attachment II.8. The results of this survey indicate the probable absence of the species from the project area. Therefore a protection and enhancement plan or timber cut period is not required as outlined within the 2013 guidelines. Additionally, this has been documented in the Threatened and Endangered Species Project Assessment within Attachment II.8.

Response to Comment No. 26 – The applicant has provided a protection and enhancement plan for wetlands which is contained within Attachment II.8

Response to Comment No. 27 – The applicant has provided a protection and enhancement plan for riparian areas which is contained within Attachment II.8

Response to Comment No. 28 – Refer to Part II-8 for the narrative concerning the protection of raptors.

Response to Comment No. 29 – No permanent diversion is currently proposed; therefore Part V-6 has not been completed. The streams to be permanently affected within the project area are less than a 1 square mile drainage area, and no known groundwater inflows exist. Therefore according to the definitions outlined in IL CFR 62-1701 based upon this definition the stream reach is considered ephemeral. Please note that this may not be consistent with the criteria utilized by the Corps of Engineers for the determination of intermittent stream systems.

Based upon the definitions contained in ILCFR 62-1701 the only intermittent stream channel to be affected by this project will be an Unnamed tributary of Pond Creek which will receive drainage from Pond No. 9. Drainage from this area will be captured via constructed surface ditches and conveyed off of the facility into sediment control ditches and ultimately into Pond No. 9 for discharge. Drainage Structures associated with this area have been shown on Drawing No. B12-271-M16 Entitled "Abandonment Map".

Response to Comment No. 30 – As outlined in Response to Comment No. 14 above multiple methods will be utilized to minimize the electrocution hazard to raptors in association with the proposed project. No bald eagle nests are known to exist within a one mile radius of the project location, however given the recent increases in the bald eagle population within Illinois it is possible that bald eagles could utilize the project area for feeding and foraging, even though their preferred feeding habitat does not exist within the project area. Therefore the applicant has prepared and submitted a protection and enhancement plan for the bald eagle which is contained within Attachment II.8

Response to Comment No. 31 – The number of boring used were 20. The text has been corrected to reflect this in Part III.2.A.1.

Response to Comment No. 32 – The number of cross sections has been corrected in Part III.2.A.1.

Response to Comment No. 33 – Acid base accounting has been included for the coal refuse in Attachment III.2.A.3.

Response to Comment No. 34 – The sulfur forms for the Herrin No. 6 coal seams are contained in Attachment III.2.A.3.

Response to Comment No. 35 – Groundwater quality sampling and laboratory analysis has been performed for seven (7) groundwater monitoring wells (GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28) located at/near proposed RDA No. 3. The location of each of these wells is presented upon the Geologic Cross Sections Location Map (Drawing No. B12-271-E1). Submitted are laboratory analytical reports for these samples, which were collected on a quarterly basis spanning the third and fourth calendar quarters of 2013 and the first and second

quarters of 2014. Excepting only GW-8R which was dry during the third and fourth quarter 2013 sampling events, all other wells were recorded as having water present for sampling during the year.

Based upon this suite of groundwater analyses, the pH of these wells was characteristically circum-neutral, with the highest pH in the data set measuring 7.5 and the lowest 6.6. As would be expected from that pH range, the groundwater has considerably higher alkalinity in comparison to acidity. Alkalinity ranged from a high of 800 to a low of 190 mg/L; and, acidity spanned from < 10 up to 150 mg/L. Hardness is very high in all samples, with a low of 292 and high of 3800 mg/L. Total dissolved solids (TDS) and sulfates were also characteristically high to very high, with TDS spanning between a low of 638 and high of 5736 mg/L and sulfates between a low of 284 and high of 3730 mg/L. Total iron was variable even on an intrawell basis, with same-well concentration ranging from below the method detection limit to a high of 3.072 mg/L in GW-14 during the year. Other wells too exhibited notable iron concentration fluctuations. Total manganese likewise exhibited variable intrawell concentration, along with considerable variability between wells. Both the sampling events where water was present in well GW-8R exhibited high total manganese, with reporting of 7.107 and 9.124 mg/L. In the other wells, total manganese values spanned from below the method detection limit up to 8.630 mg/L. In collective consideration of the aforementioned parameters and concentrations, the existing shallow groundwater quality on/near proposed RDA No. 3 is regarded to be poor.

Response to Comment No. 36 – Groundwater usage and rates of discharge are regarded as nominal on/near RDA No. 3. No domestic groundwater users have been identified in the area. Surface watercourses in this local area characteristically exhibit significant periods of no flow, which is indicative of no to only very limited timeline groundwater contribution to surface water flow at/near RDA No. 3. Clayey till is deposited across the RDA No. 3 area, and the till is characteristically underlain by shale. This geologic setting impedes productive groundwater recharge, and inherently provides a hydrogeologic setting where both horizontal and vertical permeabilities are low/very low. To further demonstrate the geology and hydrogeology of this area, Geologic Cross Section AA - AA' (Drawing No. B12-271-E15) has been prepared. That drawing exhibits the available field sampling and corresponding laboratory testing of the till across the currently permitted RDA Nos. 1 and 2, as well as proposed RDA No. 3. The drawing also exhibits permeability data acquired during slug testing of some of the groundwater monitoring wells in the area, along with the monitoring (i.e. screened) interval within those wells. As evident on the drawing, the monitoring interval within some of the slug tested wells includes the top of bedrock underlying the till. Regardless, all results from both slug testing as well as laboratory testing of till consistently demonstrate remarkably low permeability values, which documents that there is nominal to no potential for any appreciable quantity of groundwater to be transported by these hydrostratigraphic horizons across the proposed RDA No. 3 area. As an added measure of hydrogeologic evaluation, the same sandstone unit that was reviewed on the RDA Nos. 1 and 2 locations was also reviewed at the proposed RDA No. 3 site. The drawing titled Sandstone Unit Isopach Map (Drawing No. B12-271-E14) depicts this sandstone's thickness as well as the layout/location of Geologic Cross Section AA-AA'. As evident upon viewing the isopach map, this sandstone unit is laterally discontinuous and the vast

majority of RDA Nos. 1, 2 and 3 either have the unit absent beneath them or else it characteristically is at a thickness of 3 feet or less.

Groundwater elevation measurements recorded on February 27, 2014 for monitoring wells GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28 were used to generate a Potentiometric Surface/Water Table Map (Drawing No. B12-271-E17) for the shallow water bearing zone. The groundwater surface contours were constructed on a 5-foot elevation contour interval. The map illustrates that the groundwater flow direction is in a northerly direction across the site. The calculated hydraulic gradient based on those contours is 0.007 ft./ft.

Response to Comment No. 37 – A narrative description of the surface water quality has been provided in Part III.2.C.2.a. A surface water data summary sheet is provided in Attachment III.2.C.2.a.

Response to Comment No. 38 – The response to Part III.2.C.1 has been modified to address streams sampling locations.

Response to Comment No. 39 – The response to Part III.2.C.1 has been modified to address the types of streams in the permit area.

Response to Comment No. 40 – A discussion of the refuse being produced and is proposed for disposal in the permit area has been discussed in Part III.2.D.1.b.

Response to Comment No. 41a. and b. – The response has been changed to reflect a new NPDES permit is being sought in Part III.3.

Response to Comment No. 41c. – Outlet 009 has been relocated at the pond outlet. Refer to the Surface Facilities Map (Drawing No. B12-271-M24).

Response to Comment No. 42 – Downstream water users are described in Part III.3.f.

Response to Comment No. 43 – The reply to Part III.3.G.2 has been removed.

Response to Comment No. 44 – Additional information for outfall locations has been provided on the Schedule A.

Response to Comment No. 45 – Part III.5 has been edited to discuss the existing refuse areas. The existing refuse area operates as a closed system. The water is reused in the preparation plant and may be recirculated into the impoundment, if necessary. Therefore, there is no discharge under normal operation conditions and no affect to the stream quality. The same condition should exist for the proposed refuse disposal facility.

Response to Comment No. 46 – Additional groundwater data has been included in Attachment III.2.B.2.

Response to Comment No. 47a. – Additional analysis has been added.

Response to Comment No. 47b. – Data for PC2 has been included.

Response to Comment No. 47c. – Drawing No. B12-271-M23 has been added to Map 4 – Hydrogeologic Map.

Response to Comment No. 48 – The Cumulative Impact Area has been addressed in Part III.2.d.

Response to Comment No. 49 – Acid base accounting has been included in Attachment IV.6.A. The response to Part IV.6.A has been revised.

Response to Comment No. 50 – The response to Part IV.6.1 has been revised and a narrative included.

Response to Comment No. 51a.i. – The subject map contained within Holcomb Foundation Engineering Co., Inc.'s (Holcomb) July 21, 2009 report is an older map that was likely provided to Holcomb early in the project, prior to completion of their drilling and monitoring well installations at this site. Rather than using that map which is a part of that report, please refer to the Geologic Cross Sections Location Map (Drawing No. B12-271-E1) for a more adequate correlation of respective borehole/monitoring well locations and names. Fortunately, Holcomb's report does reference the boreholes/wells in their report by the same names as is identifiable upon the Geologic Cross Sections Location Map. For further resolution/confirmation purposes, it is evident that the respective Northing/Easting coordinates for each of Holcomb's boreholes/wells are shown both upon their logs and also in the table titled "Surveyed Borehole Locations" provided on the Geologic Cross Sections Location Map. Drilling logs/well installation information for groundwater monitoring wells GW-10, GW-11, GW-12, GW-13 and GW-14 are provided within Holcomb's report and the corresponding locations are adequately presented upon the Geologic Cross Sections Location Map.

Response to Comment No. 51a.ii. – As evident upon the respective drilling logs for boreholes BH-5 and BH-5A, each hole has the very same Northing/Easting coordinates because they were virtually drilled side-by-side at practically the same location. The sole purpose of BH-5A was to acquire a single, undisturbed shelby tube sample of the clay till at the depth interval spanning between 18.5 ft. and 21 ft. Toward the end of Holcomb's report, you will see that they actually referenced the shelby tube sample tested for permeability to be from BH-5, rather than BH-5A. Therefore, only BH-5 and not BH-5A has been mapped.

Response to Comment No. 51a.iii. – See explanation given in response to comment 21 a. i. The information shown on the older map contained within Holcomb's July 21, 2009 report is correlative at the present time as follows: (1) the borehole/well denoted on that map as BH/GW-1 actually evolved to GW-12; (2) the borehole/well denoted as BH/GW2 became GW-13; and, (3) the borehole/well denoted as BH/GW-3 became GW-14.

Response to Comment Nos. 51b.i. and 51b.ii. – As has earlier been handwritten upon that log, BP4 is actually the drilling log for the borehole within which groundwater monitoring well GW-28 was constructed. Therefore, BP4 and GW-28 are the very same location, and it has simply been mapped as GW-28 on the Geologic Cross Sections Location Map (Drawing No. B12-271-E1).

Response to Comment No. 51c.i. – Borehole D-1 has been shown on Drawing No. B12-271-E1 entitled, "Geologic Cross Section Location Map".

Response to Comment No. 51c.ii. – Borehole BH-5A has been shown on Drawing No. B12-271-E1.

Response to Comment No. 51c.iii. – Borehole No. D-2

Response to Comment No. 51c.iv. – Boring logs have been provided for GW-8R, GW-28, B-5 and B-7. Boring GW-8 and GW-8R are the same. GW-8 was damaged and replaced by GW-8R.

Response to Comment No. 51c.v. – The reference has been changed to Drawing No. B12-271-E1 entitled, "Geologic Cross Sections Location Map".

Response to Comment No. 52 – The test pits have been removed. They were excavated to obtain soil samples for foundation and embankment design.

Response to Comment No. 53 – Drawing No. B12-271-A5 entitled, "Borehole/Groundwater Monitoring Well Sealing Plan" has been included. The response has been changed.

Response to Comment No. 54 – The two structures are no longer there and have been removed from the map.

Response to Comment No. 55 – Soil and subsoil will be stockpiled on adjacent permit No. 375. A narrative describing these locations has been provided in Part IV(2)(B)(1).

Response to Comment No. 56 – A response for treatment methods and measures has been provided in Part IV(2)(B)(3).

Response to Comment No. 57 – The permit boundary has been adjusted to include the Pond 9 existing structure. The Operations Plan drawing (Drawing No. B12-271-M24) has been revised.

Response to Comment No. 58 – The acreage has been corrected in Part IV(5)(B).

Response to Comment No. 59a. – The reference has been changed to "Refer to Volume 2".

Response to Comment No. 59b. – The SEDCAD calculations have been revised to utilize Table 13 from Bulletin 79 from the IL State Water Survey.

Response to Comment No. 59c. – A cross section of the proposed culvert is shown on Drawing No. B12-271-B2 entitled, "Culvert C-1 Profile and Section".

Response to Comment No. 60 – Information for protecting the inlet end of culverts has been addressed on Drawing Nos. B12-271-B4 entitled, "Culvert Inlet Protection Stone", and B12-271-B3 titled, "Culvert Inlet Protection Silt Fence".

Response to Comment No. 61 – A response has been provided.

Response to Comment No. 62 – The reference has been changed to Volume 2.

Response to Comment No. 63 – The reference has been changed to "Pond 9".

Response to Comment No. 64 – The table in Part IV(7)(E) has been revised to include the drainage area and total disturbed area.

Response to Comment No. 65a. – The reference to the sediment pond has been removed.

Response to Comment No. 65b. – The reference to the drawing has been removed. The reference to the calculations has been added.

Response to Comment No. 65c. – The reference to Attachment IV.7.F has been removed and the correct reference inserted.

Response to Comment No. 65.d. – Corrected in the initial response.

Response to Comment No. 66.a. – Corrected in the initial response.

Response to Comment No. 66.b. – A profile and cross section has been provided on Drawing No. B12-271-E13.

Response to Comment No. 67 – Corrected in the initial response. Refer to Part IV, page 19.

Response to Comment No. 68 – Corrected in the initial response.

Response to Comment No. 69 – Part IV(7)(I) has been addressed.

Response to Comment No. 70 – The reference has been changed to Volume 2.

Response to Comment No. 71 – The reference has been changed and the legend corrected.

Response to Comment No. 72 – The design report is contained in Volume 2. The reference has been corrected.

Response to Comment No. 73 – The final elevation of the facility is 636 feet. This has been corrected on Part V(1)(B)(1). The Map 7, "Reclamation Map" (Drawing No. B12-271-M25) has been corrected to 636.

Response to Comment No. 74 – The topsoil thickness in Part II(13)(D) has been changed to ____ inches. The statement in Part V(1)(C)(1) has been removed. The location of the soil storage area is the area south of the existing Refuse Area No. 1 (Permit No. 382).

We trust this letter and attachments are acceptable to the IDNR. If there are any questions, or if further clarification is required, please contact us.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Senior Project Manager

Claudio E. Yon, P.E.
Senior Project Manager

SMS/CEY:kjs

File: 12271-13

P

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Pat Quinn, Governor
Marc Miller, Director

October 24, 2014

James Morris
Williamson Energy, LLC
PO Box 1829
1107 W. DeYoung
Marion, IL 62959

Re: Permit Application No. 417
Incomplete

Dear Mr. Morris:

This letter will serve as notice that the permit application to surface coal mining and reclamation operations No. 417 for Pond Creek #1 mine, submitted under the Surface Coal Mining Land Conservation and Reclamation Act and the promulgated rules and regulations, is **not** administratively complete for review.

The following points must be addressed by the applicant for the department to continue its review process.

1. Part I.1.C, the applicant indicates the operator for the site will be Mach Mining, LLC. However, the applicant did not provide ownership and control information for the operator, pursuant to 62 Ill Adm. Code 1778.13 c), and as defined in section 1773.5 b)2). The applicant shall provide the required ownership and control, and operations information as outlined in part c) and d) of section 1778.13, to be included in their responses for Part I.6.A and I.6.B, and violation history as required in Part I.9.A.

2. Part I.3.A and 62 Ill. Adm. Code 1778.13 e) requires the applicant to provide information for any holder of record of leasehold interest. The applicant indicates no leasehold interest. However, in Part I.2.A the applicant, in attachment I.2.B, the owner of the property is owned by New River Royalty, LLC., indicating the proposed surface area is uncontrolled by the applicant. The applicant shall update attachment I.2.B to indicate the type of documents granting them right of entry for the proposed area or submit a completed landowner affidavit indicating approval by the landowner to include the property in the proposed boundary.

3. Response to Part I.6.A is incomplete. Although the applicant provided the owner of the applicant, Foresight Energy, LLC, the applicant must provide all owners and controllers (officers and directors) of the applicant as defined by 62 Ill. Adm. Code 1773.5 for five

years preceding the date of the application. Information required includes owners and controller of the applicant's owners through the top level of the corporate structure. The Department is also requiring an organization chart for Ownership and Control. Ownership and Control is also required for the listed operator in Part I.1.C.

4. Response to Part I.6.B of the application is incomplete. Pursuant to 62 Ill Adm. Code 1778.13(d) the applicant must provide the operations information required for all of its owners and controllers identified in Part I.6.A (revised) of the application, including operation for the listed operator in Part I.1.C.

5. Part I.9.A refers to attachment I.9 for violation history. Pursuant to 62 Ill. Adm. Code 1778.14(c) the applicant must provide a listing of all violations for all operations which the applicant owns and controls. The information provided appears only for the applicant and nothing for the owners/controllers of the applicant, nor does it provide violation status. The applicant shall update the attachment providing violations for the owners/controllers of the applicant as well as itself, and provide the status of each violation.

6. Part I.10.A requires affidavits, certifications and insurance certificates.

   - Proof of insurance submitted has expired December 31, 2013. Pursuant to 62 Ill. Adm. Code 1778.18 the applicant shall provide a valid certificate of insurance.
   - The Legal Right to Enter and Mine affidavit is deficient in that it does not indicate the type of documents giving such right to enter and mine and must be updated along with Part I. 3.A. The applicant shall indicate the type and date of documents granting them the right to enter and mine.

7. Part I.12.B.4 response indicates no roads will be removed, relocated or temporarily closed. However, operations plan and maps indicate the impoundment is to connect to the existing impoundment in Permit No. 375, west of Dwina Road. Response conflicts with the information provided in the application and must be clarified. If the response is Yes, copy of the agreement with the road authority will be required along with measures to be used to insure the interest of the public and land owners will be protected.

8. Part I.12.C indicates operations will be within 100 feet of Dean Road, Section 7, T8S, R4E. In conjunction with Part I.12.B.4, application maps show construction through Dwina road. The applicant therefore either needs to explain the temporary closing, relocation or removal of Dwina Road or indicate operations shall be within 100 feet of the right of way for all roads.

9. Part I.11 public notice shall be revised based on revisions to responses of Parts I.12.B.4 and I.12.C, and other revisions necessary prior to department approval for publishing.

10. Pursuant to 62 Ill. Adm. Code 1783.22, Question , II-6,II-13 C & D, Attachments II-6 and II-13B, do not provide, the required soil information for productivity, capability, onsite topsoil thickness and acreage and soils and negative determination maps in the required format as required by the Department. In addition, 1817.22 requires a minimum of 6 inches of topsoil be removed and replaced.

11. Pursuant to 62 Ill. Adm. Code 1823.11 Question V2 must be addressed to discuss the applicability of the prime farmland exemption.

12. Pursuant to 62 Ill. Adm. Code 1783.22, Question II-13E, must describe the volumes and depth of subsoil removal, in order to insure adequate volumes are available for the covering of the refuse and other areas.

13. Pursuant to 62 Ill. Adm. Code 1783.12, response II 10, page II-5 must be modified to clarify if the entire permit area has been surveyed. The survey report in the application does not include the entire permit area.

14. Pursuant to 62 Ill. Adm. Code 1783.22, Question II-13E, must describe the volumes and depth of subsoil removal, in order to insure adequate volumes are available for the covering of the refuse and other areas.

15. The application did include summary site specific information regarding threatened and endangered species and their potential likelihood or unlikelihood to occur within the permit and adjacent areas and their potential to be impacted by the proposed mining operation. Pursuant to 62 Ill. Adm. Code 1784.21 and as required by Part II-8 of the application, the applicant shall furnish more detailed site specific resource information for each species identified within the application that potentially could occur within the permit area and **a protection and enhancement plan for each of those species**, or provide justification why additional site specific resource information and protection and enhancement plans are not required. Also, it was noted that a site survey was conducted, in order to properly assess the adequacy of the survey(s), additional detail and information shall be provided on survey methodologies including the number, seasonality and type of survey(s) done. Also, pursuant to 62 Ill. Adm. Code 1777.13 the applicant shall provide the names of persons or organizations that collected or analyzed data, their qualifications and descriptions of methodologies used to collect or analyze data.

16. In response to Part II-9 the application did include some summary site specific information regarding the existing vegetation on the permit and adjacent acreage as required under 62 Ill. Adm. Code 1783.19. However, the information provided, particularly for the permit area itself, was not adequate to assess to what degree the pre-existing habitat qualifies as important habitat for fish and wildlife and did not appear sufficient enough to design the protection and enhancement plans required by 1784.21(b). The description of existing vegetation will need to be more detailed, complete and thorough. Also, pursuant to 62 Ill. Adm. Code 1777.13 the applicant shall provide the names of persons or organizations that

collected or analyzed data, their qualifications and descriptions of methodologies used to collect or analyze data.

17. As required under 62 Ill. Adm. Code 1784.21 and in response to Parts II-8 and 9, the application needs to have descriptions of how the operator will minimize disturbances and adverse impacts on fish and wildlife and related environmental values and what protective measures will be used during the active mining phase of operation. Since the mining activity proposed under this application is a coal waste structure with inherent limitation on possible site restorative options in reclamation for wildlife habitat replacement, enhancement and mitigation, a thorough discussion shall be provided explaining what type of enhancement is not practicable, what enhancement is practicable and what compensatory approaches, if any, will be taken.

18. Part II-12(B) of the application requires information on the elevation and location of all monitoring stations used to gather data for water quality and quantity, fish and wildlife and air. The response to that question provided that information only for water monitoring. This information is also to be furnished for any monitoring or survey work done for fish and wildlife and air. If no monitoring or survey work was done, then an explanation and rational is to be provided for not establishing monitoring stations or conducting any monitoring for fish and wildlife and air.

19. The response to Part IV-7(I) indicates that no intermittent or perennial stream will be affected. That does not appear to be the case. This needs to be explained. If an intermittent or perennial stream is to be affected Part IV-7(I) requires a detailed response regarding any mining activity within 100' of an intermittent or perennial stream and any permanent stream diversion. 62 Ill. Adm. Code 1817.57 restricts activities on lands lying within 100 feet of the top of the bank of the normal channel of a perennial or intermittent stream. Pursuant to 62 Ill. Adm. Code 1817.57 the applicant shall identify on a map all areas within the proposed permit area which lie within 100 feet of the top of the bank of the normal channel of any perennial or intermittent stream, or justify why this regulation is not applicable. For those areas in which disturbances are planned, the applicant shall supply all information necessary for the Department to make the requisite written findings including:

    a) how the activities will not cause or contribute to a violation of 62 Ill. Adm. Code 1817.42,
    b) how the activities will not adversely affect water quality and quantity, and
    c) how the activities will not adversely affect other environmental resources of the stream including aquatic biota.

20. Part V-1(A) requires an overview of the reclamation process for the permit area. The response specifies that reclamation of the gob pile includes covering to a depth of four feet with a soil cover. There was no mention of a lime application prior to soil placement. Current reclamation practice required by the Department for gob piles includes an application and incorporation of a lime treatment based on acid-base accounting of the

surface gob material (top 12") when construction is completed. The response needs to be expanded to indicate lime application or to justify why no lime application is needed.

21. The responses to Part V-1(D)(1) &1(D)(2)(b) & 1(D)(3) do not adequately describe the revegetation program to be used in final reclamation. The applicant has committed to the post-mining acreage having a permanent vegetative cover of herbaceous wildlife. Reclaiming to this category usually means a final vegetative cover of native warm season grasses and forbs. The commitment to having primarily native warm season vegetation as the final permanent vegetative cover is universally understood to require more intensive and precise establishment practices and more time than what is needed for a non-native cool season grass ground cover. In particular, the type of information needed includes the strategy, scheduling, timing and methods to be used in establishing native warm season grasses and forbs. For example, will warm season grasses be established alone or after a temporary cover of cool season grasses have been established? If cool season grasses are established first as temporary cover, what species will be used and will they be eliminated or will over-planting be done? If eliminated, how will this be accomplished? What will be the timing? If native forbs will be part of the mix, what species, seedling rates and/or establishment practices will be employed? This application did not state that a cool season cover would be established first, however, if that strategy is anticipated, it will need to be explained and, a replacement strategy will need to be articulated in sufficient detail. What will be the expected amount of time until the warm season grass cover becomes the dominant cover type? These and other establishment issues will need to be articulated. The species list provided in the application includes cool season grasses, several non-native species and trees. The use of non-native species will need to be justified as required under 62 Ill. Adm. Code 1897.97(b). Also, the Department does not allow any tree planting on reclaimed above-grade gob disposal areas due to increased issues of long-term site stability of the soil cover and compatibility with permanent herbaceous vegetation. The Department will allow the side slopes of reclaimed gob piles to be revegetated to a permanent cover of native and non-native cool season vegetative, with adequate justification for use of the non-native types. The relatively flat or gentle sloping top areas are encouraged to be vegetated with the warm season types. The more detailed level of information is being required so a reasonable assessment can be made that there is a reasonable expectation that the requirements of 62 Ill. Adm. Code 1817.97(a,g); 1817.111(a,b,c) and 1817.113(a) can be met; and so that the finding required under 62 Ill. Adm. Code 1773.15 (c) (2) can be made.

22. The response to Part V-2(B)(4) refers to "Attachment V.2.A". This attachment could not be found. If it is to be a part of the application it needs to be included.

23. The response to Part V-3(A)(2) refers to woody plantings in reclamation. The reclamation plan indicates all acreage as wildlife-herbaceous. Since the permit acreage is almost entirely a reclaimed above grade gob pile, woody vegetation cannot be proposed as a final vegetative type. If forestry or wildlife-woody is begin proposed for non-gob pile portions of the permit area, all tables, post-mining land use designations and all reclamation narrative in all

applicable maps and parts of the application must be changed to reflect that option. Also, non-native tree species cannot be proposed for use as a final vegetative cover in reclamation.

24. Pursuant to 62 Ill. Adm. Code 1780.16(b) and as required by Part V-3-B-4 of the application, the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (Revised February, 2013) developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines. The information provided in this application is incomplete in terms of the requirements of the "Guidelines." In determining whether or not a protection and enhancement plan is required the decision flow chart as outlined in the "Guideline" is to be presented and responded to appropriately and must be appropriately referenced that the "Guideline" was followed and appropriately documented. In addition, any reference to a "cut period" must indicate October 15 to March 31 as that time period. Also, Pursuant to 62 Ill. Adm. Code 1777.13, the applicant shall provide the names of persons or organizations that have made the determination of possible impacts to the Indiana bat at this site and that data collected or analysis made to make that determination must include descriptions of methodologies used.

25. Pursuant to 62 Ill. Adm. Code 1780.16(a-e), to insure compliance with 62 Ill. Adm. Code 1817.97, and as required by Parts V-3-A-1,2&3 and V-3-B-4 of the application, the applicant shall provide a protection and enhancement plan for the Northern Long-eared Bat (*Myotis septentrionalis*) meeting the specifications of the July 2009 Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (Revised February, 2013) developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines. The information provided in this application is incomplete in that a protection and enhancement plan for the Northern Long-eared Bat following the procedures outlined in the "Guidelines" is not included. This information is now required since the Northern Long-eared Bat is a proposed federally listed threatened and endangered bat species and under 62 Ill. Adm. Code 1780.16 (a)(2)(A) regulatory protections also apply to species proposed to be listed under the Endangered Species Act. Any reference to a "cut period" must indicate October 15 to March 31 as that time period. Also, Pursuant to 62 Ill. Adm. Code 1777.13, the applicant shall provide the names of persons or organizations that have made the determination of possible impacts to the northern long-eared bat at this site and include a list of the credentials for those individuals or organizations. In addition, the data collected or analysis made to make that determination must include descriptions of methodologies used.

26. Pursuant to 62 Ill. Adm. Code 1780.16, the applicant shall provide site specific resource information and a protection and enhancement plan meeting the specifications of that regulation for wetlands, or justify why these items are not required. Pursuant to 62 Ill. Adm. Code 1817.97(f), the applicant shall explain how wetlands are to be avoided, enhanced, restored, or replaced. Pursuant to 62 Ill. Adm. Code 1780.18(b)(9), the applicant shall update the Department regarding steps being taken to comply with Section 404 of the Clean

Water Act regarding wetlands. Also, maps and information provided in the permit application do not clearly depict the location of riparian areas, wetlands and stream locations. Maps will need to be provided that clearly indicate those types of habitats of unusually high value for fish and wildlife. Pursuant to 62 Ill. Adm. Code 1777.13, the applicant shall provide the names of persons or organizations that collected or analyzed data, their qualifications and descriptions of methodologies used to collect or analyze data.

27. Pursuant to 62 Ill. Adm. Code 1780.16, the applicant shall provide site specific resource information and a protection and enhancement plan meeting the specifications of that regulation for riparian areas, or justify why these items are not required. Pursuant to 62 Ill. Adm. Code 1817.97(f) the applicant shall explain how riparian areas are to be avoided, enhanced, restored, or replaced.

28. Pursuant to 62 Ill. Adm. Code 1817.97(e), the applicant shall demonstrate how, to the extent possible using the best technology currently available, they will ensure that electric power lines and other transmission facilities used for or incidental to surface mining activities on the permit area are designed and constructed to minimize electrocution hazards to raptors, or justify why this requirement does not apply.

29. It is unclear in the application whether or not surface drainage includes intermittent or perennial streams. It appears intermittent and perennial streams will be impacted and permanently diverted. If not, then the application will need to clearly reflect that condition and depict exactly where the final surface configuration will route surface runoff. However, if there is permanent diversion of some level, there must be adequate response in the application to all of Part V-6 and subparts, perennial and intermittent stream diversions. This appears to be an omission since "Attachment II.9" seems to indicate the presence of perennial or intermittent streams. It is not clear within the application that there will be a post-mining permanent relocated stream channel of some sort. Part V-6-D must be responded to completely, thoroughly and in its entirety to reflect what in fact is the applicant's plan for a post-mining landscape configuration and how surface drainage will be handled and how it will conform to the final reclamation plan. In responding to Part V-6-D, the monitoring requirement specified in Part V-6-D-5 is not to be overlooked. Pursuant to 62 Ill. Adm. Code 1777.13, the applicant shall provide the names of persons or organizations that collected or analyzed all stream data, their qualifications and descriptions of methodologies used for collecting data.

30. Pursuant to 62 Ill. Adm. Code 1817.97(c)&(d) and as required by Part V-3-B(2) of the application, the application must be modified to provide current information, including accurate information on distances to known bald eagle nest sites within a one mile radius of the permit boundary, detailing the measures to be taken to insure compliance with all aspects of the Federal Endangered Species Act of 1973 as amended and the Bald Eagle Protection Act as amended.

31. On page 2 of Part III, at Part III.2.A.1, the applicant states *"A network of twenty (20)*

borings..." but later in this response only nineteen borings are listed. Pursuant to 62 Illinois Adm. Code 1784.22(b), the applicant shall clarify this discrepancy.

32. On page 2 of Part III, at Part III.2.A.1, the applicant states, "*...a series of six (6) geologic cross sections...*" but later in this response states "*All eight (8) of the geologic cross sections...*" Pursuant to 62 Illinois Adm. Code 1784.22(b), the applicant shall clarify this discrepancy.

33. The applicant failed to provide a response to Part III.2.A.2 regarding the acid-base accounting information of any strata that may contain acid or toxic-forming materials. Pursuant to 62 Illinois Adm. Code 1784.22(b)(2)(B), the applicant shall provide this information.

34. The applicant failed to provide a response to Part III.2.A.3 regarding information on the coal seam, including the acid-base accounting information for the coal. Pursuant to 62 Illinois Adm. Code 1784.22(b)(2)(C), the applicant shall provide this information.

35. The applicant failed to provide a description of the groundwater quality as required by Part III.2.B.2. Pursuant to 62 Illinois Adm. Code 1784.14(b)(1), the applicant shall provide a narrative description of the groundwater quality in the vicinity of the proposed permit area.

36. The applicant failed to provide a discussion regarding the rates of discharge and/or usage of the groundwater. The applicant failed to provide a potentiometric or water table map of the shallow water-bearing zone encountered in the vicinity of the proposed permit area. Pursuant to 62 Illinois Adm. Code 1784.14(b)(1)(B) and as required by Part III.2.B.3 the applicant shall provide the required information.

37. The applicant failed to provide a description of the surface water quality as required by Part III.2.C.2.a. Pursuant to 62 Illinois Adm. Code 1784.14(b)(2), the applicant shall provide a narrative description of the surface water quality in the vicinity of the proposed permit area.

38. Pursuant to 62 Illinois Adm. Code 1784.14(b)(1) and as required by Part III.2.C.1, the applicant shall provide justification for the locations of the surface water monitoring points.

39. The applicant states in response to Part III.2.C.1 that "*One un-named tributary of Pond Creek...is considered to be intermittent.*" However, in Part III.2.C.2.b, the applicant states the streams are "*...typical of ephemeral headwater streams in the area.*" These statements appear to contradict. Pursuant to 62 Illinois Adm. Code 1784.14(b)(2), the applicant shall clarify this discrepancy and where necessary correct and/or amend the responses to Parts III.2.C.1 and III.2.C.2.b.

40. In Part III.2.D.1.b the applicant states that "*The only potentially acid-forming strata...(is) the Energy Shale and the underclay beneath the coal seam.*" The applicant fails to include a discussion of the refuse that is being produced and is proposed for disposal in the proposed

permit area. Pursuant to 62 Illinois Adm. Code 1784.14(3)(3), the applicant shall provide a discussion of the potential for the refuse to contaminate the surface and/or groundwater supplies.

41. In Part III.3. the applicant indicates that an NPDES permit is not being sought nor has an NPDES permit been issued.

    a. NPDES Permit No. IL0077666 was issued on June 28, 2005 and remains in effect for this facility.
    b. The applicant includes a Schedule A, which proposes a new NPDES Outfall, 009.
    c. Outfall 009 appears to be located within the receiving stream, not at the proposed Pond outlet.

    Therefore, pursuant to 62 Illinois Adm. Code 1777.11(a)(3), the applicant shall clarify these discrepancies regarding the NPDES permit and shall correct and/or amend the responses to Parts III.3.a and III.3.b and associated maps/drawings.

42. In Part III.3.f, the applicant failed to provide a discussion of the "downstream water uses/users." Pursuant to 62 Illinois Adm. Code 1784.14(i), the applicant shall provide a discussion of the downstream water uses and users so that potential impacts are properly evaluated.

43. In Part III.3.g, the applicant responds *"No"* then proceeds to provide an answer to Part III.3.G.2 of *"Yes"* which appears to be unnecessary. Pursuant to 62 Illinois Adm. Code 1784.14(i), the applicant shall clarify this discrepancy.

44. As required by Part III.3.c., the applicant provided a partially completed Schedule A. Pursuant to 62 Illinois Adm. Code 1784.14(i), the applicant shall provide a completed Schedule A for each proposed outfall.

45. In response to Part III.5 the applicant fails to discuss the existing refuse disposal areas in Permit No. 375 adjacent to the proposed Permit No. 417 area. Pursuant to 62 Illinois Adm. Code 1784.14(e), the applicant shall provide a discussion on the existing RDA's and their potential pollution sources which could affect the stream quality in the vicinity of the proposed permit area.

46. In Attachment III.2.B.2, the applicant provided groundwater data from installed wells.

    a. Only six (6) sampling events are included.
    b. Only select parameters are included on the summary sheets.
    c. A limited set of lab data sheets are included.

    Pursuant to 62 Illinois Adm. Code 1784.14(b)(1) the applicant shall provide all groundwater data collect to date and shall provide the data in a tabular format for all required parameters. In addition, pursuant to 62 Illinois Adm. Code 1777.13 all technical data shall be accompanied by the name of person/organization that collected and analyzed the data, dates

of collection and analysis and a description of the methodology used to collect and analyze the data.

47. In Attachment III.2.C.2, the applicant provided surface water data from monitoring points PC1, PC3, PC4, C1 and C2.

    a. Not all sampling points have the minimum number of required samples.
    b. There is no data from PC2, which is depicted on Map 4 Hydrogeologic Map (Drawing No. B12-271-M23).
    c. There is data from points C1 and C2 which are not depicted on Map 4 Hydrogeologic Map (Drawing No. B12-271-M23).

    Pursuant to 62 Illinois Adm. Code 1784.14(b)(2) the applicant shall correct these discrepancies.

48. The applicant failed to include a discussion of the Cumulative Impact Area (CIA) of the proposed and existing permit area(s). Pursuant to 62 Illinois Adm. Code 1784.14(e) and as required by Part III.2.D, the applicant shall propose a CIA for this facility based upon the information included in the current Probable Hydrologic Consequences (PHC) discussion.

49. In Part IV.6.A., the applicant failed to provide the acid-base accounting information for the refuse being produced and to be disposed of within the proposed permit area. Pursuant to 62 Illinois Adm. Code 1784.22(a)(2), the applicant shall provide the required information.

50. In Part IV.7.I the applicant responds *"No"* to the permit application question regarding the presence of perennial or intermittent streams present within the proposed permit area. However, as noted above, in Part III.2.C.1 the applicant states there is an intermittent stream flowing through the proposed permit area. Pursuant to 62 Illinois Adm. Code 1784.14(b)(2) the applicant shall correct this apparent discrepancy.

51. The following comments pertain to the maps included in the permit application:

    a. In Attachment IV.3.A.3, the applicant provides a soil boring/groundwater monitoring well report which includes a map of the boring locations.
        i. None of the identified groundwater monitoring wells (GW10, GW11, GW12. GW13 or GW14) are included on this map.
        ii. Boring BH-5A is not included on the map.
        iii. Neither BH/GW1, BH/GW2 nor BH/GW3 have boring logs included in this report.
    b. A boring log, noted as BP4 is included, but is not depicted on the map included in the report, nor on Drawing No. B12-271-E1 (Geologic Cross Sections Location Map).
        i. The boring log notes that a well was set at this location one foot shallower than the total depth.
        ii. Well construction diagram GW28 appears to be associated with this boring

log, even though the log indicates no water was encountered during drilling.

c. The Geologic Cross Sections Location Map (Drawing No. B12-271-E1) includes a "Surveyed Borehole Locations" table.
   i. Borehole D-1 is not included on this map.
   ii. Borehole BH-5A is not included on this map, nor in the table.
   iii. Borehole D-2 is not included on this map, nor in the table.
   iv. No boring logs have been included for: groundwater monitoring well GW-8R, groundwater monitoring well GW-28, or borings B-5 and B-7.
   v. Several of the geologic cross sections reference maps/drawings that do not appear to be included in the application. References are made to Drawing B08-467-E7 on Cross Sections I-I', J-J', and K-K'.

Pursuant to 62 Illinois Adm. Code 1777.11, these discrepancies shall be corrected or an explanation for the missing information shall be provided.

52. The Hydrogeologic Map (Map 4 – Drawing No. B12-271-M23) shows locations of "Test Pits". It is unclear what these test pits were utilized for, as no discussion of them is included in Part III of the application. Pursuant to 62 Illinois Adm. Code 1777.14, the application shall provide additional information on the depicted test pits.

53. In Part V.1.G, the applicant's response of *"No mine openings...are proposed..."* is inappropriate. Because boreholes and groundwater monitoring wells have been installed within the proposed permit area, a plan to seal those holes must be provided. Therefore, pursuant to 62 Illinois Adm. Code 1784.13(b)(8) the applicant shall provide an appropriate response.

54. In response to Part I(12)(C)(2) of the permit application, the applicant indicates no mining activities will be conducted within 300' of an occupied dwelling. Upon review of the Operations Plan Map, it appears two (2) occupied dwellings are located within 300' of the proposed Pond No. 9 on properties identified as A080406-306 and A080406-308. The applicant shall revise the response in accordance with 62 Ill. Adm. Code 1761.11(e) and identify the 300' buffer area on the Operations Plan Map. In addition, a waiver shall be provided in accordance with 62 Ill. Adm. Code 1761.12(d).

55. In response to Part IV(2)(B)(1) of the permit application, the applicant references the Operations Plan Map for the location of soil stockpiles. Upon review, no stockpiles are identified. Please provide a narrative indicating where the soil stockpiles will be located in accordance with 62 Ill. Adm. Code 1784.11(b)(2). In addition, explain where the soil stockpiles associated with Permit No. 375 (located within the footprint of the proposed refuse impoundment) will be handled.

56. Part IV(2)(B)(3) of the permit application fails to describe the methods and treatment measures to be used on exposed areas where topsoil has been removed to prevent excess air and water pollution in accordance with Section 1817.95. This discrepancy shall be corrected as necessary.

57. In response to Part IV(2)(C) of the permit application, the applicant references the Operations Plan Map for permit boundaries. Upon review, the boundary is not clear in the northeast corner. It appears a portion of the discharge structure for Pond No. 9 is outside the proposed permit boundary. In accordance with 62 Ill. Adm. Code 1784.23(a), the applicant shall revise the permit boundary to include all areas proposed to be affected by mining and/or reclamation activities.

58. The total acreage presented on the table in Part IV(5)(B) does not correlate with the acreages presented in Part I(1)(G & H). Please clarify.

59. In response to Part IV(5)(C)(2) of the permit application, the applicant references Attachment IV.5.C.2 in Volume 2 for specifications and plan-profiles of the transportation facilities. Upon review, the following items shall be addressed:

    a. It appears the applicant has referenced the incorrect Attachment. Attachment IV.5.C.2 in Volume 2 could not be located. Please clarify.

    b. The rainfall depths utilized in the SEDCAD calculations for the culvert sizing is incorrect. These calculations shall utilize Table 13 from Bulletin 79 from the Illinois State Water Survey for correct rainfall depths for given storm events.

    c. The applicant shall provide a profile and cross-section for the proposed culverts.

60. In response to Part IV(5)(C)(7) of the permit application, the applicant indicates Not Applicable. Given the applicant proposes the installation of three (3) culverts, this Part shall be completed in accordance with 62 Ill. Adm. Code 1784.24(a)(4).

61. In response to Part IV(6)(C) of the permit application, the applicant indicates Not Applicable. The permit application proposes a refuse impoundment, which is coal waste. Therefore, this Part shall be completed in accordance with 62 Ill. Adm. Code 1817.81.

62. In response to Part IV(6)(G) of the permit application, the applicant references Attachment IV.5.C.2. Upon review, this Attachment could not be located. Please clarify.

63. In response to Part IV(6)(J)(2) of the permit application, the applicant indicates clarified water from the proposed slurry cell will be pumped into the sediment ditches and will discharge into Sediment Structure No. 1. Upon review of the Operations Plan Map, it appears the sediment ditches discharge into sediment Structure No. 9. Please explain/clarify.

64. The table provided in Part IV(7)(E) is incomplete. The total drainage area and total disturbed area shall be depicted.

65. In response to Part IV(F)(1) of the permit application, the following items shall be addressed:

    a. The incorrect sediment structure is referenced. Please revise.
    b. The response references a drawing not design calculations as the Application requests.
    c. Attachment IV.7.F does not contain any calculations for the sediment ditch design. This information shall be included.
    d. The rainfall depths utilized in the SEDCAD calculations presented in Volume 2 are incorrect. These calculations shall utilize Table 13 from Bulletin 70 from the Illinois State Water Survey for correct rainfall depths for given storm events.

66. In response to Part IV(F)(2) of the permit application, the following items shall be addressed.

    a. The incorrect sediment structure is referenced. Please revise.
    b. The applicant shall provide a profile and cross-section of the proposed sediment ditch in addition to the sediment pond

67. In response to Part IV(F)(3) of the permit application, the applicant references the incorrect sediment structure. Please revise.

68. All SEDCAD calculations included in Volume 2 utilize the incorrect rainfall depths. These should be revised utilizing Table 13 from Bulletin 79 from the Illinois State Water Survey for correct rainfall depths for given storm events.

69. In response to Part IV(7)(I) of the permit application, the applicant indicates no perennial or intermittent streams occur within the proposed permit area. Upon review of the Operations Plan Map, the applicant's response is correct. However, the discharge structure for Pond No. 9 is proposed within 100' of a stream that lies outside the permit boundary. Therefore, the applicant shall provide a narrative requesting an exception to the 100' buffer zone and indicate how compliance with 62 Ill. Adm. Code 1817.57 will be assured. In addition, the buffer area depicted on the Operations Plan shall be continued along the stream that is adjacent to north permit boundary.

70. In response to Part IV(7)(J)(4) of the permit application, the applicant references Attachment IV.5.C.2. Upon review, this Attachment could not be located. Please clarify.

71. In response to Part V(1)(C)(2) of the permit application, the applicant references the Abandonment Map. Upon review of Map 7 – Reclamation Map, it appears the soil information located in the legend is mislabeled. Both boxes that contain hatching are labeled a low capability soil. Please clarify.

72. In response to Part V(4)(A) of the permit application, the applicant references the design

report. Please provide a more specific reference.

73. In Part V 1) B) 1) a), the elevation of the gob pile is shown as initial elevation 425 feet, final elevation 475 feet. The Map 6, Operations Map shows final elevation of refuse pile as 626 feet. Map 7, Reclamation Map, shows final elevation as 636 feet. These discrepancies shall be corrected as necessary.

74. Part II 13) D) states topsoil replacement thickness will be 3.5 inches. Part V 1) C) 1) states "due to out slopes of the refuse area, the total surface area of the refuse area will be greater than the pre-mining surface area, therefore, topsoil depth will be less that the pre-mining condition." In Part V 1) B) 1) a) (Gob pile) shows cover thickness of 4 feet. Part V 1) B) 1) b) (Gob and Slurry Disposal * Below Grade or in levees) shows Cover Thickness: Root medium 36 inches Topsoil 12 inches. Please address where the areas will be of topsoil replacement, and what will be the depth of topsoil replacement.

Upon submission of the above listed information for inclusion in the application, the Department will again review the permit application to determine if it is administratively complete.

Should you have any questions, please contact this office.

Sincerely,

Scott K. Fowler, Supervisor
Land Reclamation Division

SKF:JSc

cc: B. Schoeppel

10101450.doc

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS
PERMIT - UNDERGROUND OPERATIONS
UCM-1

PART I

(Application to be submitted 120 days (180 days for NPDES) prior to the desired effective date of the permit)

DATE: November 17, 2014

NOTICE

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill. Rev. Stat. 1989, ch. 96 1/2, par. 7901 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(~~I~~) (~~We~~) (The) **Williamson Energy, LLC**
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 300, Johnston City, IL 62951 (Address) **(618) 983-3020** (Telephone Number)

hereby submit application #**417** for a permit to mine during a permit term of **5** years.

Type of Application:

[X] Underground Mining
[ ] Revision No. _____ to Permit No. _____
[ ] Shadow Area Addition
[ ] Renewal No._____ to Permit No. _____
[ ] Transfer of Permit No. _____
[ ] Acres to be added under renewal

Applicant's Social Security No. ____ (Voluntary) and/or Federal Employer Identification No. **20-0888529.**

Name of Mine **Pond Creek 1 Coal Refuse Disposal Facility No. 3**,

List the Mine Safety and Health Administration (MSHA) number(s) for all mine associated structures that require MSHA approval.

RESPONSE: IL08-03141-03

I, **Mark Schuerger** (Name) _____ (Signature) **Authorized Agent** (Title)

under penalties of perjury declare that I have examined this application, including accompanying statements and documents and to the best of my knowledge it is true, and correct. (Signee must be at least a vice president or duly authorized representative for NPDES 35 Ill. Adm. Code 309.103(e)

This application is also to be used to apply for a:

IEPA Subtitle D (State) Permit Yes __X__ No _____ NPDES Yes __X__ No _____

New __X__

Renewal No. _____ Date: _____

Renewal No. _____ Date: _____

Modification No. _____ Date: _____

Modification No. _____ Date: _____

If this is an application for a NPDES permit, the Consolidated Permits Program - Application Form 2C (renewal), Form 2D (new), or Form 2E (sanitary) must be completed.

B) I _____
(vice president or his duly authorized representative)

hereby waive my right of the 90-day permit issuance deadline as required by the Illinois Environmental Protection Act, Section 39(a)(4) and the Illinois Pollution Control Board Rules and Regulations, 35 Ill. Adm. Code 309.225(c).

C) Who will be the operator of the permit site?

Name **Mach Mining, LLC**

Pursuant to 62 Ill. Adm. Code 1701.5 an operator is any person engaged in coal mining who removes or intends to remove more than 250 tons of coal.

If the operator is different from the applicant, provide the following information.

1) Operator's address **P.O. Box 300**
Johnston City, IL 62951
2) Operator's telephone No. **(618) 983-3020**
3) Operator's Social Security No. _____
(voluntary) and/or Federal Employer Identification No. **73-1734826**

D) Who will extract coal under this permit?

Name **Mach Mining, LLC**

If different from applicant or operator provide the following:

1) Address **P. O. Box 300**
Johnston City, IL 62951

2) Telephone No. **(618) 983-3020**

3) Social Security No. (Voluntary) and/or federal employer identification No.
_____

E) Who will pay abandoned mine land reclamation fees?

Name **Williamson Energy, LLC**

If the person paying the abandoned mine land reclamation fee is different from the applicant, provide the following information.

1) Address _____
_____
_____

2) Telephone No. _____
3) Payee's Social Security No. _____
(voluntary) and/or Federal Employer Identification No. _____

F) The permittee requests a permit on the following area as shown on the permit map.

Mine Address	Pit No. or Name	Acres to be Permitted	Sec.	Twp.	Range	County
16468 Liberty School Road, Marion IL 62959	**Refuse Disposal Facility No. 3**	**2.61**	**12**	**T8S**	**R3E**	**Williamson**
	Refuse Disposal Facility No. 3	**227.17**	**7**	**T8S**	**R4E**	**Williamson**

Total Acres **229.78**

G) Indicate the type of disturbance and associated acreage.

Acres		Type of Disturbance
0.00		Deep Mine Entries, Ventilation, Air Shafts
203.87		Mine Waste Areas
0.00		Processing Areas & Support Facilities
0.00		Access, Haul Roads, & Transport Facilities
0.00		Soil Storage Areas
25.91		Diversions
0.00		Other
0.00		Not to be Disturbed

H) For each phase (permit) of the proposed surface coal mining and reclamation operation over the life of the mine provide the anticipated or actual starting and termination date and the anticipated number of acres to be affected. Designate the boundaries of each phase on the pre-mining land use map or other designated map.

Phases (Permits)	Starting Date	Termination Date	Acres to be Affected
Stage 1	**Feb., 2013**	**May, 2014**	**229.78**
Stage 2	**May, 2014**	**Aug. 2015**	**229.78**

Stage 3	**Aug. 2015**	**July, 2022**	**229.78**
Stage 4	**July, 2022**	**Nov., 2025**	**229.78**
Abandonment	**Oct., 2029**	**Oct., 2034**	**229.78**

2) A) Provide name and address of every legal or equitable owner of record of the permit area, and the mineral property to be mined.

RESPONSE: Refer to Attachment I.2.A

B) Provide name and address of the owner of record for all surface and subsurface areas contiguous to any part of the proposed permit area.

RESPONSE: Refer to Attachment I.2.B

C) Show location of owners of record of those lands, both surface and subsurface, included in or contiguous to the permit area on premining land use map or another map, if necessary.

RESPONSE: Refer to Map 2, Identification of Interest

3) A) Provide name and address of any holder of record of leasehold interest for the permit area, and the mineral property to be mined.

RESPONSE: No holder of record of leasehold interest and no mineral removal is proposed to be mined in this application.

B) Provide a statement of all lands, interest in lands, options or pending bids on interest held or made by the applicant for lands which are contiguous to the permit area.

RESPONSE: N/A

4) Provide name and address of any purchaser of record under a real estate contract of the property for the permit area.

RESPONSE: N/A

5) A) The applicant is: ____**X**__ corporation, _____ partnership, _____ single proprietorship, _____ association or other business entity.

B) For the resident agent who will accept service of process for the applicant provide the following information.

1) Name of resident agent **Illinois Corporation Service Company**

2) Address **801 Adlai Stevenson Drive, Springfield, IL 62703**

3) Telephone No. **(800) 877-2556**

4) Social Security No. _____ (voluntary) and/or Federal Employer Identification No. **81-0669143**.

6) OWNERSHIP AND CONTROL INFORMATION

Ownership and control is evidenced by being the permittee of a surface coal mining operation, or by being the owner of record of 50 percent or more of an entity controlling a surface coal mining operation or by having any relationship which gives direct or indirect authority over an entity controlling a surface coal mining operation.

Ownership and control is presumed if an entity is an officer or director; is an operator of a surface coal mining operation; has the authority to commit the financial or real property assets or working resources of an entity; is the owner of record of ten (10) through fifty (50) percent of an entity; is a general partner of a partnership; owns or controls coal to be mined by another entity and has the right to receive that coal after mining; or has the authority to determine how the surface coal mining operations will be conducted.

For an entity to refute a presumed ownership and control relationship, the entity must demonstrate to the satisfaction of the Department that the entity subject to the presumption does not have the authority directly or indirectly to determine the manner in which the relevant surface coal mining operation is conducted.

A) For each entity who owns or controls the applicant provide the following information.

1) Name of entity **Foresight Energy, LLC**

2) Address **211 North Broadway, Suite 200**
St. Louis, MO 63102

3) Social Security No. _____ (voluntary) and/or
Federal Employer Identification No . **22-4448612**

4) The entity's specific ownership and control relationship with the applicant **100%**

If more than one ownership and control relationship exists, list each relationship separately under this part providing all information requested.

a) Percentage of ownership if any _____

b) Location in organizational structure _____

c) Position title _____

i) Date position was assumed _____

ii) Date of departure from position _____

B) For each surface coal mining and reclamation operation in the United States either presently owned or controlled or owned or controlled within the five (5) years preceding the date of the application by the entity listed in (A) above provide the following information.

1) Name **Williamson Energy LLC**

2) Address **P. O. Box 300, Johnston City, IL 62951**

3) Name of regulatory authority **Illinois Department of Natural Resources**

4) Identification number.

a) Social security No. _____ (voluntary) and/or federal employer identification No. **81-0669143**

b) Federal permit No. _____

c) State permit No. **375**

d) MSHA No. **11-03141** and date of issuance **07/07/2005**

7) For each surface coal mining operation in the United States owned or controlled by the applicant provide the following information.

a) Name of Operation **Williamson Energy LLC**

b) Address of Operation **P. O. Box 300, Johnston City, IL 62951**

c) Name of regulatory authority **Illinois Department of Natural Resources**

d) Identification number:

i) Social Security No. _____ (voluntary) and/or Federal Employer Identification No. **20-0888529**

ii) Federal permit No. _____

iii) State permit No. **375**

iv) MSHA No. **11-03141** and date of issuance **07/07/2005**

8) A) Has the applicant, any subsidiary, affiliate or entity controlled by or under common control with the applicant had:

1) A State or Federal coal mining permit suspended or revoked in the five (5) years prior to the date of submission of the application?

Yes _____ No **X**

2) A forfeiture of a performance bond under a coal mining permit?

Yes _____ No **X**

B) If the response to A)1) or 2) was yes, provide the following information:

1) Provide the identification number of the permit.

2) Provide the date of permit issuance.

3) Provide the date of permit suspension or revocation and/or the date of bond forfeiture.

4) Provide the name of regulatory authority who suspended or revoked the permit and/or forfeited the bond.

5) Provide a statement of the reason for the suspension, revocation and/or forfeiture action.

6) Provide the current status of the permit and/or bond.

7) For any administrative or judicial proceedings initiated concerning the suspension, revocation, and/or forfeiture provide the following:

a) Date of proceeding,
b) Location of proceeding, and
c) Current status of proceedings.

RESPONSE: N/A

C) If the response to A)2) was yes, provide information on the applicant's present financial condition to provide assurances satisfactory to the Department that forfeiture will not again be necessary.

9) Violation history

A) For the three (3) year period preceding the date of submission of the application, provide a listing of Notices of Violation received for any provision of the Federal Act or any Federal State law, rule, or regulation pertaining to air or water environmental protection incurred in connection with any surface coal mining operations. The listing shall include the following:

1) Notice of violation number or other identifier.
2) Date of NOV issuance.
3) Permit identification number.
4) MSHA number.
5) Name of entity to whom NOV was written.
6) Name of regulatory authority or agency which issued the NOV.
7) A brief description of the alleged violation.
8) For any administrative or judicial proceedings initiated concerning the violation, provide the following:
    a) Type of proceedings.
    b) Date of proceedings
    c) Location of proceedings.
    d) Current status of proceedings.
9) Actions, if any, to abate the alleged violation.

RESPONSE: Refer to Attachment Part I.9

B) For any unabated cessation orders or unabated air and water quality violation notices received prior to the date of submission of the application for any surface coal mining and reclamation operation owned or controlled by the applicant or by any entity which owns or controls the applicant, provide a listing of the unabated cessation orders or violation notices which include the following:

1) Cessation order or notice of violation number or other identifier.
2) Date of CO or NOV issuance.
3) Permit identification number.
4) MSHA number
5) Name of entity to whom CO or NOV was written
6) Name of regulatory authority or agency which issued the CO or NOV.

7) A brief description of the alleged cessation order or violation.
8) For any administrative or judicial proceedings initiated concerning the cessation order or violation, provide the following:
   a) Type of proceedings.
   b) Date of proceedings
   c) Location of proceedings
   d) Current status of proceedings.
9) Actions, if any, to abate the alleged cessation order or violation.

RESPONSE: N/A

10) Affidavits, Certifications, Insurance Certificate

A) Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the permit area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (Section 1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin mining activities.

RESPONSE: Refer to Attachment Part I.10.A

B) Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except a otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: Refer to Attachment Part I.10.B

C) A certificate of liability insurance or evidence that the applicant is self-insured is required prior to permit issuance. The certificate may be submitted with the application or when fee and bond are submitted. Minimum insurance coverage required is for bodily injury $300,000 for each occurrence, and $500,000 aggregate and for property damage $300,000 each occurrence, and $500,000 aggregate.

RESPONSE: Refer to Attachment Part I.10.C

11) Provide a draft copy of proposed newspaper notice, and the name of local newspaper of general circulation in which advertisement of the application will be published. Certificate of publication is to be submitted not later than four weeks after the last date of publication.

RESPONSE: Refer to Attachment Part I.11. The public notice will be published in the "The Daily American", West Frankfort, Illinois.

12) Areas Designated Unsuitable for Mining

A) Does proposed permit area include and/or shadow area include –

Areas designated unsuitable for surface coal mining and reclamation operations, or under study for designation in an administrative proceeding as unsuitable for surface coal mining and reclamation operations? (Sections 1762 and 1764)

Yes _____ No ___X___

B) Does proposed permit area include and/or shadow area include –

1) Lands within boundaries of the National Park System, National Wildlife Refuge System, the National System of Trails, the National Wilderness Preservation System, the Wild and Scenic Rivers System, and National Recreation Areas, etc. (Section 1761.11(a))?

Yes _____ No ___X___

2) National Forest land?

Yes _____ No ___X___

3) Any land which will adversely affect any publicly-owned park or places included in the National Register of Historic Places, etc. (per Sections 1761.11(c))?

Yes _____ No ___X___

If yes, complete Part II, Section 10, B) and C).

4) Any public roads which are to be removed, relocated or temporarily closed?

Yes _____ No ___X___

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

C) Within the proposed permit area will Surface Coal Mining and Reclamation operations be located –

1) Within 100 feet of the right-of-way line of any public road?

Yes ___X___ No _____

If yes, explain proposed procedures for complying with regulation Section 1761.14(b), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

RESPONSE: **A variance is requested to affect within 100 feet of the outside right of way of Dean Road, where the road border Section 7, T8S, R4E (refer to Map 6 S.F., Operations Plan Map**

(Surface Facilities). Dwina Road has been removed from the area to be permitted. It is no longer in existence from the intersection of Dean Road, south to the railroad tracks where the road borders Section 7, T8S, R4E and Section 12, T8S, R3E. A portion of the area to be permitted is within one hundred feet of Dwina Road at its intersection of Dean Road. The anticipated surface affects will be the construction, maintenance and use of: sediment control ponds/structures and drainage diversions.

The public notice may provide for a public hearing in accordance with Section 1761.14. The proposed public notice will include notice of affecting within 100 feet of the outside right of way of the aforementioned roads. The Department may provide a finding that the interests of the affected public and landowner will be protected as required by 1761.11 (d)(2)(B).

The applicant will also obtain the necessary input and approvals from the owners of public road where the aforementioned proposed surface mining affects will be within 100 feet of the outside right of way of public roads to further assure that surface mining affects will not interfere with visibility of traveling public, and driveway/access road entrances meet the requirements of the owner of the public road.

2) Within 300 feet measured horizontally form any occupied dwelling?

Yes _____ No __X__

If so, is waiver provided meeting requirements of Section 1761.12(d)?

3) Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?

Yes _____ No __X__

4) Within 100 feet measured horizontally of a cemetery?

Yes _____ No __X__

D) Are valid existing rights claimed for any part of the permit area?

Yes _____ No __X__

If yes, provide documentation to substantiate claim.

PART I ATTACHMENTS

ATTACHMENT I.2.A

SURFACE OWNERSHIP

Property ID	Owners	Address	City	State	Zip Code	Mineral Owner
A080407-101	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-102	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-106	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-107	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-108	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-301	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-302	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A
A080407-303	Williamson Energy, LLC	PO Box 300	Johnson City,	IL	62951	N/A

Attachment Part I.2.A
Surface Owners

R08906

ATTACHMENT I.2.B
CONTIGUOUS OWNERS

PROPERTY ID	OWNERS	ADDRESS	CITY	STATE	ZIP CODE	MINERAL OWNER
A080407-203	Peggy Trout	302 Indian Drive	Johnson City	IL	62951	N/A
A080407-415	Phillip Anderson	16661 Liberty School Road	Marion	IL	62959	N/A
A080407-402	New River Royalty, LLC	208 Public Square -- 4th Floor	Benton	IL	62812	N/A
A080407-304	Williamson Development C	1107 W. DeYoung St., Suite E	Marion	IL	62959	N/A
A080407-103	Ward & Eva McKown	800 Perrine St.	Johnson City	IL	62951	N/A
A080406-308	Nathan & Amber Smith	18940 Dean Rd	Thompsonville	IL	62890	N/A
A080406-306	Scottie Harris	18942 Dean Rd	Thompsonville	IL	62890	N/A
A080301-408	Paula Atlee	18724 Dean Rd	Marion	IL	62959	N/A
A080312-201	Steelhead Development Co	430 Harper Park Dr., Suite A	Beckley	WV	25801	N/A
A080312-401	Steelhead Development Co	430 Harper Park Dr., Suite A	Beckley	WV	25801	N/A
A080312-404	Steelhead Development Co	430 Harper Park Dr., Suite A	Beckley	WV	25801	N/A

ATTACHMENT I.6

OWNERSHIP & CONTROL

BAILEY&GLASSER LLP

Lawyers
Internet www.baileyglasser.com
Phone (304) 345-6555 Fax (304) 342-1110

209 Capitol Street
Charleston WV 25301

MEMORANDUM

TO: **James Schafer, Permit Coordinator**
Land Reclamation Division
Illinois Department of Natural Resources

FROM: **John C. Ailes, Investigator**

DATE: **December 3, 2014**

RE: **Ownership & Control**
Updated Information – Cline Resource and Development Company

Please allow this Memo to serve as a continued update of all ownership and control information for the entities listed in this Memo.

1. Chris Cline
   3801 PGA Boulevard, Suite 903
   Palm Beach Gardens, FL 33410

2. Cline Resource and Development Company, a West Virginia corporation
   430 Harper Park Drive, Suite A
   Beckley, WV 25801

   Officers:

   John Dickinson, President
   Donald R. Holcomb, Vice President, Secretary and Chief Financial Officer
   (End Date effective March 31, 2013)
   Chris Cline, Director

3. Insight Resource, LLC, a Nevada limited liability company
   3801 PGA Boulevard, Suite 903
   Palm Beach Gardens, FL 33410

Officers:

John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Chief Financial Officer and Vice President
(Effective August 10, 2012 - End Date effective March 31, 2013)

4. FRLP 2008 No. 2 LLC
3801 PGA Boulevard, Suite 903
Palm Beach Gardens, FL 33410

Cline Resource and Development Company, Manager

5. Foresight Reserves, LP
3801 PGA Boulevard, Suite 903
Palm Beach Gardens, FL 33410

Insight Resource, LLC is the General Partner

Board of Managers:

Christopher Cline
E. Bartow Jones
John Dickinson

6. Foresight Energy GP LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Executive Officers and Directors:

Christopher Cline, Chairman of the Board of Directors and Principal Strategy Advisor
Michael J. Beyer, Director and President & Chief Executive Officer
John F. Dickinson – Director
E. Hunter Harrison – Director
E. Bartow Jones – Director
Oscar A. Martinez – Senior Vice President – Chief Financial Officer
Christopher N. Moravec – Senior Vice President
Rashda M. Buttar – Senior Vice President – General Counsel & Corporate Secretary
Daniel Hermann, Director

7. Foresight Energy LP
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Energy GP LLC is the General Partner

8. Foresight Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Management LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

9. Foresight Energy Services LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Energy LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

10. Foresight Management, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

Officers:

Homer Drexel Short Jr., Jr., Chief Operating Officer (End date as of August 16, 2011)
John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Vice President and Chief Financial Officer
(Effective August 10, 2012 - End Date effective March 31, 2013)

11. Gatling LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

Officers:

Donald Holcomb, Secretary/Treasurer (End Date effective March 31, 2013)
Barry Elliott, VP left the organization with an end date of June 18, 2006

12. Gatling Ohio LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

13. Hillsboro Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

12192 Filmore Trail
Hillsboro, Illinois 62049

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

14. Lower Wilgat, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

15. Macoupin Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

14300 Brushy Mound Road
Carlinville, Illinois 62626

Board of Managers:

Michael J. Beyer, Chief Executive Officer
Oscar A. Martinez, Executive Vice President for Finance
Homer Drexel Short Jr., Chief Operating Officer
Tony Harris, Chief Financial Officer

16. Meigs Point Dock LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

17. Middle Wilgat, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

18. Sugar Camp Energy, LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

11351 N. Thompsonville Road
Macedonia, Illinois 62860
Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

19. Williamson Energy, LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

16468 Liberty School Road
Marion, Illinois 62959

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Foresight Reserves, LP Affiliate Entities

1. Foresight Management, LLC

Cline Resource and Development Company, Manager

Officers:

Homer Drexel Short Jr., Chief Operating Officer (End date of August 16, 2011)
John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Vice President and Chief Financial Officer
(Effective August 10, 2012 - End Date effective March 31, 2013)

Permits: none

Violation: none

2. Akin Energy, LLC

Foresight Management LLC, Manager

Permits: none

Violation: none

FRLP 2008 No. 2 LLC Affiliate Entities

1. Middle Wilgat LLC

Cline Resource and Development Company, Manager

Permits: none

Violations: none

2. Gatling Ohio LLC

Cline Resource and Development Company, Manager

Permits:

- D-2317 Ohio

Violations:

- Violation # 19879 issued September 29, 2009 abated January 12, 2010 affected areas outside of permit
- Violation #28310 issued May 3, 2010 abated August 23, 2011 affected areas outside of permit
- Violation #29308 issued January 25, 2012 abated February 3, 2012 breached perimeter diversion

3. Lower Wilgat, LLC

   Cline Resource and Development Company, Manager

   Permits: none

   Violations: none

4. Gatling LLC

   Cline Resource and Development Company, Manager

   Permits:

   - O-3019-05 WV
   - U-3016-05 WV
   - O-3013-06 WV

   Violations:

   - O-3019-05 #1 - Issued April 11, 2006 - abated March 5, 2007 permit conditions
   - O-3019-05 #2 - Issued March 10, 2010 - abated March 23, 2010 effluent limits
   - U-3016-05 #1 - Issued March 21, 2007 - abated April 5, 2007 Blaster certification
   - U-3016-05 #2 - Issued July 20, 2007 - abated July 25, 2007 fly rock
   - U-3016-05 #3 - Issued September 28, 2007 - abated October 12, 2007 Fees
   - O-3013-06 #1 – Issued August 14, 2014 – Failed to properly prepare and vegetate disturbed area – extended – pending abatement

5. Meigs Point Dock LLC

   Cline Resource and Development Company, Manager

   Permits:

   - D-2323 Ohio

   Violations: None

Foresight Energy LLC Entities

1. Foresight Energy LLC

   Foresight Management LLC, Manager

   Officers:

   Michael J. Beyer, President and Chief Executive Officer
   Oscar Martinez, Senior Vice President and Chief Financial Officer
   Christopher Moravec, Senior Vice President
   Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
   Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

   Permits: none

   Violations: none

2. Foresight Energy Services LLC

   Foresight Energy LLC, Manager

   Officers:

   Michael J. Beyer, President and Chief Executive Officer
   Oscar Martinez, Senior Vice President and Chief Financial Officer
   Christopher Moravec, Senior Vice President
   Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

   Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

   Permits: none

   Violations: none

3. Hillsboro Energy LLC

   Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit 399 – Illinois

Violations:

IDNR –

- 38-04-09 issued September 14, 2009 failed to follow approved mining plan – abated.
- 38-04-11 issued February 10, 2011 failed to follow approved mining plan – abated.
- 38-05-11 issued February 10, 2011 failed to report impoundment exam report – abated.
- 38-06-11 issued February 10, 2011 failed to complete field density testing – abated.
- 38-03-11 issued February 10, 2011 failed to maintain ditch 7b – abated.
- 38-12-11 issued June 30, 2011 failed to construct and maintain sediment control – abated.
- 34-01-2013 issued February 27, 2013 – failure to follow approved plan – clean coal stockpile expanded beyond approved protective base – abated on April 18, 2013.
- 38-07-13 issued November 1, 2013 – failed to report surface water discharge excursions within five days of receiving analytical results – abated on November 18, 2013.
- 38-01-2014 issued February 21, 2014 – failure to file renewal application within time frame required by the regulations – application submitted; no additional abatement measures required.
- 38-02-2014 issued April 28, 2014 – failure to follow approved plan, failure to protect topsoil from contamination and route all drainage to a sediment pond – abated on May 30, 2014.
- 68-1-2014 issued August 5, 2014 for failure to pass drainage through a sediment pond – abatement pending.
- 68-2-2014 issued August 5, 2014 for failure to remove topsoil prior to disturbance – abatement pending.
- 38-03-14 – issued August 28, 2014 for discharging water in excess of NPDES limits for chlorides and sulfates – corrective action was taken; abated October 29, 2014.

- 38-04-14 – issued on September 12, 2014 for discharging water in excess of NPDES limits for chlorides and sulfates – corrective action was taken; abated October 3, 2014.

IEPA –

- VN W-2010-30248 – failed to submit DMR's at the required frequency – CCA submitted and frequency being maintained.
- W-2014-50161 – discharge of contaminants, offensive conditions, unauthorized discharge, creating a water pollution hazard, failure to apply for a construction permit and failure to comply with NPDES permit – all water based issues have been corrected. Within the 45-day request period, a meeting will be requested.

4. Macoupin Energy LLC

Officers/Board of Managers:

Michael J. Beyer – CEO
Oscar A. Martinez – Executive Vice President for Finance
Homer Drexel Short Jr. – Chief Operating Officer
Tony Harris, CFO

Permits:

- Permit #56 Illinois
- Permit #209 Illinois
- Permit #265 Illinois
- Permit #291 Illinois
- Permit # 302 Illinois
- Permit # 419 Illinois

Violations:

IDNR –

- 38-03-12 issued April 16, 2012 failed to file renewal application public notice within the timeframe to conduct a hearing and allow for issuance of renewal decision – abated
- 38-05-12 issued July 2, 2012 failed to conduct non-MSHA quarterly exam for sediment pond 003 – abated
- 38-06-13 issued July 1, 2013 for failure to conduct surface coal mining and reclamation operation as described in the approved application. The operator installed an access road on the permit area without obtaining approval from the Department. Violation is abated, no penalty assessed.

IEPA –

- VN W-2011-00040 – exceed ground water standards – CCA approved September 12, 2011

5. Sugar Camp Energy LLC

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit #382 Illinois

Violations:

IDNR -

- 19-01-09 – issued April 27, 2009 failed to construct siltation structure prior to disturbance – abated
- 19-02-09 – issued June 2, 2009 failed to follow approved operations plan – abated
- 57-02-11 – issued July 27, 2011 failed to notify IDNR of non-compliant surface water samples – abated
- 57-03-11 – issued August 25, 2011 failed to follow approved plan – abated
- 19-1-11 – issued March 9, 2011 failed to comply with required surface water sampling parameters –abated
- 19-2-11 – issued March 9, 2011 failed to comply with required ground water sampling parameters – abated
- 57-01-13 – issued March 5, 2013 – discharging water from Outfall 008 with a chloride excursion of 874.6 mg/L – Abated.
- 57-3-13 – issued July 25, 2013 – failure to notify Department of noncompliance surface water sample with five day reporting period. Required letter submitted. Penalty assessment is pending.
- 57-02-14 – issued on July 9, 2014 for failure to follow approved plan, placement of coal slurry in experimental Geotubes in an unapproved location – abated on August 1, 2014.

IEPA –

- VN: W-2013-50008 issued April 25, 2013 – exceeding effluent limits and unpermitted mixing, dilution and discharge –CCA approved July 8, 2014.
- VN: W-2013-50133 issued April 30, 2013 – exceeding effluent limits –CCA approved July 8, 2014.
- VN: W-2014-50014 issued March 14, 2014 - violation of Chloride water quality standards on September 18, 2013 and November 26, 2013 –CCA approved July 8, 2014.
- VN: A-2014-00284 issued July 31, 2014 – failure to submit an Annual Emissions Report for calendar year 2013 – CCA accepted November 7, 2014.
- VN: M-2014-02002 issued October 23, 2014 – failure to comply with effluent conditions of NPDES permit, discharge of contaminants and offensive conditions – pending CCA request.

6. Williamson Energy LLC

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit # 375

Violations:

IDNR –

- 26-1-09 issued April 3, 2009 failed to follow approve plan – abated
- 26-2-09 issued April 8, 2009 failed to submit fourth quarter subsidence control plan report – abated
- 26-3-09 issued April 17, 2009 failed to provide survey for buildings greater than 40 years old – abated
- 28-01-09 issued September 9, 2009 drainage leaving permit without passing through a sediment control structure – abated
- 47-2-10 issued March 9, 2010 disturbed within 100 feet of cemetery – abated
- 47-5-10 issued May 13, 2010 failed to maintain freeboard in sediment basin – abated
- 47-4-10 issued May 13, 2010 discharge from disturbed area did not pass through a

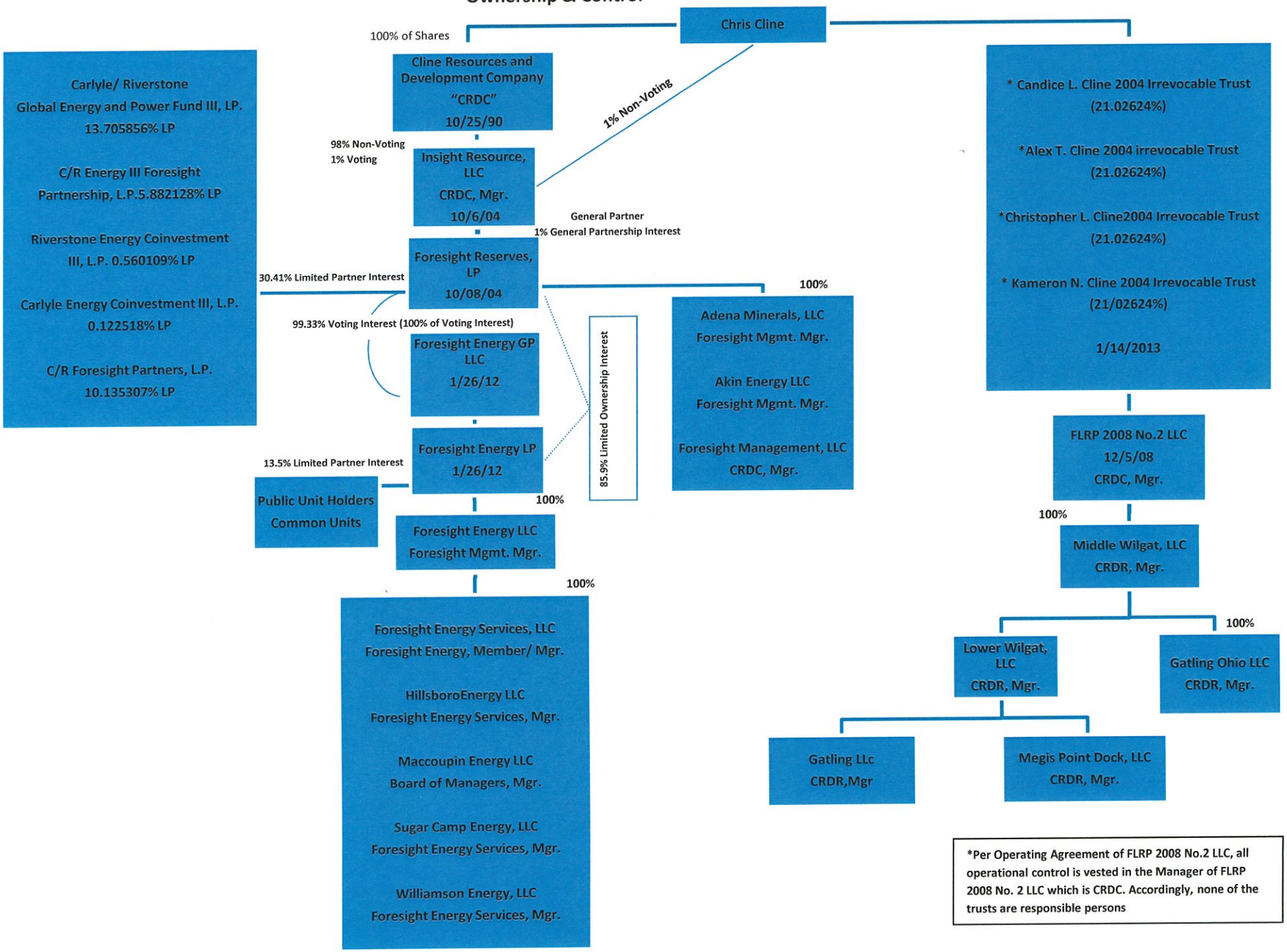
siltation structure before leaving the permit – abated

- 47-6-10 issued November 8, 2010 surface drainage flowing off permit without reporting to a sediment control structure – abated
- 47-2-11 issued April 27, 2011 petroleum based contaminant observed on water surface in sediment basin 004 – abated.
- 43-3-11 issued April 27, 2011 failed to maintain adequate freeboard in a sediment basin – abated
- 47-06-13 issued June 12, 2013 failed to submit site specific minimization of damage to structures plan – abated
- 62-1-14 issued March 20, 2014 for failure to report discharge excursions to the Department and failure to submit DMR's and groundwater reports for the 3rd and 4th quarters of 2013 – abated
- 62-2-14 issued May 1, 2014 for failure to report a non-compliant discharge – abated

IEPA –

- A-2014-00285 issued July 31, 2014 for failure to submit an Annual Emissions Report ("AER") to the Illinois Environmental Protection Agency for calendar year 2013 – AER submitted on August 29, 2014 and CCA letter issued on September 9, 2014

Ownership & Control



*Per Operating Agreement of FLRP 2008 No.2 LLC, all operational control is vested in the Manager of FLRP 2008 No. 2 LLC which is CRDC. Accordingly, none of the trusts are responsible persons

R08924

ATTACHMENT I.9.A

VIOLATION HISTORY

BAILEY&GLASSER LLP

Lawyers
Internet www.baileyglasser.com
Phone (304) 345-6555 Fax (304) 342-1110

209 Capitol Street
Charleston WV 25301

MEMORANDUM

TO: **James Schafer, Permit Coordinator**
Land Reclamation Division
Illinois Department of Natural Resources

FROM: **John C. Ailes, Investigator**

DATE: **December 3, 2014**

RE: **Ownership & Control**
Updated Information – Cline Resource and Development Company

Please allow this Memo to serve as a continued update of all ownership and control information for the entities listed in this Memo.

1. Chris Cline
   3801 PGA Boulevard, Suite 903
   Palm Beach Gardens, FL 33410

2. Cline Resource and Development Company, a West Virginia corporation
   430 Harper Park Drive, Suite A
   Beckley, WV 25801

   Officers:

   John Dickinson, President
   Donald R. Holcomb, Vice President, Secretary and Chief Financial Officer
   (End Date effective March 31, 2013)
   Chris Cline, Director

3. Insight Resource, LLC, a Nevada limited liability company
   3801 PGA Boulevard, Suite 903
   Palm Beach Gardens, FL 33410

Officers:

John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Chief Financial Officer and Vice President
(Effective August 10, 2012 - End Date effective March 31, 2013)

4. FRLP 2008 No. 2 LLC
3801 PGA Boulevard, Suite 903
Palm Beach Gardens, FL 33410

Cline Resource and Development Company, Manager

5. Foresight Reserves, LP
3801 PGA Boulevard, Suite 903
Palm Beach Gardens, FL 33410

Insight Resource, LLC is the General Partner

Board of Managers:

Christopher Cline
E. Bartow Jones
John Dickinson

6. Foresight Energy GP LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Executive Officers and Directors:

Christopher Cline, Chairman of the Board of Directors and Principal Strategy Advisor
Michael J. Beyer, Director and President & Chief Executive Officer
John F. Dickinson – Director
E. Hunter Harrison – Director
E. Bartow Jones – Director
Oscar A. Martinez – Senior Vice President – Chief Financial Officer
Christopher N. Moravec – Senior Vice President
Rashda M. Buttar – Senior Vice President – General Counsel & Corporate Secretary
Daniel Hermann, Director

7. Foresight Energy LP
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Energy GP LLC is the General Partner

8. Foresight Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Management LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

9. Foresight Energy Services LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

Foresight Energy LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

10. Foresight Management, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

Officers:

Homer Drexel Short Jr., Jr., Chief Operating Officer (End date as of August 16, 2011)
John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Vice President and Chief Financial Officer
(Effective August 10, 2012 - End Date effective March 31, 2013)

11. Gatling LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

Officers:

Donald Holcomb, Secretary/Treasurer (End Date effective March 31, 2013)
Barry Elliott, VP left the organization with an end date of June 18, 2006

12. Gatling Ohio LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

13. Hillsboro Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

12192 Filmore Trail
Hillsboro, Illinois 62049

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

14. Lower Wilgat, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

15. Macoupin Energy LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

14300 Brushy Mound Road
Carlinville, Illinois 62626

Board of Managers:

Michael J. Beyer, Chief Executive Officer
Oscar A. Martinez, Executive Vice President for Finance
Homer Drexel Short Jr., Chief Operating Officer
Tony Harris, Chief Financial Officer

16. Meigs Point Dock LLC
P.O. Box 960
New Haven, WV 25265

Cline Resource and Development Company, Manager

17. Middle Wilgat, LLC
3801 PGA Boulevard, #903
Palm Beach, FL 33410

Cline Resource and Development Company, Manager

18. Sugar Camp Energy, LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

11351 N. Thompsonville Road
Macedonia, Illinois 62860
Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

19. Williamson Energy, LLC
Metropolitan Square Building
211 North Broadway, Suite 2600
St. Louis, MO 63102

- and –

16468 Liberty School Road
Marion, Illinois 62959

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Foresight Reserves, LP Affiliate Entities

1. Foresight Management, LLC

Cline Resource and Development Company, Manager

Officers:

Homer Drexel Short Jr., Chief Operating Officer (End date of August 16, 2011)
John F. Dickinson, II, President (Effective August 10, 2012)
Donald R. Holcomb, Vice President and Chief Financial Officer
(Effective August 10, 2012 - End Date effective March 31, 2013)

Permits: none

Violation: none

2. Akin Energy, LLC

Foresight Management LLC, Manager

Permits: none

Violation: none

FRLP 2008 No. 2 LLC Affiliate Entities

1. Middle Wilgat LLC

Cline Resource and Development Company, Manager

Permits: none

Violations: none

2. Gatling Ohio LLC

Cline Resource and Development Company, Manager

Permits:

- D-2317 Ohio

Violations:

- Violation # 19879 issued September 29, 2009 abated January 12, 2010 affected areas outside of permit
- Violation #28310 issued May 3, 2010 abated August 23, 2011 affected areas outside of permit
- Violation #29308 issued January 25, 2012 abated February 3, 2012 breached perimeter diversion

3. Lower Wilgat, LLC

Cline Resource and Development Company, Manager

Permits: none

Violations: none

4. Gatling LLC

Cline Resource and Development Company, Manager

Permits:

- O-3019-05 WV
- U-3016-05 WV
- O-3013-06 WV

Violations:

- O-3019-05 #1 - Issued April 11, 2006 - abated March 5, 2007 permit conditions
- O-3019-05 #2 - Issued March 10, 2010 - abated March 23, 2010 effluent limits
- U-3016-05 #1 - Issued March 21, 2007 - abated April 5, 2007 Blaster certification
- U-3016-05 #2 - Issued July 20, 2007 - abated July 25, 2007 fly rock
- U-3016-05 #3 - Issued September 28, 2007 - abated October 12, 2007 Fees
- O-3013-06 #1 – Issued August 14, 2014 – Failed to properly prepare and vegetate disturbed area – extended – pending abatement

5. Meigs Point Dock LLC

Cline Resource and Development Company, Manager

Permits:

- D-2323 Ohio

Violations: None

Foresight Energy LLC Entities

1. Foresight Energy LLC

   Foresight Management LLC, Manager

   Officers:

   Michael J. Beyer, President and Chief Executive Officer
   Oscar Martinez, Senior Vice President and Chief Financial Officer
   Christopher Moravec, Senior Vice President
   Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
   Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

   Permits: none

   Violations: none

2. Foresight Energy Services LLC

   Foresight Energy LLC, Manager

   Officers:

   Michael J. Beyer, President and Chief Executive Officer
   Oscar Martinez, Senior Vice President and Chief Financial Officer
   Christopher Moravec, Senior Vice President
   Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

   Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

   Permits: none

   Violations: none

3. Hillsboro Energy LLC

   Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)
Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit 399 – Illinois

Violations:

IDNR –

- 38-04-09 issued September 14, 2009 failed to follow approved mining plan – abated.
- 38-04-11 issued February 10, 2011 failed to follow approved mining plan – abated.
- 38-05-11 issued February 10, 2011 failed to report impoundment exam report – abated.
- 38-06-11 issued February 10, 2011 failed to complete field density testing – abated.
- 38-03-11 issued February 10, 2011 failed to maintain ditch 7b – abated.
- 38-12-11 issued June 30, 2011 failed to construct and maintain sediment control – abated.
- 34-01-2013 issued February 27, 2013 – failure to follow approved plan – clean coal stockpile expanded beyond approved protective base – abated on April 18, 2013.
- 38-07-13 issued November 1, 2013 – failed to report surface water discharge excursions within five days of receiving analytical results – abated on November 18, 2013.
- 38-01-2014 issued February 21, 2014 – failure to file renewal application within time frame required by the regulations – application submitted; no additional abatement measures required.
- 38-02-2014 issued April 28, 2014 – failure to follow approved plan, failure to protect topsoil from contamination and route all drainage to a sediment pond – abated on May 30, 2014.
- 68-1-2014 issued August 5, 2014 for failure to pass drainage through a sediment pond – abatement pending.
- 68-2-2014 issued August 5, 2014 for failure to remove topsoil prior to disturbance – abatement pending.
- 38-03-14 – issued August 28, 2014 for discharging water in excess of NPDES limits for chlorides and sulfates – corrective action was taken; abated October 29, 2014.

- 38-04-14 – issued on September 12, 2014 for discharging water in excess of NPDES limits for chlorides and sulfates – corrective action was taken; abated October 3, 2014.

IEPA –

- VN W-2010-30248 – failed to submit DMR's at the required frequency – CCA submitted and frequency being maintained.
- W-2014-50161 – discharge of contaminants, offensive conditions, unauthorized discharge, creating a water pollution hazard, failure to apply for a construction permit and failure to comply with NPDES permit – all water based issues have been corrected. Within the 45-day request period, a meeting will be requested.

4. Macoupin Energy LLC

Officers/Board of Managers:

Michael J. Beyer – CEO
Oscar A. Martinez – Executive Vice President for Finance
Homer Drexel Short Jr. – Chief Operating Officer
Tony Harris, CFO

Permits:

- Permit #56 Illinois
- Permit #209 Illinois
- Permit #265 Illinois
- Permit #291 Illinois
- Permit # 302 Illinois
- Permit # 419 Illinois

Violations:

IDNR –

- 38-03-12 issued April 16, 2012 failed to file renewal application public notice within the timeframe to conduct a hearing and allow for issuance of renewal decision – abated
- 38-05-12 issued July 2, 2012 failed to conduct non-MSHA quarterly exam for sediment pond 003 – abated
- 38-06-13 issued July 1, 2013 for failure to conduct surface coal mining and reclamation operation as described in the approved application. The operator installed an access road on the permit area without obtaining approval from the Department. Violation is abated, no penalty assessed.

IEPA –

- VN W-2011-00040 – exceed ground water standards – CCA approved September 12, 2011

5. Sugar Camp Energy LLC

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit #382 Illinois

Violations:

IDNR -

- 19-01-09 – issued April 27, 2009 failed to construct siltation structure prior to disturbance – abated
- 19-02-09 – issued June 2, 2009 failed to follow approved operations plan – abated
- 57-02-11 – issued July 27, 2011 failed to notify IDNR of non-compliant surface water samples – abated
- 57-03-11 – issued August 25, 2011 failed to follow approved plan – abated
- 19-1-11 – issued March 9, 2011 failed to comply with required surface water sampling parameters –abated
- 19-2-11 – issued March 9, 2011 failed to comply with required ground water sampling parameters – abated
- 57-01-13 – issued March 5, 2013 – discharging water from Outfall 008 with a chloride excursion of 874.6 mg/L – Abated.
- 57-3-13 – issued July 25, 2013 – failure to notify Department of noncompliance surface water sample with five day reporting period. Required letter submitted. Penalty assessment is pending.
- 57-02-14 – issued on July 9, 2014 for failure to follow approved plan, placement of coal slurry in experimental Geotubes in an unapproved location – abated on August 1, 2014.

IEPA –

- VN: W-2013-50008 issued April 25, 2013 – exceeding effluent limits and unpermitted mixing, dilution and discharge –CCA approved July 8, 2014.
- VN: W-2013-50133 issued April 30, 2013 – exceeding effluent limits –CCA approved July 8, 2014.
- VN: W-2014-50014 issued March 14, 2014 - violation of Chloride water quality standards on September 18, 2013 and November 26, 2013 –CCA approved July 8, 2014.
- VN: A-2014-00284 issued July 31, 2014 – failure to submit an Annual Emissions Report for calendar year 2013 – CCA accepted November 7, 2014.
- VN: M-2014-02002 issued October 23, 2014 – failure to comply with effluent conditions of NPDES permit, discharge of contaminants and offensive conditions – pending CCA request.

6. Williamson Energy LLC

Foresight Energy Services LLC, Manager

Officers:

Michael J. Beyer, President and Chief Executive Officer
Oscar Martinez, Senior Vice President and Chief Financial Officer
Christopher Moravec, Senior Vice President
Homer Drexel Short Jr., Chief Operating Officer (End date as of February 1, 2014)

Rashda Buttar, Senior Vice President, General Counsel and Corporate Secretary

Permits:

- Permit # 375

Violations:

IDNR –

- 26-1-09 issued April 3, 2009 failed to follow approve plan – abated
- 26-2-09 issued April 8, 2009 failed to submit fourth quarter subsidence control plan report – abated
- 26-3-09 issued April 17, 2009 failed to provide survey for buildings greater than 40 years old – abated
- 28-01-09 issued September 9, 2009 drainage leaving permit without passing through a sediment control structure – abated
- 47-2-10 issued March 9, 2010 disturbed within 100 feet of cemetery – abated
- 47-5-10 issued May 13, 2010 failed to maintain freeboard in sediment basin – abated
- 47-4-10 issued May 13, 2010 discharge from disturbed area did not pass through a

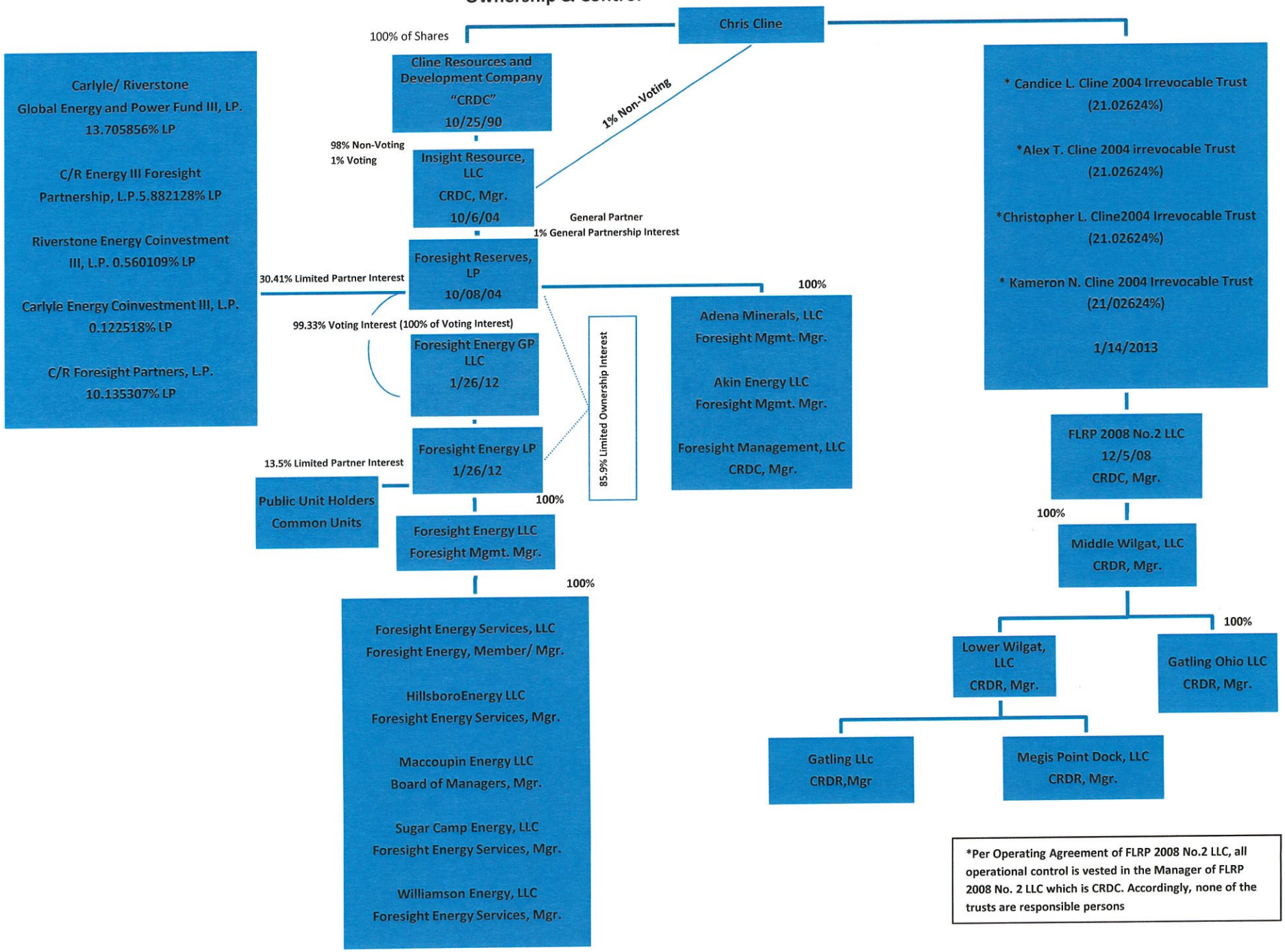
siltation structure before leaving the permit – abated

- 47-6-10 issued November 8, 2010 surface drainage flowing off permit without reporting to a sediment control structure – abated
- 47-2-11 issued April 27, 2011 petroleum based contaminant observed on water surface in sediment basin 004 – abated.
- 43-3-11 issued April 27, 2011 failed to maintain adequate freeboard in a sediment basin – abated
- 47-06-13 issued June 12, 2013 failed to submit site specific minimization of damage to structures plan – abated
- 62-1-14 issued March 20, 2014 for failure to report discharge excursions to the Department and failure to submit DMR's and groundwater reports for the 3rd and 4th quarters of 2013 – abated
- 62-2-14 issued May 1, 2014 for failure to report a non-compliant discharge – abated

IEPA –

- A-2014-00285 issued July 31, 2014 for failure to submit an Annual Emissions Report ("AER") to the Illinois Environmental Protection Agency for calendar year 2013 – AER submitted on August 29, 2014 and CCA letter issued on September 9, 2014

Ownership & Control



R08940

PART I ATTACHMENT I.10.A
AFFIDAVIT OF LEGAL RIGHT TO ENTER

Attachment I.10.A

(I) (~~We~~) Anthony Webb
(Individual or Individuals)

under penalties of perjury declare on behalf of the applicant, Williamson Energy, LLC that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed permit area, and the shadow area, and such legal right is not in any way the subject of pending court litigation.

Dated this 28 day of June, 20 13.

Anthony Webb
Signature

Authorized Agent
Title

Sworn to and subscribed before me

this 28 day of June, 20 13.

Gwen Finnegan
Notary Public

My Commission Expires: 9-6-15

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

RIGHT OF ENTRY AFFIDAVIT

(Required by 62 Ill. Adm. Code 1778.15(f))

I, **Anthony Webb**, under penalties of perjury, declare on behalf of the applicant, **Williamson Energy, LLC**, that said applicant has or will possess, prior to planned subsidence impacting streams as defined by the regulations and any related drainage, documents which bestow upon the applicant a legal right and all regulatory approvals to enter upon all surface property with the purpose to correct subsidence impacts to said streams and related drainage. Documents in support of granting the rights herein claimed by the applicant will be provided to the Department upon request.

Date June 28, 2013

Signature Anthony Webb Title Authorized Agent

Sworn to and subscribed before me

this 28 day of June, 2013.

Gwen Finnegan

Notary Public

My Commission Expires: 9-6-15

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

PART I ATTACHMENT I.10.B
ENGINEERING CERTIFICATION

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" on the line below if that item is relevant.

(1)_____ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

(2) _____ Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

(3) Certification of the Illinois Environmental Protection Agency-35 Ill. Adm. Code 405.104(a) Permit.

_____ In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

INDIVIDUAL P.E. CERTIFICATION

Claudio E. Yon
Name

062-050632
Illinois Registration Number (Seal)

Alliance Consulting, Inc.
Firm

124 Philpott Lane, Beaver, WV 25813
Address

304-255-0491
Phone Number

Claudio E. Yon
Signature

November 17, 2014
Date

CLAUDIO ELI YON
062-050632
LICENSED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

PROFESSIONAL DESIGN FIRM CERTIFICATION

Complete if applicable. If not, respond N/A.

Claudio E. Yon As an employee of a "professional design firm" as defined by the Illinois Department of Financial and Professional Regulation, I certify that the professional design firm is registered and in good standing with the Illinois Department of Financial and Professional Regulation.

Alliance Consulting, Inc. of West Virginia
dba Alliance Consulting, Inc.
Professional Design Firm Name

184.006236
Professional Design Firm Number

PART I ATTACHMENT I.10.C
CERTIFICATE OF LIABILITY INSURANCE

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 12/30/2013

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
MCGRIFF, SEIBELS & WILLIAMS, INC.
P.O. Box 10265
Birmingham, AL 35202

CONTACT NAME:
PHONE (A/C, No, Ext): 800-476-2211 FAX (A/C, No):
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Houston Specialty Insurance Company	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Foresight Energy, LLC including Williamson Energy, LLC
211 North Broadway
Suite 2600
St. Louis, MO 63102

COVERAGES **CERTIFICATE NUMBER:** JVGCSRXR **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY			MNG880434-01	12/31/2013	12/31/2014	EACH OCCURRENCE	$ 1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	X POLICY PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
								$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS / NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N						WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)	N/A					E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
								$ $ $ $ $

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)
Evidence of Insurance as repects to any and all permits held by Williamson Energy, LLC.
No exclusion for blasting or subsidence.

CERTIFICATE HOLDER

IL Dept of Natural Resources
and Reclamation Division
ice of Mines & Minerals
e Natural Resources Way
Springfield, IL 62702-1271

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

© 1988-2010 ACORD CORPORATION. All rights reserved.

The ACORD name and logo are registered marks of ACORD

ATTACHMENT I.11

PUBLIC NOTICE

Williamson Energy, LLC
Attachment I.11.

PUBLIC NOTICE

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy LLC, P. O. Box 300, Johnston City, IL 62951, hereby gives notice that on _____ 2015, a Permit Application 417 was determined to be complete by the Illinois Department of Natural Resources, Office of Mines and Minerals, to construct a surface facility for construction of a refuse impoundment for Permit No. 375, Revision No. 10 and Application No. 417.

The Permit Area is located in Williamson County, Township 8 South, Range 3 East, Section 12 and Township 8 South, Range 4 East, Section 7.

Approval is also requested to operate within 100 feet of the outside right-of-way of public road (Dean Road and Dwina Road) which is located as follows:

> Dean Road along the east side of Township 8 South, Range 3 East, Section 12 and the north and west side of Township 8 South, Range 4 East, Section 7
> Dwina Road at the intersection of Dean Road where the road borders Section 7, T8S, R4E and Section 12, T8S, R3E

Activities to be conducted within 100 feet of the outside right-of-way of public roads can include but not be limited to drainage structure installation and refuse material placement.

Copies of the application for this permit request are available for inspection at the following locations:

Williamson County Clerk's Office, Marion, IL 62959 and Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division, One Natural Resources Way, Springfield, Illinois 62702-1271.

Written comments, objections, request for informal conferences, or request for public hearings may be submitted to the Department at the above addresses.

Part II

PREMINING INFORMATION

Premining information is to be displayed on premining land use map unless otherwise indicated.

1) Describe how the permit area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the permit area. Provide a description of the reference point and a sketch relating the reference point to the permit area perimeter.

RESPONSE: **The perimeter of the permit area will be delineated by using PVC and/or metal pipes. The pipes will be within eyesight of one another and the top of each post will be painted blue. A reference point will be located at the intersection of Dwina Road and Dean Road.**

2) Provide slope measurements to represent existing land surface configuration of proposed permit area. A soils map of medium intensity prepared to NRCS specifications or a contoured aerial photo may be submitted to meet this requirement.

RESPONSE: **Refer to Map 5 – Soils Map (Drawing No. B12-271-E5) and Attachment II.13.A – Custom Soil Resource Report for the soils information and the slope classifications for the individual map units within the permit area.**

3) A) Has previous mining activity occurred within the permit area and/or adjacent areas?

Yes X No _____

If yes, provide the following information, if available:

1) Type of mining, surface, underground, or both?

RESPONSE: **Underground**

2) What coal seam or other mineral(s) were extracted?

RESPONSE: **Herrin No. 6**

3) What was the extent of coal or other mineral(s) removed? Delineate on the pre-mining land use map, or other designated map, the areas disturbed by previous mining activities, including active, inactive or abandoned underground mine work along with any mine opening to the surface.

Identify for each area the type of mining and the approximate date of extraction.

RESPONSE: **No surface coal mining has occurred. The deep mining is associated with the adjacent Permit 375, which is on-going. The area disturbed is associated with Permit 375.**

4) Identify on all maps submitted with the application areas where surface coal mining operations were conducted prior to August 3, 1977; after August 3, 1977 and prior to May 3, 1978; after

May 3, 1978 and prior to February 1, 1983; and any permanent regulatory program permit issued after February 1, 1983.

RESPONSE: **No surface coal mining has been conducted in the vicinity of the proposed operation. The mining in this area is associated with this permit application.**

5) Identify the land uses preceding mining.

RESPONSE: **Fish & Wildlife Herbaceous, Fish & Wildlife Woody, and Industrial/Commercial.**

4) Give the acreage of each land use within the proposed permit area, employing land use categories of Section 1701.5 listed below, and delineate on premining land use map existing land uses in the proposed permit area and within 1,000 feet adjacent to it. Include on the premining land use map the location of all buildings and identify the current use of these buildings.

Land Uses	Acreage
Cropland	**0.00**
Pasture Land	**0.00**
Grazing Land	**0.00**
Forestry	**0.00**
Residential	**0.00**
Industrial, Commercial	**14.40**
Recreation	**0.00**
Fish and Wildlife - Water	**0.00**
Fish & Wildlife - Herbaceous	**81.18**
Fish & Wildlife - Woody	**124.80**
Fish & Wildlife - Wetland	**9.40**
Developed Water Resources	**0.00**
Undeveloped land or no current use or land management	**0.00**
TOTAL	**229.78**

5) Have any of the land uses changed within the last five years?
Yes _____ No __X__

If yes, indicate the acreage and changes of land uses.

6) A) Provide a narrative of land capability and productivity of the proposed permit area prior to mining which shall provide an analysis of:

1) The capability of the land to support a variety of uses, giving consideration to soil and foundation characteristics, topography, vegetative cover and hydrology;

RESPONSE: **In general terms, the proposed permit area currently is capable of supporting a variety of uses, considering the soil and foundation characteristics, topography, vegetative cover, and hydrology. See Attachment II.13.A – Custom Soil Resource Report generated from the NRCS Web Soil Survey.**

2) The productivity of the total area expressed as average yield of food, fiber, forage, or wood products under high level management.

RESPONSE: **See Attachment II.13.A – Custom Soil Resource Report**

B) Where the narrative of land capability and productivity employs the U.S.D.A Natural Resources Conservation Service (NRCS) Land-Capability Classification (Agriculture Handbook No. 210) in conjunction with the soil information provided under Part II 12) of this part, soil

interpretation sheets or published soil survey or complete soil information chart for productivity from Circular 1156 are to be submitted for each soil type occurring in the permit area.

RESPONSE: **See Attachment II.13.A – Custom Soil Resource Report**

7) Provide a description of the existing land uses and land classifications under local law, if any, for the proposed permit and adjacent areas.

RESPONSE: **Currently no local laws pertaining to land use and land classification are applicable to the proposed permit and adjacent areas in Williamson County, Illinois.**

8) Provide fish and wildlife resource information for the proposed permit area and any adjacent areas. Prior to initiation of studies to obtain fish and wildlife resource information, the applicant must contact the Department for a determination of what fish and wildlife resources information will be required. Pursuant to 62 Ill. Adm. Code 1784.21(a)(1) and (2), the Department will determine the level of detail and the areas of study. Site-specific resource information will be required by the Department if either the permit area or adjacent area is likely to include threatened or endangered species or their critical habitats or habitats of unusually high value for fish and wildlife.

The applicant should complete the description of plant communities within the permit area and adjacent area, requested in Part II 9), below, prior to contacting the Department for a determination of the fish and wildlife resource information.

RESPONSE: **Of the threatened and endangered species known to occur in Williamson County, three (3) are small mammals: eastern wood rat (*Neotoma floridana*), golden mouse (*Ochrotomys nuttalli*), and marsh rice rat (*Oryzomys palustris*). There are four (4) listed bat species: gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and southeastern myotis (*Myotis austroriparius*). Also, there are eight (8) listed fish species: bigeye shiner (*Notropis boops*), cypress minnow (*Hybognathus hayi*), Iowa darter (*Etheostoma exile*), least brook lamprey (*Lampetra aepyptera*), pallid sturgeon (*Scaphirhynchus albus*), river redhorse (*Moxostoma carinatum*), sturgeon chub (*Macrhybopsis gelida*), and western sand darter (*Ammocrypta clarum*).**

A small mammal survey, bat survey, and fish survey were performed during the 2010 field season on property surrounding and including the proposed refuse disposal facility project area. No state or federally threatened or endangered small mammals, bats, or fish were captured during these surveys, specifically within the proposed refuse disposal facility area. Drawing No. B12-271-D1, entitled "Endangered Species Survey Map" located in Attachment II.8, shows the proximity of both the Proposed Coal Refuse Disposal Facility No. 3 and the Pond Creek Mine No. 1 shadow area (Permit 375). Williamson Energy, LLC is requesting to utilize the 2010 small mammal, bat, and fish surveys for the proposed refuse disposal facility project area.

Additionally, a second endangered bat survey was completed in 2014 and again no captures of threatened or endangered bats occurred. This survey is contained within Attachment II.8.

Refer to the Threatened and Endangered Species Project Assessment contained within Attachment II.8 for further details.

Qualifications of Alliance personnel working on the Williamson Energy proposed project can be found in Attachment II.8 – Endangered or Threatened Species.

The applicant will utilize raptor safe suspension configurations and maintain at least 60" of clearance between lines, as well as raptor safe insulators and, if necessary, utilize perch guards on poles. It is important to note that existing electrical lines currently crosses the proposed permit area and no raptor fatalities are known to have occurred.

9) Give a description of the plant communities within the proposed permit area and delineate on a vegetation map the vegetative types occurring within the proposed permit area and within any proposed reference area. Where a map or aerial photograph is required provide coverage of sufficient adjacent areas to allow evaluation of vegetation as important habitat for fish and wildlife for those species of fish and wildlife identified under Section 1784.21. The description shall include information adequate to predict the potential for reestablishing vegetation.

RESPONSE: Refer to the Habitat Map (Drawing No. B08-467-D4) contained within Attachment II.9 for the vegetation and habitat types found within the project area.

Refer to Attachment II.9 for the plant community descriptions.

10) A) Pursuant to 62 Ill. Adm. Code 1783.12(a), provide a description of the cultural, archeological and historic resources listed or eligible for listing on the National Register of Historic Places and any known archeological features within the proposed permit, adjacent areas, and shadow area (for planned subsidence). The description of the cultural, historic and archeological resources occurring within the permit area and adjacent areas shall be based upon available data, including data of State and local archeological, historical and cultural preservation agencies.

RESPONSE: Refer to Attachment II.10.A – Cultural, Archeological and Historical Resources Report.

B) 1) Pursuant to 62 Ill. Adm. Code 1783.12(b):

a) State whether there is a substantial likelihood of currently unknown resources which would be eligible for the National Register of Historic places within the proposed permit, or adjacent areas or shadow area (for planned subsidence).

RESPONSE: Refer to Attachment II.10.A – Cultural, Archeological and Historical Resources Report.

b) Provide a plan detailing the manner in which additional information will be gathered by the applicant to enable the Department to identify and evaluate such resources.

RESPONSE: Refer to Attachment II.10.A – Cultural, Archeological and Historical Resources Report.

2) Please Note: If the Department determines that the Part II 10)A) resource information is not adequate to make the required finding under 62 Ill. Adm. Code 1773.15(c)(12) because information available to the Department indicates a substantial likelihood of currently unknown resources within the permit area or adjacent areas which would be eligible for the National Register of Historic Places, the Department will require the applicant to submit additional information to enable the Department to identify and evaluate the potential resources. Such information might include the results of field investigations of the permit

area and adjacent area if it is determined by the Department, in consultation with the Illinois State Historic Preservation Agency, that the field investigation will provide the information required under Part II 10)A).

RESPONSE: **Refer to Attachment II.10.A – Cultural, Archeological and Historical Resources Report.**

C) For the permit area and/or shadow area (for planned subsidence) locate on the vegetation map or the land use map the following:

The boundaries of any publicly owned parks, locations of any cultural resources, historical resources listed or eligible for listing on the National Register of Historic Places.

RESPONSE: **N/A**

D) Provide a map showing the location of know/Archeological site(s) listed on or eligible for listing on the National Register of Historic Places. Provide identifying field markings to be employed to insure that the site(s) will not be disturbed by surface coal mining and reclamation operations. The map is to be submitted in separate cover from the rest of the application. The Department will hold the map as a confidential document.

RESPONSE: **N/A**

E) Provide a plan for publicly owned park(s), or place(s) identified above in paragraph(c) that may be adversely affected by the proposed operation describing the measures to be employed:

RESPONSE: **N/A**

1) To prevent adverse impacts caused by underground mining related activities including, but not limited to, loss or destruction of historic artifacts and damage to historic structures or property; or

RESPONSE: **N/A**

2) If valid existing rights exist or joint agency approval is to be obtained under 62 Ill. Adm. Code 1761.12(e), to minimize adverse impacts.

RESPONSE: **N/A**

11) For the permit area and/or shadow area (for planned subsidence) locate on the vegetation map or land use map the boundaries of any public or private cemeteries or Indian burial grounds.

RESPONSE: **N/A**

12) A) Provide the location of surface and subsurface man-made features within, passing through, or passing over the proposed permit and shadow areas on the pre-mining land use map or other designated map.

RESPONSE: **Refer to Map 6 S.F., Operations Plan Map**

Such features should include but are not limited to major electric transmission lines, pipelines, agricultural drainage tile fields, gas and oil wells, and water wells. For gas, oil and water wells provide the depth, if available, of the well.

RESPONSE: **There are no oil or gas wells in the area. Refer to Map 4, HydroGeologic Map (Drawing No. B12-271-M23) for water well locations.**

B) Provide the elevation and location of all monitoring stations used to gather data for water quality and quantity, fish and wildlife, and air in preparation of the application.

RESPONSE: **Refer to Map 6 S.F., Operations Plan Map (Drawing No. B12-271-M24), the Threatened and Endangered Species Survey Map (Drawing No. B12-271-D1) and Map 4, HydroGeologic Map (Drawing No. B12-271-M23) for water well locations**

13) Soils Information Map

A) Does the submitted soils map represent a map developed by the Natural Resources Conservation Service?

Yes __X__ No _____

If no, explain. If SCS map has been modified, explain (Example - photographically enlarged; soil map units recorrelated; area affected after initial mapping). Soil map scale must be 1" = 400' unless otherwise approved by the Department.

RESPONSE: **The Map 5 – Soils Map was prepared using information from the NRCS Williamson County Soils Report. For clarity purposes, the map scale is provided as 1" = 200 feet.**

B) Are any of the identified map units correlated as prime farmland by SCS criteria?

Yes __X__ No _____

If yes, provide acreage by completing soil information chart.

RESPONSE: **Refer to the chart on Map 5 – Soils Map (Drawing No. B12-271-E5) and the Soil Resource Report contained in Attachment II.13.A.**

C) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the permit area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: **Refer to the chart on Map 5 – Soils Map (Drawing No. B12-271-E5) and the Soil Resource Report contained in Attachment II.13.A.**

D) Indicate the average topsoil thickness of each of the soil map units to be affected. Locate on soils map the test holes for soil horizon thickness sampling. The topsoil replacement thickness (inches) will be **(see below) inches**.

RESPONSE: **Holcomb Foundation Engineering Co., Inc. measured topsoil thickness. A letter report dated November 12, 2014 with the measurements and a "Boring Location Diagram" are included in Attachment II.13.D. The average topsoil thickness is 6 inches. The**

topsoil replacement thickness will be 6 inches. Refer to Table 4.1 contained in the Custom Soil Resource Report (Attachment II.13.A).

E) List the soil types and acreages of areas that will require the B and/or portions of the C horizon to be removed and replaced in order to establish the root medium necessary to achieve soil productivity consistent with the proposed post-mining land use.

Alternatively, a narrative description explaining why specific soil type acres information for reclamation plan achievement is not necessary may be provided instead.

RESPONSE: **Soil for reclamation will come from soils excavated during facility construction and from borrow areas. There are three subsoil borrow areas as shown on Drawing No. B12-271-A6, entitled "Soil Borrow Area Location Map". Details are also shown on Drawing Nos. B12-271-A7, B12-271-A8, and B12-271-A9 for each site. The excess soil from construction is the material generated from excavation of the sediment and drainage structures and the incised cell. The area of refuse to be reclaimed is approximately 222 acres, which would require 1,433,931 cubic yards to achieve a depth of 4 feet of cover. It is anticipated that removal of 8 inches of topsoil, along with the construction of the sediment structures, will generate approximately 800,000 cubic yards of the required material. The remaining 633,931 cubic yards will come from the Borrow Areas 1, 2, and 3. The cut in Area 1, with an average depth of 14.62 feet, will generate 305,987 cubic yards of soil for reclamation. This area will be leveled in three tiers, the lowest being El. 472 and the upper most El. 500, in order to maximize the borrow potential of Area No. 1. The nearest rock, based upon the drilling information, is approximately 20 feet below the surface elevation at most locations. The remaining 327,944 cubic yards required will come from Areas 2 and 3; the total acreage of these areas is 26.0 acres. Taking an average cut of 7.9 feet within these areas will generate the remaining volume of 327,944 required for reclamation. Refer to Drawing No. B12-271-A6 for borehole locations B-1, MCC-31, 8312-CP, and MCC-25. Borehole B-1 shows a depth to top of rock of 17 feet; Borehole MCC-31 shows a depth to top of rock of 20 feet; Borehole 8312-CP shows a depth to top of rock of 19.5 feet; and, Borehole MCC-25 shows a depth to top of rock of 22 feet.**

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes **X** No _____

If yes, provide the appropriate information required under Section 1785.21(b). Also, identify source of the substitute materials and the topsoils to be substituted away from on a separate soils map unless the Department grants permission to describe the area in narrative form or to use the soils map provided in Part II 13(A). Explain why the proposed plan will provide the best available material of equal or better quality than present topsoil or surface existing material. This section must be addressed when reaffecting previously disturbed areas.

RESPONSE: **The topsoil will be segregated for use in final reclamation. Bottomland alluvium for the Belknap series will be used to provide supplemental topsoil for use in reclamation. Rooting media will consist of B/C mix of subsoil, loess, and glacial till obtained on the upland areas for use as Custom Soil Resource Report (Attachment II.13.A) for information on the soil properties and the proposed use of supplemental materials.**

3001-15
part 2

ATTACHMENT II.8

THREATENED AND ENDANGERED SPECIES PROJECT ASSESSMENT
COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON COUNTY, ILLINOIS
WILLIAMSON ENERGY, LLC

INTRODUCTION

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal area operation. The proposed mining area is necessary to construct the surface facilities associated with an underground mine. This project will consist of the East Coal Refuse Disposal Area No.3 to service Pond Creek No. 1 Mine.

The purpose of the assessment was to survey the proposed coal refuse disposal facility permit area for the presence and/or probable absence of listed threatened and endangered species within the proposed permit area and to document the occurrence of the preferred or potential habitat for each of these species.

SITE LOCATION

The proposed permit area is located northeast of Johnston City in Williamson County, Illinois and has its approximate center at Latitude 37.844380 and Longitude -88.812612. Drawing Number B08-467-A13, found in the Figures Section, documents the boundaries of the proposed coal refuse facility site. The current permit limits is 229 acres in size. On site waters flow in a northerly to northwesterly direction to the confluence with Pond Creek of the Big Muddy River of the Mississippi River (Figures, Drawing Numbers B08-467-A13 & B08-467-A8.

Watershed Information

The permit area is situated within the Town of West Frankfort – Pond Creek watershed (HUC 12: 071401060501) of the Big Muddy River (HUC 8: 07140106) (NRCS, 2004) (Figures, Drawing No. B08-467-A6 & A7). Drainage of the permit area occurs primarily by way of several ephemeral and intermittent streams that drain to Pond Creek a perennial tributary to the Big Muddy River, a traditional navigable water (TNW). The Big Muddy River flows to the Mississippi River (TWN). The permit area is situated outside of the 100 year floodplain (Figures, Drawing No. B08-467-A8).

QUALIFICATIONS

The following report was prepared by Alliance environmental scientists Jennifer Arp-Bazzie and Braden Hoffman. Ms. Bazzie has a bachelor's degree in Biology from Ohio University and a master's degree in Environmental Microbiology from the University of North Carolina – Wilmington. Ms. Bazzie has been employed with Alliance for three years and has been conducting ecological evaluations for 12 years across multiple states. Ms. Bazzie is also a Professional Wetland Scientist. Braden Hoffman has a bachelor's degree in Environmental Science from Allegheny College and a master's in business from West Virginia University. Mr. Hoffman has been employed with Alliance for 12 years and has been conducting ecological surveys for the last 13 years. Mr. Hoffman has been conducting ecological and other endangered

species surveys in Illinois annually since 2004. Mr. Hoffman is a State and Federal Scientific collection permit holder for endangered bat surveying.

SURVEY METHODS

Federally Listed Threatened and Endangered Species

The U.S. Fish and Wildlife Serves lists (October 2013) lists two (2) species as endangered or proposed as endangered for Williamson County. Those species are listed in Table 1.

Table 1. Federally Endangered, Threatened, and Candidate Species for Williamson County, Illinois

Scientific Name	Common Name	Status
Myotis septentrionalis	Northern long-eared bat	Proposed as Endangered
Myotis sodalis	Indiana bat	Endangered

State Listed Threatened and Endangered Species

The Illinois Natural Heritage database (July 2014) lists twenty (20) species as threatened or endangered for Williamson County (Table 2).

Table 2. State Threatened and Endangered Species for Williamson County, Illinois

Scientific Name	Common Name	State Protection *	Number of Occurrences	Last Observed
Asplenium bradleyi	Bradley's spleenwort	LE	1	1994-09
Bartramia longicauda	Upland sandpiper	LE	1	1987
Crotalus horridus	Timber Rattlesnake	LT	2	1993-06-07
Dodecatheon frenchii	French's Shootingstar	LT	1	2002-08-13
Eryngium prostratum	Eryngo	LE	1	1993-07-13
Ixobrychus exilis	Least Bittern	LT	1	1993-06-30
Lampetra aepyptera	Least Brook Lamprey	LT	1	2010-10-08
Matelea decipiens	Climbing Milkweed	LE	2	2011-07-01
Myotis sodalis	Indiana bat	LE	1	2012-05-31
Nyctanassa violacea	Yellow-crowned Night Heron	LE	1	2007-05-31
Ochrotomys nuttalli	Golden Mouse	LT	2	2001-10
Orconectes indianesis	Indiana Crayfish	LE	8	2011-08-18
Oryzomys palustris	Rice rat	LT	7	2013-05-31
Paspalum dissectum	Bead Grass	LE	1	1987-09-11
Rhexia mariana	Dull Meadow Beauty	LE	5	2002-08-29
Scleria pauciflora	Carolina Whipgrass	LE	1	1983-07-04
Spiranthes vernalis	Spring Ladies' Tresses	LE	1	1991-06-23
Thryomanes bewickii	Bewick's Wren	LE	1	1987-06-24
Trillium viride	Green trillium	LE	1	1987-04-27
Tyto alba	Barn owl	LE	3	2010-02

*LE – Listed Endangered, LT – Listed Threatened

The Illinois Department of Natural Resources has identified a list of 149 state threatened and endangered species that are known to occur in Williamson and the adjacent counties (Franklin, Jackson, Johnson, Pope, and Saline) (Table 3). The bald eagle is not on the state Illinois threatened and endangered species list; however, it is still protected under the Migratory Bird Treaty Act, as well as the Bald and Golden Eagle Protection Act, therefore, this species was also assessed within this report.

Table 3. State Listed Threatened and Endangered Species for Williamson and its Surrounding Counties.

Scientific Name	Common Name	State Protection	Franklin County	Jackson County	Johnson County	Pope County	Saline County	Union County	Williamson County
			Present - Yes or No						
Agalinis skinneriana	Pale False Foxglove	LT	No	No	No	No	No	Yes	No
Ammocrypta clarum	Western Sand Darter	LE	No	Yes	No	No	No	Yes	No
Amorpha nitens	Smooth False Indigo	LE	No	No	No	Yes	No	No	No
Apalone mutica	Smooth Softshell	LE	No	Yes	No	No	No	No	No
Asclepias meadii	Mead's Milkweed	LE	No	No	No	No	Yes	No	No
Asio flammeus	Short-eared Owl	LE	No	No	No	No	Yes	No	No
Asplenium bradleyi	Bradley's Spleenwort	LE	No	Yes	No	Yes	Yes	Yes	Yes
Asplenium resiliens	Black Spleenwort	LE	No	No	No	No	No	Yes	No
Bartonia paniculata	Screwstem	LE	No	No	No	Yes	No	No	No
Bartramia longicauda	Upland Sandpiper	LE	No	No	No	No	No	No	Yes
Berberis canadensis	Allegheny Barberry	LE	No	Yes	No	No	No	No	No
Berchemia scandens	Supple-jack	LT	No	No	No	Yes	No	No	No
Botrychium biternatum	Southern Grape Fern	LT	No	Yes	No	Yes	Yes	No	No
Calmagrostis insperata	Bluejoint Grass	LE	No	No	No	Yes	No	No	No
Carex alata	Winged Sedge	LE	No	No	No	Yes	No	No	No
Carex arkansana	Arkansas Sedge	LE	No	No	No	No	Yes	No	No
Carex atlantica	Sedge	LT	No	No	No	Yes	No	No	No
Carex bromides	Sedge	LT	No	No	Yes	Yes	No	No	No
Carex communis	Fibrous-rooted Sedge	LT	No	No	No	Yes	Yes	No	No
Carex decomposita	Cypress-knee Sedge	LE	No	No	Yes	Yes	No	Yes	No
Carex gigantea	Large Sedge	LE	No	No	Yes	No	No	Yes	No
Carex intumescens	Swollen Sedge	LT	No	No	Yes	Yes	Yes	No	No
Carex nigromarginata	Black-edged Sedge	LE	No	No	No	No	No	Yes	No
Carex oxylepis	Sharp-scaled Sedge	LT	No	No	Yes	Yes	Yes	Yes	No
Carex prasina	Drooping Sedge	LT	No	No	No	Yes	No	No	No
Carex physorhyncha	Bellows Beak Sedge	LE	No	Yes	No	No	No	Yes	No
Carex plantaginea	Plantain-leaved Sedge	LE	No	Yes	No	No	No	No	No
Carex willdenowii	Willdenow's Sedge	LT	No	Yes	Yes	Yes	Yes	Yes	No
Carya aquatica	Water Hickory	LT	No	No	Yes	No	Yes	Yes	No

Scientific Name	Common Name	State Protection	Franklin County	Jackson County	Johnson County	Pope County	Saline County	Union County	Williamson County
			Present - Yes or No						
Carya pallida	Pale Hickory	LE	No	No	No	No	No	Yes	No
Chamaelirium luteum	Fairy Wand	LE	No	No	No	Yes	No	No	No
Chimaphila maculata	Spotted Wintergreen	LE	No	No	No	Yes	No	No	No
Cimicifuga racemosa	False Bugbane	LE	Yes	No	No	No	No	No	No
Cimicifuga rubifolia	Black Cohosh	LT	No	Yes	Yes	Yes	Yes	No	No
Circus cyaneus	Northern Harrier	LE	No	No	Yes	Yes	Yes	No	No
Clematis crispa	Blue Jasmine	LE	No	No	Yes	No	No	No	No
Clematis viorna	Leatherflower	LE	No	No	Yes	No	No	No	No
Corydalis halei	Hale's Corydalis	LE	No	No	No	Yes	No	No	No
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	LE	No	Yes	Yes	Yes	No	Yes	No
Crangonyx anomalus	Anomalous Spring Amphipod	LE	No	No	No	Yes	No	No	No
Crangonyx packardi	Packard's Cave Amphipod	LE	No	No	Yes	Yes	Yes	Yes	No
Crotalus horridus	Timber Rattlesnake	LT	No	Yes	Yes	Yes	Yes	Yes	Yes
Cynosciadium digitatum	Cynosciadium	LE	No	Yes	No	No	No	No	No
Cyperus lancastriensis	Galingale	LT	No	No	No	Yes	No	No	No
Dendroica cerulea	Cerulean Warbler	LT	No	Yes	No	No	No	Yes	No
Dennstaedtia punctilobula	Hay-scented Fern	LE	No	No	Yes	Yes	No	No	No
Demognathus conanti	Spotted Dusky Salamander	LE	No	No	Yes	No	No	No	No
Dichanthelium joorii	Panic Grass	LE	No	No	Yes	Yes	No	Yes	No
Dichanthelium yadkinense	Panic Grass	LE	No	No	No	Yes	No	No	No
Dodecatheon frenchii	French's Shootingstar	LT	No	Yes	Yes	Yes	No	Yes	Yes
Dryopteris celsa	Log Fern	LE	No	No	Yes	No	No	No	No
Egretta caerulea	Little Blue Heron	LE	Yes	No	No	No	No	No	No
Eryngium prostratum	Eryngo	LE	No	No	No	Yes	Yes	No	Yes
Euonymus americanus	American Strawberry Bush	LE	No	No	Yes	Yes	No	No	No
Fundulus dispar	Starhead Topminnow	LT	No	No	No	No	No	Yes	No
Fusconaia ebena	Ebonyshell	LT	No	No	No	Yes	No	No	No
Gallinula chloropus	Common Moorhen	LE	No	Yes	No	No	No	Yes	No
Gastrophryne carolinensis	Eastern Narrowmouth Toad	LT	No	Yes	No	Yes	No	Yes	No
Glyceria arkansana	Manna Grass	LE	No	Yes	No	No	No	Yes	No
Helianthus angustifolius	Narrow-leaved Sunflower	LT	No	No	No	Yes	No	No	No
Hesperiaa metea	Cobweb Skipper	LT	No	No	No	Yes	No	No	No
Heteranthera reniformis	Mud Plantain	LE	No	No	No	Yes	No	Yes	No
Hexalectris spicata	Crested Coralroot Orchid	LE	No	Yes	No	No	No	No	No
Huperzia porophila	Cliff Clubmoss	LT	No	Yes	No	Yes	No	No	No

Scientific Name	Common Name	State Protection	Franklin County	Jackson County	Johnson County	Pope County	Saline County	Union County	Williamson County
			Present - Yes or No						
Hybognathus hayi	Cypress Minnow	LE	No	No	Yes	No	No	Yes	No
Hydrolea uniflora	One-flowered Hydrolea	LE	No	Yes	Yes	No	No	Yes	No
Hyla avivoca	Bird-voiced Treefrog	LT	No	Yes	Yes	Yes	No	Yes	No
Ictinia mississippiensis	Mississippi Kite	LT	No	Yes	Yes	No	No	Yes	No
Isotia verticillata	Whorled Pogonia	LE	No	No	No	Yes	No	No	No
Ixobrychus exilis	Least Bittern	LT	No	Yes	No	No	Yes	Yes	Yes
Lampetra aepyptera	Least Brook Lamprey	LT	No	No	Yes	Yes	No	No	Yes
Lanius ludovicianus	Loggerhead Shrike	LE	No	Yes	Yes	Yes	Yes	Yes	No
Lepomis miniatus	Redspotted Sunfish	LE	No	No	No	Yes	No	Yes	No
Lepomis symmeticus	Bantam Sunfish	LT	No	No	Yes	No	No	Yes	No
Limnothlypis swainsonii	Swainson's Warbler	LE	No	Yes	Yes	No	No	No	No
Lonicera dioica var. glaucescens	Red Honeysuckle	LE	No	Yes	No	No	No	No	No
Lonicera flava	Yellow Honeysuckle	LE	No	Yes	No	Yes	No	No	No
Lysimachia radicans	Creeping Loostrife	LE	No	No	Yes	No	No	No	No
Macrhybopsis gelida	Sturgeon Chub	LE	No	Yes	No	No	No	No	No
Macrochelys temminckii	Alligator Snapping Turtle	LE	No	No	No	No	No	Yes	No
Malus angustifolia	Narrow-leaved Crabapple	LE	No	No	No	Yes	No	No	No
Matelea decipiens	Climbing Milkweed	LE	No	Yes	No	No	No	Yes	Yes
Matelea obliqua	Climbing Milkweed	LT	No	No	Yes	Yes	Yes	No	No
Melanthium virginicum	Bunchflower	LT	No	Yes	No	No	No	No	No
Melothria pendula	Squirting Cucumber	LT	No	Yes	No	Yes	No	Yes	No
Moxostoma carinatum	River Redhorse	LT	Yes	No	No	No	No	No	No
Myotis austroriparius	Southeastern Myotis	LE	No	No	Yes	Yes	Yes	Yes	No
Myotis grisescens	Gray Bat	LE	No	Yes	Yes	Yes	No	No	No
Myotis sodalis	Indiana Bat	LE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Necturus maculosus	Mudpuppy	LT	No	No	No	No	No	Yes	No
Neotoma floridana	Eastern Wood Rat	LE	No	Yes	Yes	Yes	Yes	Yes	No
Nerodia cyclopion	Mississippi Green Watersnake	LT	No	No	No	No	No	Yes	No
Notropis anogenus	Pugnose Shiner	LE	No	No	No	Yes	No	No	No
Notropis boops	Bigeye Shiner	LE	No	Yes	No	No	No	Yes	No
Notropis texanus	Weed Shiner	LE	No	No	No	No	No	Yes	No
Nyctanassa violacea	Yellow-crowned Night Heron	LE	No	No	Yes	No	No	No	Yes
Ochrotomys nuttalli	Golden Mouse	LT	No	Yes	Yes	Yes	Yes	Yes	Yes
Orconectes indianesis	Indiana Crayfish	LE	No	No	Yes	Yes	Yes	No	Yes
Orconectes placidus	Bigclaw Crayfish	LE	No	Yes	No	Yes	No	No	No
Oryzomys palustris	Rice Rat	LT	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Scientific Name	Common Name	State Protection	Franklin County	Jackson County	Johnson County	Pope County	Saline County	Union County	Williamson County
			Present - Yes or No						
Oxalis illinoensis	Illinois Wood Sorrel	LE	No	Yes	No	Yes	No	No	No
Paspalum dissectum	Bead Grass	LE	No	No	No	No	No	No	Yes
Penstemon pallidus	Short-sepaled Beard Tongue	LE	No	No	No	Yes	No	No	No
Phaeophyscia leana	Lea's Bog Lichen	LT	No	No	No	Yes	No	No	No
Pinus echinata	Shortleaf Pine	LE	No	Yes	No	No	No	Yes	No
Planera aquatica	Water Elm	LT	No	No	Yes	Yes	No	No	No
Plantago cordata	Heart-leaved Plantain	LE	No	Yes	Yes	Yes	Yes	No	No
Plantanthera clavellata	Wood Orchis	LE	No	No	No	Yes	No	No	No
Plantanthera flava var. herbiola	Tubercled Orchid	LT	No	No	Yes	No	No	No	No
Poa alsodes	Grove Bluegrass	LE	No	Yes	No	Yes	No	No	No
Poa wolfii	Wolf's Bluegrass	LE	No	No	No	No	Yes	No	No
Polygala incarnata	Pink Milkwort	LE	No	No	No	Yes	No	No	No
Potamilus capax	Fat pocketbook	LE	No	No	No	Yes	No	No	No
Prostoia completa	Central Forestfly	LE	No	No	No	No	No	Yes	No
Pseudemys concinna	River Cooter	LE	Yes	No	No	No	No	No	No
Ptillimnium nuttallii	Mock Bishop's Weed	LE	No	Yes	No	No	No	No	No
Quercus montana	Rock Chestnut Oak	LT	No	Yes	No	No	Yes	Yes	No
Quercus phellos	Willow Oak	LT	No	No	Yes	No	No	Yes	No
Rhexia mariana	Dull Meadow Beauty	LE	No	Yes	No	Yes	No	No	Yes
Rhynchospora glomerta	Clustered Beaked Rush	LE	No	No	Yes	Yes	No	No	No
Saggitaria australis	Arrowhead	LE	No	No	No	Yes	No	No	No
Salvia azurea ssp. Pitcheri	Blue Sage	LT	No	No	Yes	Yes	No	No	No
Scaphirhynchus albus	Pallid Sturgeon	LE	No	No	No	No	No	Yes	No
Scirpus polyyphyllus	Bulrush	LT	No	No	No	Yes	No	No	No
Scleria pauciflora	Carolina Whipgrass	LE	No	No	Yes	Yes	No	No	Yes
Sedum telephioides	American Orpine	LT	No	No	No	Yes	Yes	No	No
Spiranthes vernalis	Spring Ladies' Tresses	LE	No	Yes	Yes	Yes	Yes	No	Yes
Stellaria pubera	Great Chickweed	LE	No	No	No	Yes	No	No	No
Stenanthium gramineum	Grass-leaved Lily	LE	No	No	Yes	Yes	No	No	No
Styrax americana	Storax	LT	No	No	Yes	Yes	No	Yes	No
Synandra hispidula	Hairy Synandra	LE	No	Yes	No	No	No	No	No
Talinum parviflorum	Small Flower-of-an-hour	LT	No	No	Yes	Yes	No	Yes	No
Tantilla gracilis	Flathead Snake	LT	No	No	No	No	No	Yes	No
Terrapene ornata	Ornate Box Turtle	LT	Yes	No	No	No	No	No	No
Thamnophis sauritus	Eastern Ribbon Snake	LT	No	No	Yes	Yes	No	No	No
Thelypteris noveboracensis	New York Fern	LE	No	No	No	Yes	No	No	No

Scientific Name	Common Name	State Protection	Franklin County	Jackson County	Johnson County	Pope County	Saline County	Union County	Williamson County
			Present - Yes or No						
Thryomanes bewickii	Bewick's Wren	LE	No	No	Yes	Yes	No	No	Yes
Tomanthera auriculata	Ear-leafed Foxglove	LT	No	Yes	No	No	No	No	No
Torreyochloa pallida	Grass	LE	No	Yes	No	No	No	Yes	No
Toxolasma lividus	Purple Lilliput	LE	No	No	No	Yes	No	No	No
Trichomanes boschianum	Filmy Fern	LE	No	No	Yes	Yes	No	No	No
Trifolium reflexum	Buffalo Clover	LT	No	Yes	No	No	No	No	No
Trillium viride	Green Trillium	LE	Yes	No	No	No	No	Yes	Yes
Tyto alba	Barn Owl	LE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urtica chamaedryoides	Nettle	LT	No	No	No	No	No	Yes	No
Vaccinium stamineum	Deerberry	LE	No	No	No	Yes	No	No	No
Villosa lienosa	Little Spectaclecase	LT	No	No	No	Yes	No	Yes	No

Species Habitat Requirement Review

A literature review was conducted to document the preferred habitat requirements, growth habits, and known occurrences of each threatened and endangered species.

In Office GIS Survey

Alliance utilized ArcGIS Desktop to examine current and historic aerial photographs, USDA soils data, National Wetlands Inventory (NWI) data, and land cover data within and adjacent to the project area. This data was then compared to documented species occurrences for comparison to habitats within the project area.

Natural Divisions Discussion and Examination

A review of the Illinois Natural Division was conducted to assist in determining if each species is likely to occur on or adjacent to the proposed project area. Illinois is divided into 14 natural divisions that divide the Illinois landscape based upon difference in topography, glacial history, bedrock, soils and the distribution of native plants and animals (Schwegman 1973). Each natural division contains similar landscapes, climates and substrate features like bedrock and soils that support similar ecology such as vegetation and wildlife. Five distinct divisions occur within the review counties for this project, including the Southern Till Plains, Wabash Border, Shawnee Hills, Lower Mississippi Bottomlands, and the Ozarks Divisions. However, only one of these natural divisions, the Southern Till Plain, occurs within the proposed project area and adjacent areas.

The Southern Till Plain is located in southern Illinois and is a glacial till plain from the Illinoisan and Kansan age. Historically this area consisted of open woodlands with prairie on level

uplands. Today, most of the area has been converted to agricultural production, with small forested areas remaining on steep hillsides and riparian areas only. (Schwegman 1973)

EcoCAT Survey

The web-based Illinois Department of Natural Resources EcoCAT assessment tool was also utilized to determine the occurrence of potential threatened or endangered species near the proposed permit area.

Vegetation Survey

Alliance conducted a field survey from September 19 through the 23, 2011 to identify general habitat types located within the project limits. General habitat types were described and mapped with approximate acreage determined through GIS analysis. Vegetation species observed within each habitat type were recorded and dominant species identified. Representative photographs were taken along with field notes describing the vegetation and habitat characteristics.

Sensitive Habitat Survey

Alliance conducted aerial and field surveys to determine if suitable or preferred habitat for listed threatened and endangered bird species occurred within the project limits. Additionally, an absence/presence survey was completed for those areas that potentially could contain listed threatened and endangered plants.

Migratory Bird Survey

A modified migratory bird survey was conducted on four consecutive days using a point-transect method. Six transects (A, B, C, D, E, F) were established throughout the site, with point intervals at approximately every 200 feet (Figures, Drawing No. B08-467-D1). The point intervals were ten minutes in duration and were conducted from 10:00 a.m. to 4:00 p.m. September 19 through the 22, 2011. All birds seen and heard during the 10-minute period were recorded as well as flight direction and time of observation. Species seen while walking transects were recorded as well. A Cannon EOS 60D camera was used to photograph bird species observed within the project limits. Guides used to aid in field identification and habitat preference for the bird surveys included: The Sibley Field Guide to Birds of Eastern North America, 2003; Birds of Illinois, 2004; and the Field Guide to the Birds of North America, 3rd edition, 1999.

Dawn & Dusk Bird Survey

Dawn and dusk point surveys were conducted on five consecutive days from September 19 through the 23, 2011. Three dawn (Monday, Wednesday, and Friday) and two dusk surveys (Tuesday and Thursday) were completed from daybreak (approximately 6:30 a.m.) to 10:00 a.m. and 6:00 p.m.to sunset (approximately 7:00 p.m.) respectively (Figures, Drawing No. B08-467-D1). All birds seen and heard during the point survey were recorded as well as flight direction, age, and time of observation. Point surveys were located at preferred habitat type for listed

threatened and endangered bird species. A Cannon EOS 60D camera was used to photograph bird species observed within the project limits.

"Adjacent Area" Defined

As defined in 62 Ill. Adm. Code Section 1701. Appendix A, "adjacent area means the area located outside of the permit area, or shadow area, where a resource or resources, determined according to the context in which adjacent area is used, are or reasonably could be expected to adversely impacted by proposed mining operations".

IMPACTS

Impacts of Mining Operations to Noise

Mining operations such as construction, and vehicular traffic, will increase the noise on the permit area and adjacent areas.

Impacts of Mining to Forested Habitat

Development of the proposed facilities will result in forest clearing. The project area and adjacent areas are already fragmented by agricultural habitat (row crops). The majority of the proposed forest to be cleared is isolated woodlots surrounded by old field habitat. Therefore, the proposed clearing will have a very minimal effect on habitat fragmentation and increased edge affect.

Impacts of Mining to Water Quality and Quantity

Coarse and fine coal refuse disposal is proposed by the permit application. Surface disturbance will include the coarse and fine coal refuse disposal area, sediment ditch & pond, and access road. Impacts to the water quality and quantity are expected to be increased due to runoff and erosion during the initial periods of construction because of decreased vegetative cover. However, the proposed sediment ditch & pond will be the first items to be installed. Upon completion of the sediment ditch & pond, the water quality and quantity should return to near-normal levels.

Runoff from all proposed surface facilities will pass through the sediment ditch and pond unless otherwise noted in the permit application. The sediment ditch & pond for the coarse and fine coal refuse disposal area has been sized to treat the projected sediment load from the site and, because the structure will be considered a permanent structure, it will have been sized to account for a 100 year/6 hour storm event. All discharges will be permitted by Illinois Environmental Protection – Mine Pollution Control Program and effluent limits will be set by this agency. Adhering to the requirements of the Illinois Department of Natural Resources; Office of Mines and Minerals and the Illinois Environmental Protection – Mine Pollution Control Program should limit the impacts to the water.

Ten (10) hours of the 10 year/24 hour storm event and 0.1 acre feet per acres is used in the sizing the dimensions of the sediment ditch & pond. Primarily, it is a retention factor for a storm surge. No other sediment structures are planned for the site. Drainage ditches and/or flumes are sized according to IDNR-OMM requirements, and work in conjunction with, but are not sediment structures.

Impacts at Adjacent Areas Defined for Different Groups of Species

The adjacent areas for different groups of species as analyzed in this document have been defined below.

Plants

Plants located immediately adjacent to the permit boundary line may be impacted by tree clearing or other disturbance associated with the project. The project may result in changing sun and/or wind exposure in adjacent areas. As a result, adjacent areas for plant species are defined as 1,000 feet from the permit area or area of disturbance.

Birds

Birds located adjacent to the permit area may be impacted by increased noise on the project area. Noise can distract and alarm foraging or nesting birds and cause birds to abandon their nests. Utilizing the national Bald Eagle Management Guidelines as an informal guidance the buffer distance suggested for blasting activities or other extremely loud noises is ½ mile. These guidelines were determined to be the best available information and appropriate for other nesting and/or foraging birds. The adjacent areas for birds are defined as ½ mile from the permit area line or area of disturbance.

Terrestrial Reptiles

Terrestrial reptiles located immediately adjacent to the permit boundary line may be impacted by tree clearing or other disturbance associated with the project. The project may result in changing sun and/or wind exposure in adjacent areas. As a result, adjacent areas for terrestrial reptiles are defined as 1,000 feet from the permit area or area of disturbance.

Aquatic Organisms

Given the applicant's sediment and erosion control plans and the compliance requirements that will be in place through the applicant's NPDES permits it is unlikely there will be any substantial water quality or quantity changes within aquatic resources outside of the permit area.

Mammals

Mammals living adjacent to the project area could be affected by noise and vegetation changes that will occur on the project. An adjacent area of ½ mile will be used for mammals.

RESULTS

EcoCAT Assessment

The Illinois Department of Natural Resources EcoCAT assessment tool was utilized for project planning purposes. The EcoCAT assessment listed one (1) species, the rice rat (*Oryzomys palustris*) that may be in the vicinity of the proposed project. The EcoCAT results are enclosed.

Site Specific Vegetation Survey

Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous

The majority of the project area exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Appendix B, Photograph 1) (Figures, Drawing No. B08-467-D4).

Upland Forest

The project area contained 45.2 acres of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management (Appendix B, Photograph 2). Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub

The project area contained 5.6 acres of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management (Appendix B, Photograph 3). Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub

The project area contained 43.6 acres of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Appendix B, Photograph 4) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous

The project area contained 3.2 acres of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Appendix B, Photograph 5) (Figures, Drawing No. B08-467-D4).

Palustrine Forest

The project area contained 20.0 acres of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Appendix B, Photograph 6) (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub

The project area contained 1.1 acres of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Appendix B, Photograph 7) (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub

The project area contained 9.3 acres of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Appendix B, Photograph 8) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent

The project area contained 2.0 acres of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Appendix B, Photograph 9) (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent

The project area contained 7.4 acres of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Appendix B, Photograph 10) (Figures, Drawing No. B08-467-D4).

Open Space Developed

The project area contained 14.4 acres of disturbed habitat which consists predominately of

disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Appendix B, Photograph 11) (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation

Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland and five (5) intermittent and ephemeral streams were delineated within the proposed Permit Area no. 417.

Bird Survey

Thirty-four (34) species of birds were identified as occurring within the project limits by sightings and calls (Table 4). All species observed were determined to be common and breeding season or year-round residents.

Table 4. Bird Species Observed within the Proposed East Coal Refuse Disposal Area No.3

Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Agelaius phoeniceus	red-winged blackbird	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PEM
Aix sponsa	wood duck	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PFO
Ardea alba	great egret	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	DS
Ardea herodias	great blue heron	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH
Anas platyrhynchos	mallard	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PEM
Atchilochus colubris	ruby throated hummingbird	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	GH, SS
Bombycilla cedrorum	cedar waxwing	9/20/2011	Year-Round Resident	Not Listed	Not Listed	PFO, FOR
Branta canadensis	Canada goose	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH
Buteo jamaicenis	red-tailed hawk	9/22/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Buteo lineatus	red-shouldered hawk	9/20/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR

Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Butoides virescens	green heron	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	PFO, PSS/PEM
Cardinalis cardinalis	northern cardinal	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Carduelis tristis	American goldfinch	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Carpodacus mexicanus	house finch	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Cathartes aura	turkey vulture	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, DS
Ceryle alcyon	belted kingfisher	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH
Charadrius vociferus	killdeer	9/19/2011	Year-Round Resident	Not Listed	Not Listed	DS, PEM
Colinus virginianus	northern bobwhite	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH
Contopus virens	eastern wood-pewee	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR
Corvus brachyrhynchos	American crow	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, DS
Cyanocitta cristat	blue jay	9/20/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Dumetella carolinensis	gray catbird	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR, SS
Melanerpes carolinus	red-bellied woodpecker	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO
Melanerpes erythrocephalus	red-headed woodpecker	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO
Mimis polyglottos	northern mockingbird	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Passerina cyanea	indigo bunting	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR, SS
Picoides pubescens	downy woodpecker	9/20/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO

Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Sialia sialis	eastern bluebird	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Strix varia	barred owl	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Sturnus vulgaris	European starling	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Tachycineta bicolor	tree swallow	9/20/2011	Breeding Season Resident	Not Listed	Not Listed	GH, FOR
Turdus migratorius	American robin	9/20/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR

State Listed Threatened and Endangered Species Surveys

Summer Survey for Indiana Bat and Northern Long-eared Bat

A summer survey for the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) was completed for the proposed East Coal Refuse Disposal Area No.3. Field surveys were conducted from August 4 through August 8, 2014. A total of eighteen (18) net nights were completed within the survey area. During the mist net survey a total of forty (40) bats representing two (2) species were captured and identified. The eastern red bat (*Lasiurus borealis*) was the species most commonly encountered, making up 95 percent of the total capture, while the tri-colored bat (*Pipistrellus subflavus*) made up the remaining 5 percent of total captures. No Indiana bats or northern long-eared bats were captured during the survey. Listed state threatened or endangered species for Williamson County and its adjacent counties include the Rafinesques's big-eared bat (*Corynorhinus rafinesquii),* southeastern myotis (*Myotis austroriparius*), grey bat (*Myotis grisescens*), and the Indiana bat (*Myotis sodalis*). None of the listed species were captured within the survey area and therefore in accordance with current U.S. Fish and Wildlife Service Protocol are not present within the project area. In accordance within the current Protection and Enhancement Plan guidelines for the Indiana bat, no protection and enhancement plan for the above species is required as per the following flow chart:

1) Is there suitable bat habitat? – Yes
2) Will the proposed mining activity impact this habitat? – Yes
3) Is it within known endangered bat habitat? – No
4) Can you justify no adverse effect/take? – No
5) Do you want to assume presence? - No
6) Action – Conduct summer survey – Completed summer 2013.
7) Were endangered bats determined to be present? – No
8) No additional summer habitat assessments/surveys are required.

As documented above, based upon the 2013 Protection and Enhancement Plan guidelines, no further work and/or a species specific protection and enhancement plan is required for any of the listed or proposed listed bat species.

Small Mammal Survey

A small mammal survey was completed for the proposed East Coal Refuse Disposal Area No.3. Field surveys were completed using general small-mammal trapping protocols modified by Alliance, the ILDNR and IEPA specifically to target the rice rat. Field surveys were conducted from February 24 through March 3, 2010. A total of 200 rodents of two (2) species were captured during the survey of the proposed project area. The white-footed mouse (*Peromyscus leucopus*) was the species most commonly encountered, making up 95 percent of the total capture. The other species captured was the marsh rice rat (*Oryzomys palustris*) making up five (5) percent of the total capture. A total of ten (10) marsh rice rats, and one (1) recapture were captured at the project area. It is important to note that the eastern wood rat (*Neotoma floridana*), and the golden mouse (*Ochrotomys nuttalli*) were not identified within the project area and therefore have been considered not to be present within the project area or adjacent area.

Fish Survey

Fish surveys were completed within and adjacent to the proposed East Coal Refuse Disposal Area No.3 at eleven (11) biological monitoring stations within Pond Creek and Middle Fork of the Saline River Watersheds. The fish survey was conducted from August 4 through August 7 and August 25 through September 2, 2009. Ten (10) sites, PC-MS, PC-T2-S1, PC-T2-S2, PC-T2-S3, PC-T4-S1, PC-T5-S1, PC-T6-S1, PC-T6-S2, PC-T6-S3, and PC-T7-S1, were monitored within Pond Creek and its tributaries. Sampling Location PC-MS had 552 total fish captured with 13 distinct species. Sampling Location PC-T2-S1 had 249 total fish captured with 10 distinct species. Sampling Location PC-T2-S2 had 382 total fish captured with 8 distinct species. Sampling Location PC-T2-S3 had 104 total fish captured with 5 distinct species. Sampling Location PC-T4-S1 had 154 total fish captured with 6 distinct species. Sampling Location PC-T5-S1 had 193 total fish captured with 6 distinct species. Sampling Location PC-T6-S1 had 1,029 total fish captured with 13 distinct species. Sampling Location PC-T6-S2 had 159 total fish captured with 4 distinct species. Sampling Location PC-T6-S3 had 62 total fish captured with 3 distinct species. Sampling Location PC-T7-S1 had 405 total fish captured with 8 distinct species. Sampling Location SAL-1 had 119 total fish captured with 9 distinct species. Total fish captured at all locations equaled 3,408. Based upon this survey the following state threatened or endangered listed species within Williamson and its adjacent counties were not identified and therefore are not likely to occur within the project area or adjacent areas: western sand darter (*Ammocrypta clarum*), starhead topminnow (*Fundulus dispa),* cypress minnow (*Hybognathus hayi*), least brook lamprey (*Lampetra aepyptera*), redspotted sunfish (*Lepomis miniatus*), Bantam sunfish (*Lopomis symmeticus*), sturgeon chub (*Macrhybopsis gelida*), river redhorse (*Moxostoma carinatum*), pugnose shiner (*Notropis anogenus*), bigeye shiner (*Notropis boops*), weed shiner (*Notropis texanus*) and the Pallid sturgeon (*Scaphirhynchus albus*). Therefore, no threatened or endangered fish species are likely to occur within the project area or

adjacent areas. Additionally, it is important to note that no perennial aquatic resources exist within the project area.

No other threatened or endangered species were observed within the proposed East Coal Refuse Disposal Area No.3 during Alliance's field surveys. Refer to Drawing No. B08-467-D5R1.

State Listed Threatened and Endangered Species Assessments

The following describes state listed threatened and endangered species that were identified as occurring within Williamson County and/or adjacent Counties.

PLANTS

Pale False Foxglove *(Agalinis skinneriana)*

Pale false foxglove is an annual dicot in the *Scrophulariaceae* family (USDA). It ranges in height from 10-65 cm, has a slender pale green stem with oppositely arranged leaves. The flowers are pale pink on a raceme with corollas 1.0-1.5 cm wide. Flowering generally occurs between August to September. It is hemiparasitic and generally occurs in small scattered populations throughout its range. Its preferred habitat includes sand to mesic prairie, open woods in shallow rocky soils, bluffs, barrens, pockets among dunes, sandy woods, and moist thickets. Pale False Foxglove was last observed in Union County 2005 and is state listed as threatened. Pale false foxglove has only one known occurrence in Union County that is 37.5 miles from the project area in the Berryville Shale Glade. Pale false foxglove is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat within the project limits

Smooth False Indigo *(Amorpha nitens)*

Smooth false indigo is a perennial shrub in the *Fabaceae* family (INHS). It ranges in height from 4-16 feet tall that branch occasionally. The lower stems are woody with smooth gray bark with scattered lenticels. The upper branches are dull light green and pubescent. The leaves are alternate, smooth, 1.2 cm-3.8 cm in length, odd-pinnate with 11-35 leaflets, glossy above, and short petioles. Each leaflet has pointed tip. Flowers are in racemes erect to ascending, 7.6-20.3 cm long and cylindrical in shape. Flower is 0.6 cm in length, tubular in shape from a single violet-purple petal (Wildflower). The flowers bloom from May to June. The preferred habitats include riverbanks, border of lakes, and forest thickets. Smooth false indigo was last observed in Pope County 2007 and is state listed as endangered. Smooth false indigo has two known occurrences in Pope County in the Shawnee National Forest 33.7 miles from the project area in the Big Grand Prairie Site and 37.1 miles from the project area. Smooth false indigo is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat within the project limits.

Mead's Milkweed (*Asclepias meadii*)

Mead's milkweed is a perennial dicot from the *Asclepiadaceae* family (USDA). It has an

unbranched stem that has an inflorescence that grows above the top set of leaves (CPC). Mead's Milkweed has 4-8 pairs of leaves that are bluish green and smooth with a herringbone leaf-vein pattern (CPC). The inflorescence has around 12 green-cream colored flowers (CPC). This species prefers tallgrass prairies and glade/barren habitat (CPC). It is considered endangered in Illinois (USDA). Mead's milkweed has two known occurrences in Saline County in the Shawnee National Forest 24.197 miles from the project area in Cave Hill Research Natural Area and 24.094 miles from the project area in the in Old Stone Face-Dennison Hollow State Natural Area. Mead's milkweed is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat within the project limits.

Bradley's Spleenwort (*Asplenium bradleyi*)

Bradley's spleenwort is a perennial fern from the *Asclepiadaceae* family (USDA). Roots of this plant grow slowly. Its stems are short and occasionally branched. Leaf blades have a reddish or purplish brown stalk 1-10 cm and are narrow, oblong shaped. Leaflets are broad and rounded with serrated margins and have tapered tips that occur in 5-15 pairs that are 6-40 x 3-10 mm. Veins on leaflets are scarcely to be seen. Three or more sori are found per leaflet. Bradley's Spleenwort is found on acidic rocks, typically on steep ledges (FNAA). It is considered endangered in Illinois (USDA) and its last listed occurrences were in: Jackson County 2011, Pope County 2011, Saline County 1997, Union County 2005, and Williamson County 1994. Bradley's spleenwort has one occurrence in Saline County 24.4 miles from the project area in the Shawnee National Forest in the Cave Hill Research Natural Area, one occurrence in Union County 39.721 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, one occurrence on the William/Union County border 22.3 miles from the project area in Shawnee National Forest and Crab Orchard National Wildlife Refuge, one occurrence in Pope County 25.1 miles from the project area in Sand Cave, and one occurrence in Jackson County 44.7 miles from the project area in the Piney Creek Ravine. Bradley's spleenwort is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat within the project area.

Black Spleenwort (*Asplenium resiliens*)

Black spleenwort is a perennial fern of the *Asclepiadaceae* family (INHS). The leaves are 5-30 cm long with black shiny short stalks, 1.5-5 cm. The leaf blades are narrowly-oblong or linear-lanceolate, dull to bluish green, 1.25 cm wide, one pinnate, taper at base and appe, with 20-30 pairs of opposite sessile pinnae that are oblong to lanceloate, about 3-5 times long as wide, 6-10 mm long and auriculate. The pinnae margins are slightly crenulate to nearly entire and the leaf veins are evident. Black spleenwort is normally found on moist shaded rock, particularly on limestone and dolomite or other basic rocks, on boulders, on cliff, and in sinkholes, often near streams or drainages where the air if still and humid. It is listed as state endangered and its last listed occurrence was in Union County, 2005. Black spleenwort has three known occurrences in Union County 38.6, 39.4, and 40 miles from the project area in the Shawnee National Forest in the LaRue-Pine Hills Research Natural Area. Black spleenwort is not likely to occur on the

permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat within the project area.

Screwstem *(Bartonia paniculata)*

Screwstem is an annual forb of the *Gentianaceae* family (INHS). It grows up to 40 cm tall often erect or sometimes scrambling or twining. The leaves are very small scale-leaves, mostly alternate (Mohlenbrock). The flowers are small, 2.5-4 mm, four equal white, yellow or pink petals on the tips of branched stalks. It flowers from August to September. Its preferred habitat is shaded sandstone cliffs and wetland seeps that are acidic gravel or sand seep (INHS). It is listed as state endangered and its listed occurrence was in Pope County, 2006. Screwstem has two occurrences in Pope County in the Shawnee National Forest 45.7 miles from the project area in Cretaceous Hills Nature Preserve and 48.9 miles from the project area in Kickasola Cemetery Barrens and Seeps, Snow Springs, and Poco Cemetery Barrens. Screwstem is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat within the project area.

Allegheny Barberry *(Berberis canadensis)*

Allegheny Barberry is a deciduous shrub of the *Berberidaceae* family (INHS). It can reach up to 6 feet in height. It has 3-pronged thorns and leaves that are toothed with a bristle, oval with a rounded tip and tapering base and ¾ - 3 inches in length. Flowers are drooping, yellow, with petals with notched tips. This species forms large colonies and grows best on well drained rocky slopes, although it can grow in many diverse open environments. Allegheny barberry has only one known occurrence in Jackson County 38.6 miles from the project area in the Shawnee National Forest in Fountain Bluff. Allegheny barberry is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat within the project area.

Supple-jack (*Berchenia scandens*)

Supple-jack is perennial woody vine of the *Rhamnaceae* family (INHS). It is a large twining, climbing vine, with a main stem that can be up to 1.3 to 18 dm across. The bark is smooth, grays and greens, that are often mottled. The leaves are alternate, simple, strongly pinnately veined, finely serrated or entire, elliptical, 5 to 10 cm long and dark green above (Virginia Tech). The flower is small has 5 petals and light green or white in color (INHS). It blooms in April to June. This species is found in upland mesic and floodplain forest. Supple-jack is listed as state threatened and its listed occurrence was in Pope County, 1987. Supple-jack has only one known occurrence in Pope County 30.4 miles from the project area in the Shawnee National Forest. Supple-jack is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Southern Grape Fern (*Botrychium biternatum*)

Southern grape fern is a perennial fern of the family *Ophioglossaceae* (USDA). This fern has a

stalk of 4-20 cm with 2-3 green pinnate blades that are 18x28 cm. Pinnae are in 7 horizontal pairs. Pinnules are elongated lanceolate with almost parallel fine-toothed margins and branching vein pattern. Leaves are green in winter and new leaves appear in spring-summer. Spores occur seasonally and there are 1-2 *sori* per pinnate. Leaves are green in winter and new leaves appear in spring-summer (FNAA). The southern grape fern grows in low woods and brushy fields and is considered threatened in the state of Illinois (FNAA; USDA) and is most commonly found in open oak-hickory woodlands. It is listed as state threatened and has listed occurrences in: Jackson County pre-1986, Pope County 1994, and Saline County 1997. Southern grape fern has three known occurrences in Pope County in the Shawnee National Forest 32.5 and 30.6 miles from the project area and 49.9 miles from the project area in Poco Cemetery Barrens. There are three known occurrences in Jackson County 25.4 miles from the project area, 34.0 and 31.0 miles from the project area in the Shawnee National Forest in Little Grand Canyon – Cedar Creek Natural Area. There is only one known occurrence in Saline County that is 14.9 miles from the project area. Southern grape fern was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Bluejoint Grass *(Calamagrostis insperata)*

Bluejoint grass is a perennial monocot of the *Poaceae* family. It is grass that grows up to 1 m with simple leaves, alternate, the leaf margin is entire, the leaf venation is parallel, a linear in shape (INHS). The blades are weakly scabrous and up to 12 mm wide, light green and glaucous on both sides (Gleason). The inforescence is a panicle, 1-2 dm wide. The flower is complete with 3 parts and blooms from June to July (INHS). The preferred habitat includes: mesic to wet prairie, sand prairie, dolomite prairie, and emergent wetland. Bluejoint grass is listed as state endangered and its listed occurrence was in Pope County, 2008. Bluejoint grass has three known occurrences in Pope County in the Shawnee National Forest 23.5 miles from the project area in Bell Smith Springs, 26.8 miles from the project area in Hayes Creek, and lastly 26.9 miles from the project area in Lusk Canyon. Bluejoint grass is not likely to occur on the permit area due to distance to known occurrence, as difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Winged Sedge *(Carex alata)*

Winged sedge is a perennial monocot of the *Cyperaceae* family. It is a sedge that grows up to10 dm. Main leaves are mostly 12-4 mm wide, shorter than the stems, sheaths are ventrally green-veined alost to summit with short hyaline area. Spikes are 4-8, gynaecandrous, silvery green or silvery brown, subglobose to ovide, 8-13 mm, sessile in an erect cluster 2-4 cm. Staminate flowers at the base of spike (Gleason). Achene strongly overlapping in head surround by a several nerved perigynium (INHS). Winged sedge flowers in late spring to mid summer. It is found in peaty shores, marshes, wet thickets, and woods (FNAA). It is listed as state endangered and its listed occurrence was in Pope County. Winged sedge has only one known occurrence in Pope County 52.0 miles from the project area in Round Pond. Winged sedge is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Arkansas Sedge (*Carex arkansana*)

Arkansas sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge doesn't have visible rhizomes. The stem is 15-16 cm tall and 1.4-2 mm wide at the base and 0.7-0.9 mm wide at the top. The leaves are translucent and grow 1.5mm tall and 1-2.5mm wide from green sheaths. Flowers have 3-6 spikes that are 1.5-4 cm x 7-12 mm and proximal bracts twice as long. The fruit appears in late spring. Arkansas sedge is found in moist prairies, forest openings, and roadside ditches (FNAA). It is considered endangered in the state of Illinois with a listed occurrence in Saline County 2012 (ILDNR). Arkansas sedge has three known occurrences in Saline County 17.1 miles from the project area in Krigia Flats, 19.8 miles from the project area, and 23.3 miles from the project area. Arkansas sedge is not likely to occur on the permit area due to distance to known occurrences, additionally this species has only been identified within the Ohio River drainage area in a separate physiographic region of the state.

Sedge (*Carex atlantica*)

Carex atlantica is a perennial monocot of the family *Cyperaceae* (INHS). It is a sedge that reaches about 11 dm. There are 3-5 leaves per culm; sheaths are tight with an inner band hyaline 3.5-24 cm, glaborous. The ligules are rounded to obtuse 0.5-3.7 mm. Blades are plicate 8-60 cm by 0.4-4 mm (FNAA). There are 2-8 spikes, terminal spikes always with pistils at tip. Pistillate scales are ovate with a narrow green center. They flower from May to August (INHS). Carex atlantica is found in moist prairies, forest openings, and roadside ditches (FNAA). It is considered threatened in the state of Illinois with a listed occurrence in Pope County 2009 (ILDNR). Carex atlantica has two known occurrences in Pope County in the Shawnee National Forest 45.5 miles from the project area in Cretaceous Hills Nature Preserve and 48.2 miles from the project area in Massac Tower Springs, Snow Springs, and Kickasola Cemetery Barrens and Sweeps. It is not likely to occur on the permit area due to distance to known occurrence. Additionally, this species has only been identified within the Ohio River drainage area in a separate physiographic region of the state.

Sedge *(Carex bromides)*

Carex bromides is a perennial monocot of the family *Cyperaceae* (INHS). It is a tussock forming sedge that reaches 8 dm, with main stem taller than leaves.. The leaves are very slender, erect or ascending, 1.3-3.1 mm wide. Top spike contain both staminante and carpellate flowers. The perigynium has no hairs, the beak is bidentate and is 3.3-6.7 mm long Go-Botany). They flower from May to July and are found in forests, river or stream floodplains, shores of rivers or lakes, and swamps (INHS). It is considered threatened in the state of Illinois with a listed occurrence in Pope County 2009 and Johnson County 1996 (ILDNR). Sedge (*Carex bromoides*) has two known occurrences in Pope County in the Shawnee National Forest 45.7 miles from the project area in Cretaceous Hills Nature Preserve and 48.8 miles from the project area in Snow Springs and Kickasola Cemetery Barrens and Sweeps. It has one known occurrence in Johnson County 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp. *Carex bromides* was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan

has been prepared.

Fibrous-rooted Sedge (*Carex communis*)

Fibrous-rooted sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge has a broad leaved base forms dense tussocks and grows 20-60 cm tall. Rhizomes are non-existent or very short. Leaf width is 2.6-5 mm and is smooth and hairless or rough. Leafs are produced from the plant base and is folded lengthwise. Leaf sheaths are red-purple and the lowest bract has a very short sheath, if any. Flowers occur in spikes that are 4-18 mm in length and 1-2.5 mm in width. 2-15 spikes can grow on one stem. It is found on cliffs, ledges, ridges, and forests (Go Botany). It is considered threatened in the state of Illinois (USDA). Fibrous-rooted sedge has one known occurrence in Saline County 28.1 miles in the Shawnee National Forest and one occurrence in Pope County also in the Shawnee National Forest 23.7 miles from the project area in the Bell Smith Springs. Fibrous-rooted sedge is not likely to occur on the permit area due to distance to known occurrences; also all documented occurrences of this plant have been identified within the Ohio River drainage area in a separate physiographic region of the state.

Cypress-knee Sedge (*Carex decomposita*)

Cypress-knee sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge is a robust, densely clumped glaborous sedge ranging in height 5-10 dm. The leaf sheths are dotted with purplish-red dots that can become dark with age. The leaf blades are v-shaped in cross sections when young; the upper leaves are sometime longer than the stems. The inflorescene is paniculate. The perigyna are dark and widest near the tip, two stigmas with a short bidentate beak. Its flowers in late April to late July. (INHS, 2006). Its preferred habitat includes sinkhole ponds, floodplain ponds, forested wetland and especially swamps dominated by bald cypress. It is typically found at the bases of both living and dead bald cypress tree trunks and knees and the waterline, similar bases of tupelo, the slightly submerged bases of living and dead wetland and shrubs, rotting floating or partly submerged logs in forested wetlands and on peaty mounds and tree hummocks (INHS, 2006). It is listed as state threatened and has listed occurrences in: Johnson County 2008, Pope County 2009, and Union County 2002. Cypress-knee sedge has one known occurrence in Union County 38.6 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, one occurrence in Pope County 51.9 miles from the project area in Round Pond, and two occurrences in Johnson County 28.9 miles from the project area in Deer Pond and 32.4 miles from the project area. Cypress-knee sedge is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Large Sedge (*Carex gigantea*)

Large sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge is a robust sedge ranging in height 4-12 dm with dark brown, well developed rhizomes. Leaf blades 20-60 cm long by 5-16 mm wide and V-shaped when young and smooth. The inflorescences are racemose 14-40 cm long. The perigyna are beaked with well-developed teeth and not winged, 10-20 mm long. Its preferred habitat in Illinois includes: floodplain forests, swamps, lake margins, and sinkholes, (INHS, 2006). It tends to grow in areas with very shallow water that

dries seasonally and appears to avoid dense shade preferring openings or margins of forested wetland. It is listed as state endangered and has listed occurrences in: Johnson County 1994, Pope County 2003, and Union County 2002. Large sedge has one known occurrence in Union County 40.0 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area and one occurrence in Johnson County 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp. Large sedge is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Swollen Sedge (*Carex intumescens*)

Swollen sedge is a perennial monocot of the family *Cyperaceae* (USDA). It grows up to 30 cm tall. Leaves are dark green, parallel veined and 10-25 cm in length (Kent). Sheaths at base are purple-red. Flowers are spikes that are 2-15 cm. Fruit is green and teardrop shaped occurring in spring (Kent). Swollen Sedge is found in dry-wet coniferous forests, mixed forests, deciduous forests, forest openings, thickets, wet meadows, and ditches (FNAA). It is considered threatened in the state of Illinois and has listed occurrences in Johnson County 2011, Pope County 2007, and Saline County 1992 (USDA). Swollen sedge has one known occurrence in Saline County 15.8 miles from project area, three occurrences in Pope County 33.8 miles from the project area in the Shawnee National Forest in Grand Prairie Site, 40.2 miles from the project area in the Shawnee National Forest, and 52.3 miles from the project area in Round Pond. It also has five known occurrences in Johnson County the closest being 29.0 miles from the project area. Swollen sedge is not likely to occur on the permit area due to distance to known occurrence, and the fact that this species has only been identified within the Ohio River drainage area within a separate physiographic region of the state.

Black-edged Sedge (*Carex nigromarginata*)

Black-edged sedge is a perennial monocot of the family *Cyperaceae* (USDA). It is a cespitose, mat-forming sedge and ranges in height from 8-38 cm. The leaf blade width is 1.9-4.5 mm wide, smooth and hairless, or rough and sandpapery and leaves are longer or equal in length to the main stem. The leaf sheath is tinted pink, red or purple, has hair and feels rough. The lowest spike has no peduncle. The uppermost spike contains only staminate flowers. The perigyna are green in color, hairy, length and width are 2.8-3.6 by 1.13 mm, with a bidentate beak. Black-edged sedge is found in dry to mesic woodlands with acidic soils. It is listed as state endangered and has a listed occurrence in Union County 2011, Black-edged sedge has only one known occurrence in Union County 46.1 miles from the project area in the Shawnee National Forest in Ozark Hill Prairies. Black-edged sedge is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Sharp-scaled Sedge (*Carex oxylepis*)

Sharp-scaled sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge grows in dense tufts of stems that are dark maroon near the base. Stems are 25-80 cm long and 1-2 cm wide and can be smooth or hairy. Leaves at base have maroon sheaths. The flat blades are 3-7

mm wide and are maroon to green on back and translucent light brown on front that are then streaked with dark red. Leaves and leaf margins are both hairy. Sharp-scaled sedge produces spike inflorescences and fruiting begins in late spring-early summer. It is found in floodplain forests, rich, moist, deciduous forest, near streams and swampy areas, upland forests on sandy soils, wooded bluffs, and is often associated with chalky soils containing lime and calcium carbonate (FNAA). It is considered threatened in the state of Illinois with listed occurrences in Johnson County 1994, Pope County 2010, Saline County 1997, and Union County 1986 (ILDNR). Sharp-scaled sedge has one occurrence in Saline County 24.2 miles from the project area in the Shawnee National Forest in Cave Hill Research Natural Area, five occurrences in Johnson County the closest being 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp, two occurrences in Union County 36.0 and 35.9 miles from the project area, and one occurrence in Pope County 25.8 miles from the project area in Shawnee National Forest. Sharp-scaled sedge is not likely to occur on the permit area due to distance to known occurrence, lack of preferred habitat, and different physiographic region of known occurrence.

Bellows Beak Sedge (*Carex physorhyncha*)

Bellows beak sedge is a perennial monocot of the family *Cyperaceae*. This sedge has tufts of leaves, terminal staminate spike, and an achene enclosed in a beaked perigynium. The achene is trigonous, 1.3-1.5 mm long and 1 mm wide, dark brown, apiculate; 3 stigmas, pale red-brown (Mohlenbrock). The spikes are slender and clustered towards the tips of the culm (INHS). The culms are up to 40 cm tall, slender, ascending, triangular, reddish near the base with old leaves persisting and about as long as the leaves. The leaves are 4-8 per culm, 1.5-3.0 mm wide, ascending, flat, pale green, scabrous along the margins. Bellows beak sedge flowers during late April and early May and is found in rocky forest, particularly in chert (Mohlenbrock). It is listed as endangered in the state of Illinois with listed occurrences in Jackson County 1968 and Union County 1973. It is listed as endangered in the state of Illinois (INHS). Bellow's beak sedge has one occurrence in Jackson County 33.8 miles from the project area in the Shawnee National Forest in Little Grand Canyon-Cedar Creek Natural Area and one occurrence in Union County 40.9 miles from the project area in the Shawnee National Forest in Atwood Ridge Research Natural Area. Bellows beak sedge is not likely to occur on the permit area due to distance to known occurrence and the lack of preferred habitat within the project area.

Plantain-leaved Sedge (*Carex plantaginea*)

The plantain-leaved sedge is a perennial monocot of the family Cyperaceae. It is tufted and about 3-6 dm. The fertile stems are triangular, roughened at the angles, and purple at the base. The basal sheaths are purple as well. Leaves of the sterile shoots elongate are 10-30 mm wide and often surpassing the fertile steam. Leaves of the fertile stem are reduces to bladeless or nearly bladeless purple sheaths. It has a terminal staminate spike which is 1-2 cm long, purplish, and long-peduncled. Pistillate spikes are 2-4, 1-3 cm long, and scattered. The perigyna area crowded and overlapping, 3.7-5 mm long, finely many-nerved and 2-ribbed, sharply trigonous and elliptic constricted into a short, oblique beak. It is found in rich moist woods where it blooms during mid-spring. Within these forests it may favor north-facing slopes, steep ravines, or other cool, protected microhabitat (MNDNR). It is listed as endangered in the state of Illinois

(INHS). *Carex plantaginea* has only one known occurrence in Jackson County 26.0 miles from the project area in the Shawnee National Forest in Fern Rocks. Plantain-leaved sedge is not likely to occur on the permit area due to distance to known occurrence, differences in physiographic regions of the state and only one known occurrence, which is in a natural protected area.

Drooping Sedge (*Carex prasina*)

Sharp-scaled sedge is a perennial monocot of the family *Cyperaceae (*WIDNR). This sedge is tufted and ranges in height from 3-8 dm. It is brown or greenish at base with main leaves 3-5 mm wide; sheaths are glabrous. Terminal spike is staminate. Pistillate spike 2-4 widely separated, cylindrical 2-5 cm by 5 mm, curved or nodding. Perygynia 2.9-4.2 mm, rhombic-ovoid, trigonous. Achene concavely trigonous. It is found in moist or wet woods (Gleason). It is considered threatened in the state of Illinois with listed occurrence in Pope County 1997, (ILDNR). Drooping sedge only has one known occurrence in Pope County 27.1 miles from the project area in Shawnee National Forest in Gyp Williams Hollow State Natural Area. Drooping sedge is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Willdenow's Sedge (*Carex willdenowii*)

Willdenow's sedge is a perennial monocot of the family *Cyperaceae* (USDA). This sedge grows 3.1-29.7 cm tall and grows in dense clusters. The stems have three raised edges and are the same size or shorter than the leaves. The leaves all grow from the base and are folded lengthwise (Go Botany). They are green with smooth margins or slightly hairy. It has horizontal spike inflorescences that are white usually with reddish brown color shade (FNAA). The fruits appear spring-summer and are 1.8-2.6 mm x 1.2-1.6 mm (Go Botany). Willdenow's sedge occurs in acidic, dry mesic, open, oak-dominated woodlands, usually on ridges and slopes (FNAA). It is considered threatened in the state of Illinois (USDA). Willdenow's sedge has six known occurrences in Pope County the closest being 23.5 miles from the project area in the Shawnee National Forest in Bell Smith Springs, four occurrences in Johnson County the closest being 19.2 miles from the project area in the Shawnee National Forest, one occurrence in Union County 34.7 miles from the project area in the Shawnee National Forest, and one occurrence in Saline County 24.5 miles from the project area, also in the Shawnee National Forest in Old Stone Face-Dennison Hollow Natural Area. Willdenow's sedge is not likely to occur on the permit area due to distance to known occurrence, as well as the lack of upland oak dominated ridges and slopes within the project area.

Water Hickory (*Carya aquatica*)

Water hickory is a perennial dicot of the family *Juglandaceae* (USDA). This tree grows over 100 feet and can reach several feet in diameter. It has shaggy, scaly light grey-brown bark. It has alternate; pinnately compound leafs that are 8-16 inches long. Each leaf consists of 7-15 leaflets. The leaflets are green on top with a lighter hairy bottom that are lanceolate with serrated margins (Virginia Tech). Flowers occur in spring and yellow to green; male flowers are long catkins

while female flowers are very small and angled (Virginia Tech). Its fruit is brown to black and oval shaped and flattened and is 1.5-3 x 1.5-2.5 cm in size. Its habitat includes bayous, river floodplains, bluffs, levees, and temporarily flooded bottomlands (FNAA). It is considered threatened in the state of Illinois (USDA). Water hickory has one known occurrence in Saline County 23.4 miles from the project area in the Ohio River drainage area, one occurrence in Union County 36.9 miles from the project area, three occurrences in Johnson County 31.820 miles from the project area in Little Black Slough-Heron Pond Area, 30.0 miles from the project area, and 37.0 miles from the project area in Lower Cache River Swamp. Water hickory is not likely to occur on the permit area due to distance to known occurrence, additionally this species has only been identified within the Ohio River drainage area within a different physiographic region of the state.

Pale Hickory (*Carya pallida*)

Pale hickory is deciduous tree of the family *Juglandaceae* (USDA). It forms a medium sized tree with a straight trunk, dense crown, and reaches up to 80 feet tall. Its leaves are alternate, pinnately compound, 5-9 serrated, ovate-lance shaped leaflets, mostly 7 and up to 14 inches long. The flower is monoecious, male flowers are yellow-green hanging catkins 2-4 inches long, females are short and cluster at the branch tip. The fruit is pear shaped to nearly round, ¾ to 1 ½ inch wide with thin husks split at the base, dark brown when mature, thin shelled, ridged and angled, sweet. The bark on a young tree is gray and smooth later becoming dark gray with ridges and furrow forming a rough diamond pattern. The leaf scar is three lobed on twigs (Virginia Tech). Its preferred habitat includes upland dry forest with sandy soils (INHS). It is listed as endangered in the state of Illinois (ILDNR). Pale Hickory has two known occurrences in Union County in the Shawnee National Forest 37.1 miles from the project area and 39.1 miles from the project area in LaRue-Pine Hills Research Natural Area. Pale hickory is not likely to occur on the permit area due to distance to known occurrence, differences in physiographic regions from known occurrence, and a lack of preferred habitat within the project area.

Fairy Wand (*Chamaelirium luteum*)

Fairy wand is a slow growing perennial herb of the family *Liliaceae* (USDA). The plants are unisexual with staminate plants having 5-20 leaves and are 3-7 dm tall while pistallate plants have 15-50 leaves and are 3-12 dm tall and up to 15 dm tall in fruit. The leaves are persistent, evergreen, crowded basal rosettes. The leaf blade is entire to minutely undulate margins, measure 5-20 long by 1.5-6 cm wide and spatulate to oblanceolate in shape, upper stem leaves are sessile oblanceolate to linear and 3-8 cm by 1-1.5 cm wide. The inflorescences are terminal, single, and bractless. In staminate plants they are conspicuous, racemose 7-12 cm long and 10-15 mm wide and have a nodding apex; in pistillate plants they are usually inconspicuous, racemose or spiciform, and very slender 35 cm by 4-10 mm wide. The flowers are white to green tepals which flower in late spring to early summer (INHS, 2006). Fairy wand grows mainly in moist woods (mesic upland forests) on well-drained slopes, though it can be found on more level sites as well, habitat includes upland dry forest (INHS). It is listed as endangered in the state of Illinois (ILDNR). Fairy wand has three known occurrences in Pope County all in the Shawnee National Forest 43.4 miles from the project area in Burke Branch Research Natural Area, 45.7 miles from the project area in Cretaceous Hills Nature Preserve and Klondike Spring,

and 48.6 miles from the project area in Snow Springs. Fairy wand is not likely to occur on the permit area due to distance to known occurrence, a difference in physiographic regions from known occurrence and a lack of preferred habitat.

Spotted Wintergreen (*Chimaphila maculata*)

Spotted wintergreen is a perennial evergreen half-shrub of the *Pyrolaceae* family (Gleason). Its flowering branches range from 1-2 dm tall. The leaves are opposite, 2-7 cm long, lanceolate, striped with white along the midvein and to lesser extent along the primary lateral veins, remotely and sharply toothed, acute to round at base, short petioled. There are 2-5 white to pink fragrant flowers and umbellate; 12-18 mm wide that bloom is late spring to early summer. It is dry woods with sandy soils (Gleason). It is listed as endangered in the state of Illinois (ILDNR). Spotted wintergreen has three known occurrences in Pope County all in the Shawnee National Forest 23.5 miles from the project area in Jackson Hollow, 27.5 miles from the project area in Eddysville East Botanical Area, and 30.7 miles from the project area. Spotted wintergreen is not likely to occur on the permit area due to distance to known occurrence, a difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Black Bugbane (*Cimicifuga racemosa*) sny. (*Actaea racemosa* L. var. *racemosa*)

Black bugbane, also known as black cohosh is a perennial herb of the *Ranunculaceae* family (USDA). It is a tall plant at 3-8 feet in height; the stem is glabrous and usually not grooved. It has alternate compound leaves with a serrate margin and oblong to ovate in shape. The flower is one to several racemes 6 inches or more long. The flower is white and appears to be all stamens since the petals are small. It blooms from June to July. The species prefers mesic deciduous woodlands (often where Sugar Maple is dominant) and the bases of bluffs along rivers (HDR). *Cimicifuga racemosa* is listed as state endangered (USDA). Cimicifuga racemosa has only one occurrence in Franklin County 7.7 miles from the project area in the Franklin County Country Club. Black bugbane was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Appalachian Bugbane (*Cimicifuga rubifolia*) sny. (*Actaea rubifolia*)

Black Cohosh is a perennial dicot in the *Ranunculaceae* family (USDA). This plant has a deeply grooved axis, which are pubescent. It has broad leaflets that are oval in shape, deeply lobed, have 5-9 prominent veins and are 9-30 x 9-25 cm. The inflorescences occur in summer-fall and grow on erect panicles on 2-6 raceme-like branches. They have five white sepals and no petals. Seeds are red-brown, 3mm long, covered in scales, and have a cylinder shape. This plant is found on north-facing limestone talus slopes and river bluffs, ravines, coves, and along rivers and creeks (FNAA). Appalachian bugbane is listed as threatened in the state of Illinois (USDA). *Cimicifuga rubifolia* has seven known occurrences in Pope County the closest being 19.5 miles from the project area one occurrence on the Saline/Pope County border 19.3 miles from the project area both in Shawnee National Forest, one occurrence in Johnson County 23.6 miles from the project area in Ferne Clyffe State Park, and one occurrence in Jackson County 29.6 miles from the project area in the Shawnee National Forest. Appalachian bugbane is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions

from known occurrence, and lack of preferred habitat.

Blue Jasmine *(Clematis crispa)*

Blue jasmine is perennial climbing herbaceous vine of the *Ranunculaceae* family (INHS). It can reach up to 3 m with support. It has opposite pinnately compound leaves that are lanceolate to ovate, acuminate, entire or rarely 2-3 lobed, glabrous, the lower leaflets on each leaf are much larger (Gleason). It has solitary or few violet flowers that are bell-shaped with curly edges that hang upside down, 2.5-5 cm. It flowers from April to July. It is found in wet woods and swamps. Blue jasmine is listed as endangered in the state of Illinois (ILDNR). Blue jasmine has only one known occurrence in Johnson County 31.7 miles from the project area. Blue jasmine is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Leatherflower *(Clematis viorna)*

The leatherleaf is a perennial, climbing, or sprawling herb with slightly woody, shallowly grooves, 6-angled and slightly downy too glabrous stems that grow up to 2.4-3.6 m. Leaves are compound with 2-4 pairs of thin leaflets, ovate to lanceolate to broadly elliptic, acute to acuminate, cuneate to rounded at the base, entire, glabrous above, puberlent beneath. The flowers are solitary, nodding on a long peduncle with blue to purple sepals. It flowers from May to August. Leatherleaf is found in floodplain forests and wet mesic forests. Leatherleaf is listed as endangered in the state of Illinois (ILDNR). Leather flower has only one known occurrence in Johnson County 33.6 miles from the project area in the Little Black Slough-Heron Pond Area. Leather flower is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Hale's Corydalis (*Corydalis halei*) syn. (*Corydalis micrantha ssp. australis*)

Hales corydalis is an erect or ascending annual herb of the *Fumariaceae* family (Gleason). It has a height of 1-3 dm, is glaucaus or nearly green; racemes usually well surpassing the leaves. The leaves are alternate, bipinnately dissected with short, bracteates racemes of short-pediceled flowers. The flowers are asymmetrical, pale yellow, 11-15 mm, including the 4-6 mm spur and flowers very early-late spring (Gleason). Hale's corydalis is found in abandoned fields and waste areas, roadsides and open woods in disturbed, often sandy soil (FNAA). It is listed as endangered in the state of Illinois (ILDNR). Hale's corydalis has only one known occurrence in Pope County 26.4 miles from the project area in the Shawnee National Forest in Gibbons Creek Barrens. Hale's corydalis is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of sandy soils within the project and adjacent area.

Cynosciadium (*Cynosciadium digitatum*)

Cynosciadium is an annual dicot of the family *Apiaceae.* It is erect and 3-12 dm tall with

relatively few-branches; in the upper half more or less dichotomously branched. Basal leaf blades are slender, petiolate, entire, and cross-septate. Stem leaves are petiolate with 3-5 narrow, entire, flat but cross-septate leaflets. The inflorescence of once-compound axillary and terminal umbels with unequal stalks 2-8 cm long. The involucel is usually of 2 very unequal bractlets. Umbels 2-10 per inflorescences, sometimes with 1 to few flowers as a primary umbel below; secondary umbels with 2 to several flowers. Flowers 2.5-3 mm across. Petals are white, obvate, spreading. It is found in lowland woods, coastal and blackland prairies, ditches and borrow pits. It is listed as endangered in the state of Illinois (INHS). Cynosciadium has three known occurrences in Jackson County in the Shawnee National Forest 36.5, 37.6, and 38.1 miles from the project area. Cynosciadium is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Galingale *(Cyperus lancastriensis)*

Galingale is a perennial monocot of the *Cyperaceae* family (INHS). It is cespitose with inconspicuous, short rhizomes. Culms are basally rigonous 2-8 dm by 1-3 mm, glabrous. The leaves are inversely W-shaped, 20-70 cm by 5-11 mm, adaxial surface, margins minutely scabrous. The inflorescences are spikes densely ellipsoid to obvoid, 2.5-4.3 by 1.5-3 cm; rays 5-10 by 4-20 cm, glabrous; rachis 7-14 mm; bracts 3-8, horizontal to ascending at 45 degrees, flat 5-35cm by 2.5-6 mm. Spikelets 50-90, linear-lanceoloid to linear-subulate, whitish green or often yellow-tinted, sometime reddish striate. The Galingale fruits in summer, July to August. It is found in disturbed, sunny or partly shaded places in mesic or dry-mesic soils, often on riverbanks and floodplains (FNAA). It is listed as state threatened (ILDNR). Galingale has only one occurrence in Pope County 35.3 miles from the project area in the Shawnee National Forest at the Herman Hill site. Galingale is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Hay-scented Fern (*Dennstaedtia punctilobula*)

Hay-scented fern is a perennial fern of the Dennstaedtiaceae family (INHS, 2003). It is robust with long-creeping straight rhizomes. Its leaves (fronds) are clustered or more commonly scattered along the rhizome, erect, covered throughout with short soft sometimes gland-tipped hairs, 30-80 by 9-22 cm wide, with dull straw-colored to brown stalks about half the length of the blade. The leaves and their stalks are brittle and easily broken. The leaf blade are lanceolate, widest near the bottom, about three times longer than wide, yellow-green or pale green when fresh, finely divided and twice-pinnate-pinnatifed, slightly narrowed but truncate at the base, with an acuminate apex, with soft hairs on both surfaces. It smells of fresh-cut hay. It is found on rocky slopes, meadows, woods, stream banks, and roadsides with acidic soils. It is listed as state endangered (ILDNR). Hay-scented fern has seven known occurrences in Pope County the closest is 23.7 miles from the project area in the Shawnee National Forest in Bell Smith Springs. It also has one occurrence in Johnson County 23.1 miles from the project area in Ferne Clyffe State Park in Round Bluff. Hay-scented fern is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Joor's Panicgrass (*Dichanthelium joorii*) syn. (*Dichanthelium commutatum subsp. Joorii*)

Joor's panicgrass is a native perennial grass in the *Poaceae* family (INHS). It is a rhizomatous grass with stems usually 20-55 cm tall. The stems are usually unbranched in the spring and in the autumnal phase there are more or less divaricate branches from all nodes (unreported phase in Illinois). The basal leaf blades are large, cordate, basally ciliate, usually 8-14 cm long by 7-18 mm wide, and glabrous. The stem leaf blades ae thin 8-25 mm wide and 4-8 times longer than wide, ovate-lanceolate, scarcely cordate, often glaucous, glabrous and strongly asymmetric-falcate. The inflorescence panicles are loosely flowered and 5-9 cm long. The spikelets are pubescent, 2.9-3.2 mm long and obovate to elliptic, abruptly short-pointed (INHS, 2007). It grows mainly in low swampy woods and floodplain forests. It is listed as state endangered (ILDNR). Joor's panicgrass (*Dichanthelium joorii*) has one known occurrence in Union County the closest 39.9 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area and two occurrences in Johnson County 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp and 33.6 miles from the project area in the Little Black Slough-Heron Pond Area. Panic grass is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Yadkin Panicgrass (*Dichanthelium yadkinense) syn. (Dichanthelium dichotomum subsp. Yadkinense)*

Yadkin panicgrass is a native perennial grass in the *Poaceae* family (INHS). It is non-rhizomatous cespitose grass with several erect or sub-erect stems usually 50-100 cm tall. The main stem is glabrous inconspicuously hairy nodes; the inner nodes are often yellow-green. The leaf sheaths of the stem leaves are glabrous (to sparsely hairy along the leaf margin) with pale glandular spots. The ligules are 0.2-0.8 mm long and are composed of small white hairs. The leaf blades are broad but thin; leaves at the middle of the stem are 10-12 mm wide and 9-14 cm long; they are broadest at the middle and taper at the ends. The panicles protrude and are 10-12 cm long. The spikelets are 2.2-2.5 mm long and up to 1.0 mm wide, elliptic to subfusiform, glabrous, and pointed (INHS, 2007). Yadkin panicgrass grows mainly in wet sandy soils in mesic forests and along gravelly stream banks or seep springs. Yadkin panicgrass has seven known occurrences in Pope County the closest being 23.4 miles from the project area in the Shawnee National Forest in Bell Smith Springs. Panic grass is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

French's Shootingstar (*Dodecatheon frenchii*)

French's shootingstar is a hairless perennial herb of the *Primulaceae* family. It lacks a leafy stem but had 4-10 basal, simple, entire, broadly ovate, soft-fleshy, and abruptly contracted to a narrow petiole-like base. The inflorescence is a bracteates umbel at the top of smooth, unbranched hollow stalk that ranges from 20-60 cm long. The flowers are individually stalked, pendulous, the petals are white or less often tinted pale rose to lilac, 2.0-2.5 cm long and strongly bent backwards. The petals are fused at the bases and are marked with a dark purple ring at the

base. The plants grow in linear colonies in thin sandy soil in shade directly below the outer edges of prominently extending and overhanging sandstone (large or small) ledges that are exposed along or near streams (Hill). French's shootingstar is listed as state threatened. French's shootingstar has seven known occurrences in Johnson County the closest being 21.7 miles from the project area, six known occurrences in Jackson County the closest being 23.4 miles from the project area in the Shawnee National Forest, one occurrence in Union County 28.0 miles from the project area in the Shawnee National Forest, one occurrence on the Williamson/Union County border 17.7 miles from the project area in the Shawnee National Forest, and four occurrences in Pope County the closest being 22.8 miles from the project area in the Shawnee National Forest in Bell Smith Springs. French's shooting star is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Log Fern (*Dryopteris celsa*)

The log fern is a woodland perennial fern of the *Aspleniacese* family (INHS). Leaves are 65-120 by 15-30 cm and die back in winter. The petiole is 1/3 length of the leaf, scaly at the base; scales scattered, dark brown or tan with dark central stripe. The blade is green, ovate-lanceolate, gradually tapering to tip, not glandular. The pinnae are in plane of blade, lanceolate-ovate; basal pinnae are linear-oblong and much reduced. Pinnule margins are crenately toothed. The log fern is found on shaded seepage slopes, hammock and logs in swamps (FNAA). It is listed as state endangered. Log fern has only one known occurrence in Johnson County 33.4 miles from the project area in the Little Black Slough-Heron Pond Area. Log fern is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Eryngo (*Eryngium prostratum*)

Eryngo is a perennial dicot of the family *Apiaceae* (USDA). The stems can grow 40 cm long or longer and creep along the ground. The stems are hairless and ribbed. Leaves vary in shape in size, but are around 2 cm long and are oval and elliptic shaped. Some leaves are 3-lobed and all are hairless and have serrated margins. The inflorescence is 7-8 mm x 4mm and contains abundant clusters flowers that occur spring-fall. The flowers each measure .8-1 mm x .3 mm and have five hairless purple to blue petals. The habitat of eryngo consists of low wet woods, borders of swamps and ponds, and moist prairies (Tenaglia). It is listed as state endangered (USDA). Eryngo has one occurrence in Saline County 9.6 miles from the project area, one occurrence in Williamson County 17.7 miles from the project area in the Crab Orchard National Wildlife Refuge in Cambira Neck, and one occurrence in Pope County 22.6 miles from the project area in the Shawnee National Forest in Teal Pond. Eryngo was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

American Strawberry Bush (*Euonymus americanus)*

American strawberry bush is a perennial shrub of the *Celastraceae* family. It is a loose, suckering, sprawling shrub usually between 2 and 10 feet tall. It has opposite, simple, ovate to

elliptical, 2-4 inches, finely toothed, bright green from above leaves. The flowers are perfect, small at 1/3 inch across, with five greenish-purple petals on clusters, appearing in late spring. The fruit is 4-lobed, pink to purple and open to reveal orange seeds. The bark is green but splits and becomes darker. The twigs are slender, square and green with a terminal reddish orange bud (Virginia Tech). It is found in deciduous woods, low sandy thickets, and swamps and prefers light shade. It is listed as state endangered (USDA). American strawberry bush has one occurrence in Pope County 49.1 miles from the project area in the Shawnee National Forest in the Poco Cemetery Barrens and three occurrences in Johnson County 31.9 miles from the project area, 34.3 miles from the project area in the Little Black Slough-Heron Pond Area, and 37.3 miles from the project area in Lower Cache River Swamp. American strawberry bush is not likely to occur in the project area due to distance to known occurrences as well as difference in physiographic regions from known occurrence; however, habitat exists within the permit area that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Manna Grass (*Glyceria arkansana*)

Manna grass is a perennial monocot of the *Poaceae* family. It has culms 10-15 dm, rather soft often decumbent and rooting from the lower nodes. The leaves are 6-10 mm wide with a prominent ligule. The inflorescence is narrow at 2-4 dm. The spikelets are subsessile or short pedicelled, 1-2 cm, 8-16 flowered. The sheaths are closed and the lemmas are elliptic, 3.7-5.3 mm, blunt or rounded and are minutely short-hairy and nerved (Gleason). Manna grass flowers in May to June and forms a perfect flower (INHS). It is found in shallow water or very wet soil, along roadside ditches (Gleason). Manna grass is listed as state endangered. Manna grass has two know occurrences in Jackson County in the Shawnee National Forest, 31.0 miles from the project area in the Little Grand Canyon-Cedar Creek Natural Area and 38.4 miles from the project area, and two occurrences in Union County 38.8 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area and 51.8 miles from the project area. Manna grass is not likely to occur in the project area due to distance to known occurrences as well as difference in physiographic regions from known occurrence; however, habitat exists within the permit area that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Narrow-leaved Sunflower (*Helianthus angustifolius*)

Narrow-leaved sunflower is a perennial herb of the *Asteraceae* family. It is rhizomonous and is 50-150 cm in height. Stems are erect, usually hairy. Leaves are narrow, stiff, opposite or alternate, seesile or subsessile; blades (3-nerved at base) narrowly lanceolate to linear, 8-15 by 015-0.5 cm, bases are cuneate. The leaf margin is entire, lower surface is hairy. It has yellow flowers with purplish-black disk; heads 5-7.5 cm wide (FNAA). It flowers from August to October (INHS). It is found in open to shaded floodplains and bottomlands. It is listed as state threatened. Narrow-leaved sunflower has two known occurrences in Pope County 45.3 miles from the project area in Shawnee National Forest in Cretaceous Hills Nature Preserve, Klondike Springs, and Dean Cemetery Barrens and 51.8 miles from the project area in Round Pond. Narrow-leaved sunflower is not likely to occur on the permit area due to distance to known

occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Mud Plantain *(Heteranthera reniformis)*

The mud plantain is a perennial herb of periodically flooded wetlands of the *Ponteriaceae* family. This plant is found often in naturally or artificially disturbed wetland sites. This species ranges extends from Connecticut to Missouri south to Texas and the Florida panhandle. Southern Illinois represents the northern limit range for this species; however it has been identified within Pope County in 1990. Mud plantain has one known occurrence in Pope County 38.2 miles from the project area in the Shawnee National Forest in Homberg Spring and two occurrences in Union County 40.0 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area and 43.1 miles from the project area. Mud plantain is not likely to occur on the permit area due to distance to known occurrence as well as difference in physiographic regions from known occurrence. Furthermore, given this species preference for stable water levels and required strong sunlight it is not likely that this species occurs within or adjacent to the project area.

Crested Coralroot Orchid (*Hexalectris spicata*)

The crested coralroot orchid is a perennial forb within the *Orchidaceae* family. The crested coralroot orchid is glabrous, leafless, rootless, mycotrophic and it lacks chlorophyll. The stems are yellow-brown, pink-brown, or purple in color, and grow 25-80 cm tall. It is rhizomatous. The inflorescences are racemes with 8-25 flowers towards the tip. The flowers are complete, irregular, ascending at first the more nodding with age, on pedicels 8-20 mm long. The sepals and petals are often apically recurved, yellow-tan to purple-brown with prominent purple or brown veins (INHS). It flowers in the summer from June to August and is found in calcareous open woods and prairie openings; dry, usually rocky woods of limestone strata; at or along bluff bases; sometimes bordering glades near red cedar trees; in light to moderate shade (INHS). The crested coralroot orchid is listed as state endangered for Illinois. Crested coralroot orchid has only one known occurrence in Jackson County 38.5 miles from the project area in the Shawnee National Forest in Fountain Bluff. Crested coralroot orchid is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Cliff Clubmoss (*Huperzia porophila*)

Cliff clubmoss is a leafy-stemmed perennial herb within the *Lycopodiaceae* family. It is often evergreen with sporophylls on the stem in zones alternating with zones of sterile leaves, or all the leaves becoming fertile. There are no terminal cones. The leaves have stomates on the upper and lower surface; they are spreading, slightly unequal and mostly 5-8 by 0.8-1.2 mm, broadest near the middle and obscurely toothed. It has a short, slender rooting base. Spores are produced in mid to late summer (Gleason). It grows on or over rock and requires cool, moist, shaded, acid areas. The cliff clubmoss is listed as state threatened for Illinois Cliff clubmoss has five known occurrences in Pope County, the closest being 23.0 miles from the project area in the Shawnee National Forest in Jackson Hollow, one occurrence in Johnson County 22.8 miles from the project area on the border of the Shawnee National Forest, and one occurrence in Jackson

County 29.7 miles from the project area in the Shawnee National Forest on Route 127. Cliff clubmoss is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

One-flowered Hydrolea (*Hydrolea uniflora*)

The one-flowered hydrolea is a perennial herb within the *Hydrophyllaceae* family. It has small blue, bell-shaped flowers that grow along the sides of the stems. The flower is complete regular and blooms from June to September (INHS). The stems are decumbent or creeping at the base, 3-8 dm. The leaves are lanceolate, 4-10 cm, simple, glabrous to minutely hairy, alternate (Gleason). The plants are not hairy but are armed with spines at the base of the petioles. It grows along wet shores, sloughs and ditches. The one-flowered hydrolea is listed as state endangered. One-flowered hydrolea has one occurrence in Union County 38.6 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, one occurrence in Jackson County 36.4 miles from the project area in the Shawnee National Forest, and two occurrences in Johnson County, 31.1 miles from the project area in the Shawnee National Forest in Grantsburg Swamp and 33.1 miles from the project area in the Little Black Slough-Heron Pond Area. One-flowered hydrolea is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Whorled Pogonia (*Isotria verticillata)*
The whorled pogonia is a soft-fleshy perennial terrestrial herb of the family *Orchidaceae* . This species generally prefers mesic forest communities in shade with acidic soils. In Illinois the Whorled Pogonia grows in "lowland woods" only (Mohlenbrock, 2002). Whorled pogonia has only one known occurrence in Pope County 45.8 miles from the project area in the Shawnee National Forest in Cretaceous Hills Nature Preserve. This species current distribution, as far as is known, includes only two colonies within the Shawnee National Forest, both within the protected Cretaceous Hills Ecological Area within the Coastal Plains Natural Division of Illinois. Whorled pogonia is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrences as well as the species requirements for acidic soils.

Red Honeysuckle *(Lonicera dioica var. glaucescens)*

Red honeysuckle is a perennial dicot of the family *Caprifoliaceae* (USDA). This plant is a woody plant with a vine like growth form with simple leaf blades. This plant possesses clusters of tubular, red flowers at the end of the branches with a fused pair of rounded leaves. Blooming typically occurs from April-June (Go Botany). The wetland indicator status for this plant is Facultative Upland (FACU), which indicated that red honeysuckle primarily grows within dry to wet, open woods, woodland edges & thickets, but can occasionally grow within a wetland as well (NPIN). This species is considered endangered within the state of Illinois (USDA). Red honeysuckle has only one known occurrence in Jackson County 33.7 miles from the project area in the Shawnee National Forest in Little Grand Canyon- Cedar Creek Natural Area. Red honeysuckle is not likely to occur on the permit area due to distance to known occurrence,

difference in physiographic regions from known occurrence, and all known occurrences are in natural protected areas.

Yellow Honeysuckle *(Lonicera flava)*

The yellow honeysuckle is a perennial dicot of the family *Caprifoliaceae* (USDA). This plant is a woody vine that can grow 10-15 foot in height. It produces bright orange fragrant flowers with red fruits that bloom between April-June and attracts bees, hummingbirds, and other insects (Go Botany). Preferred habitat for this species is open woods, banks, river bluffs; usually in calcareous substrates (ODNR). This species is considered endangered within the state of Illinois (USDA). Yellow honeysuckle has two known occurrences in Pope County in the Shawnee National Forest, 23.4 miles from the project area in Bell Smith Springs and 26.9 miles from the project area in Lusk Creek Canyon. It also has two known occurrences in Jackson County in the Shawnee National Forest, 33.6 miles from the project area in the Little Grand Canyon-Cedar Creek Natural Area and 38.6 miles from the project area in the Fountain Bluff. Yellow honeysuckle is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Creeping Loosestrife (*Lysimachia radicans*)

Creeping loosestrife is a perennial in the *Primulaceae* family (USDA). This plant has trailing stems that sometimes root at nodes and has rhizomes but no bulblets. The lanceolate leaves are oppositely arranged that have ciliolate margins. The inflorescences occur on the axil with only one flower. The flowers have five petals and five sepals they are yellow with a reddish center or base and occur in the summer and the capsules are 2.5-5 mm. This plants habitat consists of cypress and tupelo swamps, flood plains, stream banks, and marshes (FNAA). Creeping loosestrife is listed as endangered in the state of Illinois (ILDNR). It has four known occurrences in Johnson County the closest being 31.7 miles from the project area. Creeping loosestrife is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and a habitat preference of cypress-tupelo swamp areas, which is not present within the project area.

Narrow-leaved Crabapple (*Malus angustifolia*)

Narrow-leaved crabapple is a perennial tree in the *Rosaceae* family (USDA). This tree can grow up to 7 m tall and has pink or white flowers in early spring. IT produces an edible fruit that has a fragrant smell that is about 25mm around and slightly pear-shaped. It prefers well-drained moist soils and can grow in heavy clay soils. It is found in a light woodland or sunny edge of woodland (PFAF). Narrow-leaved crabapple is listed as endangered in the state of Illinois (ILDNR). This species is considered endangered within the state of Illinois (USDA). Narrow-leaved crabapple has two known occurrences in Pope County, 44.3 and 51.2 miles from the project area in the Shawnee National Forest. Narrow-leaved crabapple is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Climbing Milkweed (*Matelea decipiens)*

Climbing milkweed is of the *Aslepiadaceae* family. Climbing milkweed is a perennial vine with a complete regular flower that is violet with a brownish-purple corolla. Leaves are opposite, simple, entire and ovate to cordate in shape. Climbing milkweed typically grows in valleys and thickets along streams, open woods, and upland thickets. It is listed as state threatened for Illinois. Climbing milkweed (*Matelea decipiens*) has one occurrence in Johnson County 25.0 miles from the project area at Cedar Bluff in Ferne Clyffe State Park, one occurrence in Jackson County 30.2 miles from the project area, one occurrence in Williamson County 14.5 miles from the project area in Colp bottoms, and one occurrence on the Williamson/Union County border 22.4 miles from the project area in the Crab Orchard National Wildlife Refuge. Climbing milkweed was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Climbing Milkweed (*Matelea obliqua*)

Climbing milkweed is a perennial dicot of the family *Asclepiadaceae* (USDA). Stems are hairy and when broken yield a milky sap. The leave grow along the stem in opposite pairs and are oval with heart shape bases. The flowers occur from spring to fall and are in small clusters at the top of stalks. They are purple-brown with five narrow twisted petals. This plant produces large prickly seedpods after it has flowered. The plant is found in limestone glades, open woodlands, and thickets (PNHP). It is considered threatened in the state of Illinois (USDA). Climbing milkweed (*Matelea obliqua*) has three known occurrences in Johnson County the closest being 23.8 miles from the project area in the Shawnee National Forest in Todd Fink Natural Area, thirteen occurrences in Pope County the closest being 22.4 miles from the project area in the Shawnee National Forest, and four occurrences in Saline County the closest being 22.7 miles from the project area in the Shawnee National Forest. *Matela obliqua* is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Bunchflower *(Melanthium virginicum)*

Bunchflower is a perennial monocot of the family *Liliaceae* (USDA). When at maturity, this plant can stand 5 foot tall via its thick green stems. The flower of this plant blooms primarily from June-July and can be seen as large white clusters. As the blooming season continues the white color will turn to green, purple, or blackish (Mohlenbrock). Bunchflower's interpreting wetland status within the Midwest is Facultative Wet (FACW), meaning that it grows within both wetland and non-wetland habitat (USDA). Preferred habitat is that of wet prairies where plenty of sunlight and moist soils occur (Mohlenbrock). This species is considered threatened within the state of Illinois (USDA). Bunchflower has only one known occurrence in Jackson County 22.7 miles from the project area. The Bunchflower is not likely to occur in the project area due to distance to known occurrences. The area within the project area is primarily revegetated cropland with blocks of dense, thick canopied forest allowing minimal sunlight and moisture to the base flora; thus this area is likely not suitable habitat for this species.

Squirting Cucumber (*Melothria pendula)*

The squirting cucumber is a perennial dicot of the family *Cucurbitaceae.* This is a slender climbing vine with tendrils beside the leaves. The leaves of the vine are alternate and occur in 3-5 lobed bunches. The flower is 5 parted, and the fruit appears as a green or black berry with white seeds. The preferred habitat of this species is forest or natural areas, in low woods, fields, thickets, marshes; weedy in disturbed areas such as roadsides and fields (NCSU). This species is considered threatened within the state of Illinois (USDA). Squirting cucumber has two known occurrences in Jackson County in Shawnee National Forest 31.0 miles from the project area in Little Grand Canyon-Cedar Creek Natural Area and 38.3 miles from the project area, four occurrences in Pope County the closest is 23.3 miles from the project area in the Shawnee National Forest in Bell Smith Springs, three occurrences in Union County 40.7 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, 43.0 and 44.0 miles from the project area. Squirting cucumber is not likely to occur in the project area due to distance to known occurrences as well as difference in physiographic regions from known occurrence; however, habitat exists within the permit area that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Illinois Wood Sorrel *(Oxalis illinoesis)*

The Illinois wood sorrel is a perennial dicot of the family *Oxalidaceae* (USDA). The leaves from this plant all occur at the base. The leaves are cauline; yellow flowers. The plants are erect/ascending and do not root at the nodes. Flowers are 12-18 mm long with seeds ranging 1.8-2.2 mm long. Flowering is best observed between June-September, and habitat is primarily rich woods (Mohlenbrock). This species is considered endangered within the state of Illinois (USDA). Illinois wood sorrel one known occurrence in Jackson County 26.3 miles from the project area in the Shawnee National Forest and three occurrences in Pope County in the Shawnee National Forest, 27.8 miles from the project area in the East Fork Botanical Area and Martha Wood's site, 29.7 miles from the project area in Mason Ford, and 32.8 miles from the project area in Reddick Hollow. Illinois wood sorrel is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Bead Grass *(Paspalum dissectum)*

Bead grass is of the *Poaceae* family and is listed as state endangered. Bead grass is a perennial monocot which grows in a creeping, branching characteristic and often forms mats. Bead grass is typically found within palustrine emergent wetland habitat, shallow water, muddy shores, and ditches (Gleason). This species is considered endangered within the state of Illinois (USDA). Bead grass has only one occurrence in Williamson County 20.7 miles from the project area in the Crab Orchard Wildlife Refuge. Bead Grass is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Short-Sepaled Beard Tongue (*Penstemon pallidus*)

Short-sepaled beard tongue is a perennial of the *Scrophulariaceae* family (USDA). This plant is considered an herb because it has self-supporting stems and the stems have tiny hairs between nodes. There is at least one green leaf above the flowering stem that is fuzzy and lanceolate-oblong in shape. The flowers are arranged in a spiral pattern along the inflorescence axis that measures 100-250 mm. They are white, 16-22 mm, have five petals, and are bilabiate with two lobes. This species produces fruit that measures 5-7mm, is dry, and opens when it is ripe to reveal at least two seeds (GoBotany). It is found in dry upland forest, dry prairie, loess hill prairie, dry-mesic savanna, sandstone and limestone glade, limestone cliffs, and successional field habiat. Short-sepaled beard tongue is listed as endangered in the state of Illinois (ILDNR). It has only one occurrence in Pope County 22.8 miles from the project area in the Shawnee National Forest. Short-sepaled beard tongue is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Lea's Bog Lichen (*Phaeophyscia leana*)

Lea's bog lichen is a member of the *Physciaceae* family (USDA). This lichen is found on large cottonwood trunks along a river's edge, trees associated with historical river channels, oxbow lakes, and backwater sloughs that are associated with floodwaters. It prefers park-like habitats that have high levels of light and excellent air flow (Gillespie & Methven). Lea's bog lichen is listed as threatened in the state of Illinois (ILDNR). It has two known occurrences in Pope County 38.8 miles from the project area in the Shawnee National Forest and 52.3 miles from the project area. Lea's bog lichen is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and lack of preferred habitat.

Shortleaf Pine *(Pinus echinata)*

Shortleaf pine is a perennial gymnosperm of the family *Pinaceae.* This is a large tree with a broad, open crown, ranging at 50-100 foot in height. It has short spreading branches that open up with age. Needles of this pine are bright green, 5 inch tufts while the trunks of the trees have broad, flat, reddish plates. Growing conditions of shortleaf pine include partially shaded areas within dry sandy soils (NPIN). This species is considered endangered within the state of Illinois (USDA). Shortleaf pine has one known occurrence in Jackson County 31.0 miles from the project area in the Shawnee National Forest in the Little Grand Canyon-Cedar Creek Natural Area and one occurrence in Union County 38.2 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area. The shortleaf pine is not likely to occur in the project area due to distance to known occurrences and the lack of appropriate dry sandy soils within the project area.

Water Elm (*Planera aquatica*)

Water elm is a perennial tree in the *Ulmaceae* family (USDA). The leaves on this tree are 3-8 x 2-4 cm. The flowers occur in the spring and are tubercular. The fruits are compressed and

leathery, covered with wart like growths and measure 8mm. This tree is found in swamps, streams, lakes, and alluvial flood plains occurring often in large stands (FNAA). Water elm is listed as threatened in the state of Illinois (ILDNR). It has one known occurrence in Pope County 54.7 miles from the project area and three known occurrences in Johnson County 30.0 miles from the project area, 33.6 miles from the project area in the Little Black Slough-Heron Pond Area, and 37.9 miles from the project area in the Lower Cache River Swamp. Water elm is not likely to occur on the permit area due to distance to known occurrences, differences in physiographic regions from known occurrences and known occurrences within natural protected areas.

Heart-leaved Plantain (*Plantago cordata*)

Heart-leaved plantain is a perennial dicot of the family *Plantaginaceae* (USDA). This plant has heart-shaped leaves that grow up to 10 inches long in a rosette. The heart-shaped leaves grow in the summer and in the winter this plant has smaller lance shaped leaves. Heart-leaved plantain produces flower spikes in the spring that can grow 1-2 feet tall. The flower spikes contain 80-130 white flowers that are pollinated by wind. This plant grows in areas where dolomitic limestone is present. It is found in rock crevices and gravel bars in clear streams in wooded areas (CPC). It is considered endangered in the state of Illinois (USDA). Heart-leaved plantain has one known occurrence in Johnson County 25.1 miles in the Shawnee National Forest, two in Jackson County 31.2 miles from the project area in Lake Murphysboro State Park and Lake Murphysboro Hill Prairies and 37.3 miles from the project area in the Shawnee National Forest. There are two known occurrences in Saline County in the Shawnee National Forest, 24.1 miles from the project area in the Cave Hill Research Natural Area and 23.7 miles from the project area and two occurrences in Pope County in the Shawnee National Forest, 27.6 miles from the project area and 29.2 miles from the project area in Copperous Branch Hill Prairie. The heart-leaved plantain is not likely to occur on the permit area due to distance to known occurrences and the lack of limestone habitats within the project area.

Wood Orchid (*Platanthera clavellata*)

Wood orchid is a perennial and a member of the Orchidaceae family (USDA). This species of orchid has one alternate arranged elliptic leaf per leaf node along stem that measure 30-190mm x 8-35mm. The inflorescences occur in 20-60 mm spikes and there are 1-26 flowers per spike. The flower is green, yellow, or white, occurs August-June, and the petals are 3-7mm (GoBotany). This orchid is found in mesic sand prairies and thickets in northern Illinois and in acidic, forested seeps in southern Illinois (INHS, 2007). Wood Orchid is listed as endangered in the state of Illinois (ILDNR). It has two known occurrences in Pope County in the Shawnee National Forest, 45.7 miles from the project area in Cretaceous Hills Nature Preserve and 48.1 miles from the project area in Massac Tower Springs. Wood orchid is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habiat.

Tubercled Orchid *(Plantanthera flava var. herbiola)*

The tubercled orchid is a perennial monocot of the family *Orchidaceae* (USDA). This species is

a rare orchid has a lobed petal shape with at least one nectar spur present. Flower color is white with the main color of the lower petal being green to brown and yellow. Habitats of this plant is best known to be floodplains, forest edges, forests, fresh tidal marshes or flats, grassland, meadows and fields, riverine (in rivers or streams), shrub-lands or thickets, swamps, wetland margins (edges of wetlands), woodlands (Go Botany). This species is considered endangered within the state of Illinois (USDA). Tubercled Orchid has two known occurrences in Johnson County that are 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp and 33.2 miles from the project area in the Little Black Slough-Heron Pond Area. Tubercled orchid is not likely to occur on the permit area due to distance to known occurrence. The tubercled orchid is not likely to occur in the project area due to distance to known occurrences; however, habitat exists within the permit area that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Grove Bluegrass *(Poa alsodes)*

Grove bluegrass is a perennial monocot of the family *Poaceae* (USDA). This species is a loosely tufted grass that does not have rhizomes. This grass possesses inflorescence branches (flowers) that are produced in May-June (Go Botany). Grove blue grass's interpreting wetland status within the Midwest is Facultative Wet (FACW) (Go Botany). Preferred habitat in Illinois includes mesic ravines; rocky ravines and gorges, very mesic and often shaded and with dripping water on the steep cliffs of verticle sandstone walls (INHS, 2007). This species is considered endangered within the state of Illinois (USDA). Grove bluegrass has one known occurrence in Jackson County 25.9 miles from the project area in the Shawnee National Forest in Fern Rocks and one occurrence in Pope County 26.9 miles from the project area in the Shawnee National Forest in Hayes Creek. Grove bluegrass is not likely to occur in the project area due to distance to known occurrences and the lack of rocky ravines and steep sandstone cliffs as described by Mohlenbrock (1959) for his documentation in Jackson County Illinois.

Wolf's Bluegrass (*Poa wolfii*)

Wolf's bluegrass is a perennial monocot of the family *Poaceae* (USDA). This grass grows 25-90 cm tall in loose tufts and has no rhizomes (MNDNR). The leaves are narrow, 0.6-3.5 mm wide. The flowers that occur in late spring-early fall grow in a pyramid shape and 7.5-15 cm tall. There are few panicle branches with nodes that have 1-5 more branches. Wolf's bluegrass grows on slopes, cliffs, banks or outcrops in forests. It also grows in bluffs, cliffs, and taluses (MNDNR). It is considered endangered in the state of Illinois (USDA). This species has only one known occurrence 46.2 miles from the project area along the Saline River, which is in the Ohio River drainage area, in Saline County. Wolf's Bluegrass is not likely to occur on the permit area due to distance to known occurrences and the lack of preferred rocky habitat within the project area.

Pink Milkwort (*Polygala incarnata*)

Pink milkwort is an annual plant and a member of the Polygalaceae family (USDA).
This plant is has dense racemes that are 1-4 cm x 10-15 mm. The linear leaves are arranged alternately and measure 5-12 mm. The flowers, that occur July-August, are rose-purple and are 7-10mm. The fruit is hairy and 2mm long occurring August-November. This species of milkwort grows in wet-mesic to dry-mesic prairies (WIDNR). Pink Milkwort is considered endangered in

the state of Illinois (USDA). This species has two known occurrences in Pope County in the Shawnee National Forest, 46.2 miles from the project area in the Cretaceous Hills Nature Preserve and 49.2 miles from the project area in the Poco Cemetery Barrens. Pink milkwort is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Mock Bishop's Weed *(Ptillimnium nuttallii)*

Mock bishop's weed is an annual dicot of the family *Apiaceae* (USDA). This annual herb grows 1-3 foot in height, possesses simple branched stems, and blooms flowers white in color (NPIN). This species' interpreting wetland status within the Midwest is Facultative Wet (FACW). It is found in moist to wet prairies and floodplain forests (INHS). This species is considered endangered within the state of Illinois (USDA). Mock bishop's weed has only one known occurrence in Jackson County 34.3 miles from the project area in Shawnee National Forest. Mock bishop's weed has only one known occurrence in Jackson County 34.3 miles from the project area in Shawnee National Forest. Mock bishop's weed is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Rock Chestnut Oak (*Quercus montana*)

Rock chestnut oak is a perennial dicot of the family *Fagaceae* (USDA). This tree grows to around 80 feet tall with a straight trunk and narrow crown. The bark is gray-brown with thick sharp pointed ridges. The leaves are simple alternate with an elliptical shape. They are shiny green on top and lighter green on bottom 4-6 inches long with scalloped margins. Rock chestnut oak flowers in spring. The male flowers are yellow-green catkins that are 2-4 inches long and the female flowers are red spikes. This tree produces 1-1.5 inch long light brown acorns (FNAA; Virginia Tech). It grows in rocky upland forest, dry ridges, and mixed deciduous forests on shallow soils (FNAA). It is considered threatened in the state of Illinois (USDA Rock chestnut oak has one occurrence in Union County 40.6 miles from the project area in the Shawnee National Forest in Atwood Ridge Research Natural Area, one occurrence in Jackson County 32.1 miles from the project area in Lake Murphysboro State Park and Lake Murphysboro Hill Prairies, and three occurrences in Saline County in the Shawnee National Forest, 18.7 miles from the project area in Reid's Chapel Bluffs, 24.3 miles from the project area in the Cave Hill Research Natural Area, and 24.7 miles from the project area in the Old Stone Face-Dennison Hollow State Natural Area. Rock chestnut oak is not likely to occur in the project area due to distance to known occurrences, and the lack of dry rocky ridgetop habitat preferred by this species.

Willow oak *(Quercus phellos)*

Willow oak is a medium to large oak of the Fagaceae family. It grows up to 80 feet tall and forms a dense oblong crown when open grown. The leaves are alternate in arrangement, simple, 2 to 5 inches long, linear or lanceolate in shape (willow-like) with an entire margin and a bristle tip. The flower is monoecious; males borne on slender yellow-green catkins; females borne on very short axilliary spikes, both appear very early with the leaves. The fruit is am acorn that is

very small, 1/4 to 1/2 inch across, nearly round and yellow-green, turning tan when older, caps are thin, saucer-like and cover only 1/4 of acorn with thin, tomentose, appressed scales. The twigs are slender, hairless, olive-brown in color when young; multiple terminal buds are very small, reddish brown and sharp-pointed. The bark on young stems is smooth, gray and tight; later becoming darker and forming irregular rough ridges and furrows (Virginia Tech). It grows on alluvial soils on ridges and high flats on first bottoms of major streams. On second bottoms it grows on ridges, flats, and sloughs and can be very common in some minor stream bottoms. It develops best on clay loam ridges of new alluvium (USDA). Willow oak has one known occurrence in Johnson County 34.2 miles from the project area in Little Black Slough- Heron Pond Area and one known occurrence in Union 38.7 miles from the project area in Shawnee National Forest in LaRue-Pine Hills Research Natural Area. Willow oak is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Dull Meadow Beauty *(Rhexia mariana)*

Dull meadow beauty is a perennial dicot of the family *Melastomataceae* (USDA). The leaves of this plant are simple, opposite, and the edge of the leaf blade is entire. The flower of the dull meadow beauty possesses four petals and is purple in color with bright yellow stamens. This species' interpreting wetland status within the Midwest is obligate (OBL), meaning that it only grows with wetland habitats, shores of rivers or lakes, and sandplains/barrens (Go Botany). This species is considered endangered within the state of Illinois (USDA). Dull meadow beauty has one known occurrence in Saline County 14.5 miles from the project area, two occurrences in Pope County in the Shawnee National Forest, 45.2 miles from the project area in Cretaceous Hills Nature Preserve and Klondike Springs and 48.7 miles from the project area in Kickasola Cemetery Barrens and Sweeps. It has one known occurrence in Jackson County 23.1 miles from the project area and five occurrences in Williamson County 14.3 and 17.4 miles from the project area in Crab Orchard National Wildlife Refuge and 9.5, 15.1, and 16.8 miles from the project area. Dull meadow beauty is not likely to occur in the project area due to distance to known occurrences; however, habitat exists within the permit area that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Clusterd Beaked Rush (*Rhynchospora glomerata*)

Clustered beaked rush is a perennial in the *Cyperaceae* family. This rush doesn't have rhizomes but has culms. The leaves are triangular, slim, and flat 2.5-5mm wide. It has terminal inflorescences with 2-6 spikelets around axil. Spikelets are deep red-brown. Flowers have six perianth britstles. There are 1-3 fruits per spikelet in the summer that are 3-4mm and dark red-brown. This rush prefers moist-wet meadows, swales, fens, flatwoods, and bogs (FNAA). Clustered beaked rush is listed as endangered in the state of Illinois (ILDNR). It has one known occurrence in Johnson County 22.6 miles from the project area in the Shawnee National forest in Camp Ondessonk and two known occurrences in Pope County in the Shawnee National Forest, 23.1 miles from the project area in Bell Smith Springs and 28.7 miles from the project area in Lusk Creek. Clustered beaked rush is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Arrowhead (*Sagittaria australis*)

Arrowhead is a perennial and a member of the *Alismataceae* family. This plant has no rhizomes, but has stolons and corms. The leaves are emersed, each 19-85 cm, with basal lobes equal to remainder of the blade. The inflorescences occur in racemes of 5-12 whorls and are also emersed. The flowers occur in summer-early fall, are 3 cm around, with recurved sepals and cylindric filaments that are longer than the anthers. The fruit is oval in shape, 1-2.2 cm in diameter. It is found in slightly basic-slightly acidic ponds, lakes, and swamps (FNAA). Arrowhead is listed as endangered in the state of Illinois (ILDNR). This species has only one known occurrence in Pope County 45.7 miles from the project area in the Shawnee National Forest in Cretaceous Hills Nature Preserve. Arrowhead is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Blue Sage (*Salvia azurea ssp. Pitcheri*)

Blue sage is a member of the *Lamiaceae* family (INHS). This plant has simple leaves, two at each node in arranged in an opposite pattern. Its flowers have five blue-purple petals and are fused into a cup or tube with lips and have two stamens. The flowers are arranged in a spiral pattern around the axis. Blue sage's fruit is dry and does not split open when it's ripe, it is egg shaped and not flat, measures 2.3-2.8 mm long, and contains 1-4 seeds. The plant has a fruit, mint, or resin smell that is pleasant. It's found in meadows, fields, on roadsides, and waste areas (Go Botany). Blue sage is considered threatened in the state of Illinois (ILDNR). This plant has one known occurrence in Johnson County 33.4 miles from the project area in Cave Creek Barrens and three occurrences in Pope County in the Shawnee National Forest, 33.2 miles from the project area, 34.3 miles from the project area in the Werner Tract, and 36.9 miles from the project area in the Brownfield Bluff. Blue sage is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in a natural protected area.

Bulrush (*Scirpus polyphyllus*)

Bulrush is a member of the *Cyperaceae* family. This plant forms turfs or mats. It has short, tough, and fibrous rhizomes and fertile stalks. The nodes on the stalks have bulblets around the axil. Bulrush has 14-22 leaves per stalk that grow 16-31 cm tall, which have green-brown sheaths. This plant rarely has a terminal inflorescence but more commonly has one lateral inflorescence from a leaf axil with bulblets. Oval spikelets occur in dense clusters of 3-9 measuring 2.5-4x1.6-3 mm. Bulrush has red-brown circular scales with green midribs. Its flowers have 6 strong perianth bristles that are much longer than the fruit. The fruit is pale brown and oval-triangular shaped, occurring in the summer. This plant is found along wooded streams and swamps and is usually found in a place shaded by trees (FNAA). Bulrush is considered threatened in Illinois (ILDNR). Bulrush has two known occurrences in Pope County in the Shawnee National Forest 45.5 miles from the project area in Cretaceous Hills Nature Preserve and Klondike Spring and 48.1 miles from the project area in Massac Tower Springs, Snow Springs, and Kickasola Cemetery Barrens and Seeps. Bulrush is not likely to occur on the permit

area due to distance to known occurrence, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas.

Carolina Whipgrass *(Scleria pauciflora)*

Carolina whipgrass is a perennial monocot of the *Cyperaceae* family (USDA). It has an inflorescence that is mostly composed of small terminal clusters. Leaves are simple, entire and linear in shape. Carolina whipgrass is typically found on exposed sandstone ledges, chert, or granite of glades and barrens; open woodlands and prairies, and bluff edges (Gleason). This species is considered endangered within the state of Illinois (USDA). Carolina whipgrass has one known occurrence in Williamson County 22.6 miles from the project area in Crab Orchard National Wildlife Refuge, one occurrence on the Pope/Johnson County border 23.0 miles from the project area in the Shawnee National Forest in Camp Ondessonk and Todd Fink Natural Area, and three known occurrences in Pope County in the Shawnee National Forest, 26.0 miles from the project area, 46.1 miles from the project area in Cretaceous Hills Nature Preserve and Dean Cemetery Ease Barrens, and 48.7 miles from the project area in Kickasola Cemetery Barrens and Sweeps. Carolina whipgrass is not likely to occur in the project area due to distance to known occurrences, difference in physiographic regions from known occurrence, and the lack of preferred habitat for this species within the project area.

American Orpine (*Sedum telephioides*)

American orpine, also known as Allegheny stonecrop, is a perennial dicot of the family *Crassulaceae* (USDA). This plant grows 0.5-1.5 feet high. The light pink flowers bloom in late summer (NPC). American orpine has large oval leaves attached at the base of the stem (MBC). It is found in cliffs and outcrops in the mountains (MBC). It is considered threatened in the state of Illinois (ILDNR). American orpine has three known occurrences in Saline County in the Shawnee National Forest, 23.8 miles from the project area in the Old Stone Face-Dennison Hollow State Natural Area, 24.9 and 27.8 miles from the project area. American orpine is not likely to occur in the project area due to distance to known occurrences, difference in physiographic regions from known occurrence, and the lack of preferred habitat for this species within the project area.

Spring Ladies' Tresses (*Spiranthes vernalis*)

Spring ladies' tresses is a perennial monocot of the family *Orchidaceae* (USDA). This plant grows 20-65 cm tall and has several spreading roots 1 cm diameter. It has 4-5 basal leaves and then sheathing bracts on up the stem. Inflorescence spikes are spiraled typically 3-7 flowers per spiral cycle. Flowers are white or cream and are nodding or slightly ascending. Flowers occur in the fall. The habitat for spring ladies' tresses is dry to moist meadows, dune hollows, prairies, old fields, roadsides, cemeteries, and lawns (FNAA). It is considered endangered in the state of Illinois (USDA). Spring ladies' tresses has one known occurrence in Jackson County 32.7 miles from the project area in the Shawnee National Forest, one occurrence in Saline County 22.7 miles from the project area in the Shawnee National Forest, one in Williamson County 21.0 miles from the project area in the Crab Orchard National Wildlife Refuge, two occurrences in Johnson County 28.7 and 32.7 miles from the project area, and three occurrences in Pope County

in Shawnee National Forest 28.2 miles from the project area, 45.3 miles from the project area in Cretaceous Hills Nature Preserve and Dean Cemetery East Barrens, and 48.8 miles from the project area. Spring ladies' tresses are not likely to occur on the permit area due to distance to known occurrence as well as difference in physiographic regions from known occurrence.

Great Chickweed (*Stellaria pubera*)

Great chickweed is a perennial in the *Caryophyllaceae* family. It has a branched 4-sided hairy stem. The leaves on this plant are elliptic-laceolate in shape, the widest part at the middle or just past it, 1-10 cm x 5-35 mm. The inflorescences are terminal with 3-70 flowered cymes. Flowers are 10-12 mm around with 5 sepals, which are an oval shape, and 5 petals 4-8 mm longer than the sepals. Great chickweed produces brown slanted seeds that area 1.5-2 mm wide. This plant flowers in the spring and is found in rich deciduous woods with alluvial bottomlands (FNAA). Great chickweed is considered endangered in the state of Illinois (ILDNR). Great chickweed has two known occurrences in Shawnee National Forest, 39.6 miles from the project area and 43.0 miles from the project area in Burke Branch Research Natural Area. Great chickweed is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Grass-leaved Lily (*Stenanthium gramineum*)

Grass-leaved lily is a perennial of the *Liliaceae* family (USDA). This plant has a rhizome and blubs, tubers, or corms. The leaves are linear with lateral veins arranged alternately and are 200-700mm x 5-30mm. There is one alternate leaf per leaf node and basal leaves. The flowers are green-brown or white, they have petals that are 4-10 mm long and have spots or streaks on them. The flowers occur in an inflorescence. The fruit capsule splits open when dry to release seeds from three compartments and is 6-10mm long (GoBotany). This lily's habitat consists of mesic forest woodlands, especially in connection with a stream or pond, floodplains, and bottomland forests and wet-mesic prairies and the base of bluffs in Illinois (USDA, 2002). Grass-leaved lily is listed as endangered in the state of Illinois (ILDNR). It has two known occurrences in Johnson County 24.0 miles from the project area in Ferne Clyffe State Park and 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp and three occurrences in Pope County in Shawnee National Forest, 24.0, 29.2 miles from the project area, and 44.0 miles from the project area in Burke Branch Research Natural Area. Grass-leaved lily is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Storax (*Styrax Americana*)

Storax is a deciduous shrub recognized by its alternate leaves which have sparse, yellow-tipped teeth, and its showy, drooping, white flowers (HDR). Storax is an obligate wetland species found in floodplain forests, oxbow lakes, and deep swamps in southern Illinois (HDR). Storax is found in very poorly drained habitats often in association with other wetland species including bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatic*), water hickory (*Carya aquatic*), Virginia willow (*Itea virginica*), and southern buckthorn (*Bumelia lycioides*) (HDR). Storax is an obligate wetlands species and would be common in deep swamp habitats with more stable,

regular hydrology, such as a seasonally flooded or semi-permanently flooded habitat (HDR). Storax has one known occurrence in Union County 36.7 miles from the project area, two known occurrences in Pope County 52.3 miles from the project area in Round Pond and 54.6 miles from the project area, and five known occurrences in Johnson County the closest being 30.2 miles in the Shawnee National Forest in Grantsburg Swamp. Wetland and open water habitat within the project are not hydrologically stable enough to support Storax and therefore this project is unlikely to affect this species.

Hairy Synandra (*Synandra hispidula*)

The hairy synandra is a perennial dicot of the family *Lamiaceae* (USDA). This plant possesses heart shaped fuzzy leaves, and produces large, white flowers with purple-streaked lips. The flowers can be up to 1.5 inches in size and the plant altogether is generally 2-3 foot tall. This plant requires a partially shaded habitat with moist, rich, well-drained soils (COC). This species is considered endangered within the state of Illinois (USDA). Hairy synandra has five known occurrences in Jackson County the closest being 25.9 miles from the project area in Shawnee National Forest in Fern Rocks. Hairy synandra is not likely to occur in the project area due to distance to known occurrences, physiographic regional differences in known occurrences, and a lack of preferred habitat.

Small flower-of-an-hour (*Talinum parviflorum*)

Small flower-of-an-hour is a perennial of the *Portulacaceae* family (USDA). This species has several short herbaceous stems each 2cm long, coming from fibrous roots. The leaves occur alternately on the stem, are hairy and 5cm x 2mm. The plant has terminal inflorescences that produce pink-purple flowers from May-August. The flowers have five petals, purple filaments, yellow anthers, and are around 5mm x 2-2.5mm. It also has two sepals that are cupped, 2mm all around and are green. This plant prefers level sandstone and chert glades as well as rocky outcrops above bluffs (Tenaglia). Small flower-of-an-hour is listed as threatened in the state of Illinois (ILDNR). It has one known occurrence on the Union/ Johnson border 23.7 miles from the project area on the border of the Shawnee National Forest in Draper's Cedar Bluff, one known occurrence on the Johnson/Pope border 23.0 miles in the Shawnee National Forest in Todd Fink Natural Area and Jackson Hollow, three occurrences in Pope County in the Shawnee National Forest 22.8 miles from the project area in Bell Smith Springs, 26.1 miles from the project area in Lusk Creek Canyon, and 26.9 miles from the project area, and three known occurrences in Johnson County 22.5 miles from the project area in Round Bluff in Ferne Clyffe State Park, 23.3 miles from the project area in Scout Cave, Bulge Hole and Odum Tract, and 34.7 miles from the project area. Small flower-of-an-hour is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

New York Fern (*Thelypteris noveboracensis*)

New York fern is a soft deciduous, yellow-green fern, which stands 1-2ft high. This species prefers dappled sunlight to medium shade, under moist to mesic conditions, in loamy sandy or rocky soil that is somewhat acidic. It is also found in low areas along stream, in wooded areas,

shaded seeps and springs along hillsides ravines and swamps. This fern is state listed in Illinois as endangered but is most common in areas further to the east (Illinois Wildflowers). New York fern has only one known occurrence in Pope County 45.8 miles from the project area in the Shawnee National Forest in Cretaceous Hills Nature Preserve. New York fern is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and only one known occurrence, which is in a natural protected area.

Ear-leafed Foxglove *(Tomanthera auriculata)*

Ear-leafed Foxglove is an annual dicot of the family *Scrophulariaceae* (USDA). This annual plant stands erect at ranges of 12-32 inches in height, is roughly hairy, and possesses 5-parted, purple flowers that generally bloom between August-September (UWSP). It is found within habitats of moderate moisture such as prairies and open woods (UWSP). This species is considered threatened within the state of Illinois (USDA). Ear-leafed foxglove has only one known occurrence in Jackson County 22.9 miles from the project area in Faulkner-Frankie Railroad Prairie. Ear-leafed Foxglove is not likely to occur in the project area due to distance to known occurrences. The land cover within the project area is primarily cultivated cropland, with occasional dense blocks of forest with thick canopy cover; similar riparian forest zones border the riverine areas within the project sight as well. The project area is likely not suitable habitat for this species.

Pale False Mannagrass (*Torreyochloa pallida)*

Pale False Mannagrass is a perennial monocot of the family *Poaceae* (USDA). This perennial grass possesses stems that typically root at the lower nodes and leaf sheaths that are open to the base. Observation of this grass is best from mid-July to mid-August when it is typically in prime flower and fruit. This grass species' interpreting wetland status within the Midwest is obligate (OBL). It is found in shores and shallows of stream, lakes, vernal pools, and beaver ponds (USDA, MNDNR). This species is considered endangered within the state of Illinois (USDA). Pale false mannagrass has one known occurrence in Jackson County 36.0 miles from the project area in the Shawnee National Forest and one occurrence in Union County 38.8 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area. It is not likely to occur in the project area due to distance to known occurrences, physiographic regional differences in known occurrences and all known occurrences are in natural protected areas.

Filmy Fern (*Trichomanes boschianum*)

Filmy fern is a perennial herb, which is a rather small, filmy-leaved, creeping rhizomatous evergreen fern. Its widely spaced leaves (fronds) are 4-20cm long and 1-4cm wide, with green, somewhat flattened and winged petioles 1+5cm long that are shorter than the blades. Typically, the plants grow loosely rooted on the surfaces of vertical or horizontal rock outcrops, usually moist, well-weathered sandstone cliffs under overhangs or in shallow caves in deep shade. The rock outcrops where *Trichomanes boschianum* grows are generally exposed to nearly continuous moisture from seepage or spray from waterfalls. In Illinois, suitable habitat for the species occurs only along a narrow band in the sandstone areas of the Shawnee Hills (INHS). Filmy fern has

three known occurrences in Johnson-County 22.9 miles from the project area in the Scout Cave Natural Area, 22.9 miles from the project area in Bulge Hole Ecological Area, and 22.6 miles from the project area. It also has five occurrences in Pope County the closest being 23.1 miles from the project area in the Shawnee National Forest in Jackson Hollow. Filmy fern is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Buffalo Clover (*Trifolium reflexum)*

Buffalo clover is an annual biennial dicot of the family *Fabaceae* (USDA). This plant is an erect herb that forms overwintering rosettes that flower from May-July, and fruit from June-August (ODNR). Stems possess fine hairs and ascend and branch from the base. The plant has round reddish flower heads on slender pedicels, and grows 8-20 inches high. Buffalo clover is found in areas of sunny light conditions, and in dry, well drained, sandy soils (NPIN). Buffalo clover is considered endangered within the state of Illinois (USDA **Buffalo clover** has two known occurrences in Jackson County in the Shawnee National Forest, 25.7 miles from the project area and 33.7 miles from the project area in the Little Grand Canyon-Cedar Creek Natural Area. Buffalo clover is not likely to occur in the project area due to distance to known occurrences, physiographic regional differences to known occurrences, and a lack of proffered habitat.

Green Trillium (*Trillium viride*)

Green trillium is a perennial monocot in the *Liliaceae* family (USDA). This plant had bluish-green mottled lance shaped leaves. It produces a green-yellow erect flower in the spring whose petals are sometimes streaked with purple. It is found in rich woods, bluffs, rocky hillsides with limestone outcrops, in woodsy, humus rich soil over a stiff clay substrate (FNAA). Green trillium is considered endangered in Illinois (USDA). Green trillium has one known occurrence in Franklin County 12.4 miles from the project area, one occurrence in Williamson County 15.0 miles from the project area, and one occurrence in Union County 26.2 miles from the project area in the Shawnee National Forest. Green trillium was not identified during the field survey; however, habitat is present that could be utilized by the species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Nettle (*Urtica chamaedryoides*)

Urtica chamaedryoides is a fibrous rooted or weakly taprooted annual of the *Urticaceae* family (Gleason). It is bright green and its height averages from 3-8 cm. The stem is branched from the base, subglabrous except for a few stinging hairs. The leaves are oppositely arranged on long petioles, crenate-serrate with the lower broadly ovate to subrotund, the upper leaves are progressively narrower and smaller. The green axillary flowers are in small clusters (Gleason). It is found in riverbank thickest, low rich wood on alluvial ground and along slopes bordering streams, low open ground (INHS). Nettle has three known occurrences in Union County that are 42.0, 43.2, and 46.6 miles from the project area. Nettle is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Deerberry *(Vaccinium stamineum)*

Deerberry is a perennial shrub and the only member of Vaccinium section Polycodium. It is normally found in dry areas (rocky forests, thickets, grassy fields, maple or oak forests), and occasionally in wet areas such as bogs and borders of shrub swamps. It grows well on well-drained, sandy soils. Rocky substrate is generally sandstone, chert (silica), or gneissic granite. Deerberry is usually found in partial shade in openings or open forests. Deerbery is known to flower primarily from May to June within its range, but can vary from late April and through August. Suitable habitat for the species occurs only in extreme southern Illinois in the area of the Shawnee Hills (INHS). Deerberry has only one known occurrence in Pope County 25.5 miles from the project area in the Shawnee National Forest in Double Branch Hole. Deerberry is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

BIRDS

Short-eared Owl (*Asio flammeus*)

The short-eared owl is in the *Strigidae* family (INHS). Its wingspan is 85-103 cm long. Above the owl is mottled brown while below its chest is pale with small streaks. It has a big wing patch on its outer wing. The short-eared owl feeds on small mammals and birds. Its nests are lined with grass on the ground and they can produce up to 11 eggs. It is found in prairies, meadows, tundra, moorlands, marshes, savannas and open woodland (CLO). It is considered endangered in the state of Illinois (INHS) and was last observed in Saline County in 1992. The short-eared owl has only one known occurrence in Saline County 15.7 miles away from the project area. The short-eared owl was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Upland Sandpiper (*Bartramia longicauda*)

The upland sandpiper is a medium sized sandpiper of the *Scolopacidae* family. The upland sandpiper has a small head with dark prominent eyes on a long skinny neck. The body is brown mottled on the back; lightly streaked on the chest, sides and flanks and white on the belly and undertail. It has bright yellow legs and a two-toned bill. The upland sandpiper is a rare to uncommon migrant from early April to late May and from mid-July to mid-September in Illinois. The upland sandpiper prefers low prairie, low pasture, or dense medium-height grassy areas; often near airports, school, or roadsides. It is an uncommon migrant and summer resident with a statewide range in Illinois. It is listed as endangered in the state of Illinois (ILDNR). Upland sandpiper has only one known occurrence in Williamson County 12.3 miles from the project area. The upland sandpiper is not likely to occur on the permit area due to distance to known occurrences. The Permit Area does not contain suitable preferred habitat, it is unlikely to occur within the Permit Area or adjacent area.

Northern Harrier (*Circus cyaneus*)

Northern harriers are medium-sized migratory raptors from the family *Accipitridae* (INHS;

CLO). Their face is flat and round like an owls and a hooked bill. Their wings span 102-118 cm and have black tips. Their slim body is grey on top and white underneath, if male, or brown on top and white with brown streaks below, if female. They all have a white rear patch. They soar low with their wings in a V-shape. They feed mostly on small mammals and nest on the ground. The northern harrier's habitat consists of the arctic tundra, prairie grasslands, wetlands, meadows, fields and marshes (CLO). They are considered endangered in the state of Illinois (INHS). Northern harrier has one known occurrence in Saline County 23.1 miles from the project area, one occurrence in Pope County 31.9 miles from the project area in the Shawnee National Forest, and one occurrence in Johnson County 17.3 miles from the project area. The northern harrier was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Cerulean Warbler (*Dendrioica cerulean*)

The cerulean warbler is a small warbler of the *Parulidae* family. It has a solidly colored back (sky-blue in males and blue-green in females) with stripes of same color down sides of white chest and has two broad white wingbars. It is 11 cm in lenagth has a 20 cm wingspan and weighs 8-10 grams (COL). It is long winged and short tailed. Nesting birds prefer mature deciduous forests in both wet lowland and mountain slopes (Sibley). It nests and forages higher in the forest treetops than most other warblers. Its primary food is insects with some plant material (COL). The cerulean warbler listed as state threatened for Illinois (INHS Cerulean warbler has two known occurrences in Union County in the Shawnee National Forest, 39.8 miles from the project area in LaRue-Pine Hills Research Natural Area and 41.5 miles from the project area and two occurrences in Jackson County 33.2 miles from the project area in the Shawnee National Forest in Little Grand Canyon-Cedar Creek Natural Area and 33.7 miles from the project area in Post Oak Glade. The cerulean warbler was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Little Blue Heron (*Egretta caerulea*)

Little blue herons range from New England south to Florida along the Gulf Coast and north to Illinois (HDR). The little blue heron winters on the Gulf and the Atlantic Coasts north to New Jersey and can also be found in the tropics (HDR). This animal makes its home in freshwater swamps, lagoons, coastal thickets, and islands; where its diet consists of fish, crustaceans, amphibians, insects, and reptiles (HDR). Little blue heron has only one known occurrence in Franklin County 19.5 miles from the project area in Wayne Fitzgerrell Lake. Little blue heron is not likely to occur on the permit area due to distance to known occurrence as well as difference in physiographic regions from known occurrence. This species was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Common Moorhen (*Gallinula chloropus*)

The common moorhen is a waterbird of the *Rallide* family. The common moorhen has a reddish

forehead shield; yellow-tipped bill; gray black body with white streaks on sides and flanks. The legs are greenish yellow. The moorhen breeds in northeastern Illinois and is a rare migrant from mid-April to mid-May and from mid-August to mid-November statewide. The preferred habitat of the common moorhen includes wetland marshes with open water and dense vegetation, especially cattail. It is listed as state threatened. The common moorhen has one known occurrence in Perry County 42.3 miles from the project area in the Shawnee National Forest and one occurrence in Jackson County 39.8 miles from the project area. The common moorhen was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle isn't on the Illinois threatened and endangered species list, however it is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The bald eagle is a large raptor of the *Accipitridae* family. The adult has a dark brown body and wings, white head and tail, and a yellow beak. The wingspan is about 7 feet across. Year round habitats of bald eagles can include large water bodies, wetlands, lacustrine, and upland habitats. Bald eagle breeding pairs are present in forested habitats adjacent to rivers and lakes. Nests are generally built in secluded older trees that have a large diameter with minimum human contact. The bald eagle is a common migrant and winter resident along the Illinois and Mississippi Rivers and in southern Illinois on wildlife refuges (Nyboer 2004). It is considered an uncommon summer resident, but the number of nests in Illinois has been increasing in recent years (Nyboer 2004). In Illinois, bald eagles prefer relatively undisturbed areas along rivers and lakes (Nyboer 2004). They typically nest in the high branches of old trees and usually reuse nests in subsequent years (Nyboer 2004). The bald eagle has two know occurrences in Williamson County 12.8 and 26.3 miles from the project area at the Crab Orchard National Wildlife Refuge. It has one occurrence in Saline County, 12.2 miles from the project area; two occurrences in Jackson County, 20.7 and 26.3 miles from the project area; and six occurrences within Franklin County, 4.5, 11.4, 12.2, 13.8, 13.9, and 14.6 miles from the project area. The bald eagle was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Mississippi Kite (*Ictinia mississippiensis*)

The Mississippi kite is a raptor of the *Accipitridae* family. It is a medium sized falcon shaped hawk with black tail, pale gray head and underparts; dark gray mouth, and black lores (INHS). It has long, narrow, pointed wings with a pale patch on rear edge of wings as seen from above (COR). It is 34-37 cm in length and 214-388 g in weight with a 89 cm wingspan. In Illinois, the Mississippi kite requires wooded tracts or mixed bottomland forest for nesting and open fields, fallow fields, mixed forest, prairies or other openings for feeding. It is listed as state threatened. Mississippi kite has one known occurrence in Union County 40.7 miles from the project area on the Shawnee National Forest border, one occurrence on the border of Union/Jackson County 33.3 miles from the project area, three occurrences in Johnson County 22.7 miles from the project area in Ferne Clyffe State Park, 34.5 miles from the project area in Little Black Slough-

Heron Pond Area, and 39.7 miles from the project area in Lower Cache River Swamp, and two occurrences in Jackson County 28.3 and 25.2 miles from the project area. The Mississippi kite is not likely to occur on the permit area due to distance to known occurrences, as well the lack of preferred bald cypress-tupelo swamps habitat within or adjacent to the permit area.

Least Bittern (*Ixobrychus exilis*)

The least bittern is the smallest heron and is of the *Ardeidae* family (INHS). It has buff wing patches with a dark crown and back and a wingspan of only 41-46 cm. Its sides are orange and the front of its neck and chest have orange and white stripes (INHS; CLO). The least bittern feeds on small fish and insects and nests on the ground. It makes a platform and canopy for the nest from vegetation and lays 2-7 eggs. Its habitat is in freshwater or brackish marshes with tall vegetation (CLO). It is considered endangered in Illinois (INHS). Least bittern has one known occurrence on the Saline/Williamson County border 14.1 miles from the project area, one occurrence in Jackson County 38.6 miles from the project area in the Shawnee National Forest, and one occurrence in Union County 42.3 miles from the project area on the Shawnee National Forest border. The least bittern was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Loggerhead Shrike (*Lanius ludovicianus*)

The loggerhead shrike is a songbird of the *Laniidae* family. It is listed as state threatened for Jackson, Pope, Saline, Union and Johnson Counties. The loggerhead shrike is a medium-sized songbird with black tail and wings, black bill, gray crown and back, white underparts, and a wide black mask that extends above the hooked bill and onto the forehead. In southern Illinois, the loggerhead shrike is considered a fairly common year-round resident (HDR). Shrike habitat includes open lands with short vegetation such as pastures with fence rows, mowed roadsides, agricultural fields, riparian areas, and open woodlands (HDR Loggerhead shrike has two known occurrences in Jackson County in the Shawnee National Forest 35.1 and 37.7 miles from the project area, one occurrence in Union County 45.1 miles from the project area, two occurrences in Saline County 12.9 and 20.5 miles from the project area, one occurrence in Pope County 33.0 miles from the project area in the Shawnee National Forest, and one occurrence in Johnson County 21.1 miles from the project area in the Shawnee National Forest. The loggerhead shrike was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Swainson's Warbler *(Limnothlypis swainsonii)*

The Swainson's warbler is a secretive song bird of the family *Parulidae* (CLO). This is a small dull brown and unmarked songbird with weak white stripes above the eyes. Being ground foragers, these little birds forage their habitats primarily for insects and spiders. Preferred habitat for the Swainson's warbler includes forests with thick undergrowth (canebrakes), floodplain forests in lowlands, and rhododendron-mountain laurel within the Appalachians (CLO). This species is listed as endangered within the state of Illinois (USDA). Swainson's warbler has one

known occurrence in Johnson County 33.4 miles from the project area in Little Black Slough-Heron Pond Area and three occurrences in Jackson County in the Shawnee National Forest in Little Grand Canyon-Cedar Creek Natural Area 31.4, 31.7, 33.3 miles from the project area. Swainson's warbler is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Yellow-Crowned Night Heron *(Nyctanassa violacea)*

The yellow-crowned night heron is a nocturnal member of the family *Ardeidae*. This heron is medium in size and stocky. The body is primarily gray with yellow legs. The face and bill of the heron is black, cheeks are white, and the crown is marked with a bright yellowish stripe. Preferred habitat of the yellow-crowned night heron is within or near wetlands, on the coast along islands, mangroves, and barrier beaches; farther inland in wooded swamps, forested uplands, and lakes and rivers, sometimes near residential areas. Nesting usually occurs in small colonies, even with other wading birds. Primary prey for this species includes crustaceans and aquatic insects. This species is considered endangered within the state of Illinois (USDA). Yellow-crowned night heron has one known occurrence in Williamson County 8.1 miles from the project area and four occurrences in Johnson County the closest being 29.2 miles in Deer Pond. The yellow-crowned night heron was not identified during the field survey of the site; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

Bewick's Wren *(Thryomanes bewickii)*

The Bewick's wren is a perching bird of the *Troglodytidae* family. It can be found within most of western North America but has virtually disappeared from the East coast. This medium sized wren has a slender little body with long tail feathers that are held upright. They are generally brow-and-gray with a single long white stripe over the eye. The back and wings are generally plain brown with its under-parts being both gray and white. The tail has a barred black appearance and is usually tipped with white spots. Both males and females have the same appearance. The bills of the Bewick's wren are long, slender, and down-curved. These birds favor brushy, thicket habitat types in open country/woodlands near streams and rivers. They are primarily insectivores and nest in cavities of trees (CLO). This species is considered endangered within the state of Illinois (USDA). Bewick's wren has one known occurrence in Williamson County 9.4 miles from the project area, two occurrences in Pope County in the Shawnee National Forest in Jackson Hollow, 22.9 and 28.8 miles from the project area, and two occurrences in Johnson County 22.1 miles from the project area in Ferne Clyffe State Park and 32.3 miles from the project area in Little Black Slough-Heron Pond Area. The Bewick's wren is not likely to occur on the permit area due to distance to known occurrences and lack of preferred habitat.

Barn Owl (*Tyto alba*)

The barn owl is a medium sized raptor of the *Tytonidae* family. It is listed as state endangered for Williamson, Franklin, Saline and Union Counties. The barn owl has a heart-shaped, white

facial disk; dark eyes and pale bill. It is rusty brown above with white underparts. Barn owls inhabit open areas, including agricultural fields, grasslands and marshes (HDR). Their diet is dominated by voles and other small mammals (HDR). Barn owls nest and roost in a variety of places including hollows or natural cavities in trees, manmade structures, caves, and cliffs (HDR). Populations are stable in some parts of their range, but in the Unites States seven Midwestern states, including Illinois, list barn owls as threatened or endangered (HDR). As agriculture has increased in scale and modern farming techniques have been implemented many farm buildings have disappeared from the landscape, rows of trees have been removed, and production has shifted from cover crops such as oats and hay to row crops like corn (HDR). Barn owl has three known occurrences in Franklin County 5.8, 5.8 and 21.5 miles from the project area, three occurrences in Jackson County 18.7, 19.6, and 22.2 miles from the project area, five occurrences in Johnson County the closest is 23.7 miles from the project area, six occurrences in Pope County the closest being 19.5 miles from the project area in the Shawnee National Forest, two occurrences in Saline County 14.8 and 17.2 miles from the project area, ten occurrences in Union County the closest is 27.3 miles from the project area in the Shawnee National Forest, and three occurrences in Williamson 9.0, 10.0, and 15.9 miles from the project area. The barn owl was not identified during the bird survey; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

REPTILES AND AMPHIBIANS

Smooth Softshell (*Apalone mutica*)

The smooth softshell is in the *Trionychide* family. It inhabits large river or streams of the central U.S. preferring large unpolluted rivers with sandy substrate (INHS). It has a smooth leatherlike, flexible carapace and snout with a rounded tip. It is the only softshell without ridges in the nostrils and the feet are not strongly streaked or spotted. The carapace is irregularly patterned with small dark spots or dashes that expand into blotches or mottling in large females. The plastron is white to cream in color with paired, dark-bordered, white stripes which extend across snout to the eyes. The smooth softshell is listed as state endangered in Illinois (ILDNR) and has only one known occurrence in Jackson County 35.6 miles from the project area along the Big Muddy River. The smooth softshell is not likely to occur on the permit area due to distance to known occurrence,difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Timber Rattlesnake (*Crotalus horridus*)

The timber rattle snake is a venomous snake in the *Viperidae* family (INHS; IUCN). This snake can grow up to 180 cm long and colors vary from grey, yellow, and greenish-white. Across its back are 20-25 black marks ending in a black tail with a rattle. Its belly is pink, white, cream, or gray with dark stripes on the sides. The head is larger than the neck and the eyes have an oval shaped pupil. The timber rattlesnake feeds on small mammals and mates in the summer having 6-10 offspring born late summer-fall the next year. This snake is found in heavy forests along rocky outcrops and bluffs spring-fall. Most deaths that occur to the adult timber rattlesnake are of vehicles and humans. This snake is considered threatened in the state of Illinois (INHS). Timber rattlesnake has five known occurrences in Jackson County the closest being 30.4 miles from the

project area in the Shawnee National Forest on Route 127, one occurrence on the Jackson/Williamson County border 23.7 miles from the project area in the Shawnee National Forest, one occurrence in Johnson County 33.2 miles from the project area in the Little Black Slough-Heron Pond Area, three occurrences in Saline County in the Shawnee National Forest, 23.7 miles from the project area in the Old Stone Face-Dennison Hollow State Natural Area, 25.1 miles from the project area, and 27.8 miles from the project area in the Garden of the Gods Wilderness, one occurrence on the Saline/Pope County border 23.6 miles from the project area in the Shawnee National Forest in Sally Hollow, seven occurrences in Union County the closest being 35.4 miles from the project area in the Shawnee National Forest in the Bald Knob Geological Area, and one occurrence in Williamson County 17.1 miles from the project area in Crab Orchard National Wildlife Refuge. The timber rattlesnake is not likely to occur on the permit area due to distance to known occurrences and lack of preferred habitat for the species within the project and adjacent areas.

Spotted Dusky Salamander (*Demognathus conanti*)

The spotted dusky salamander is a moderately stout salamander of the *Plethodontidae* family (INHS). It is up to 12 cm in length with dark markings on back that form a broad irregular light stripe down back and onto tail. The belly is light with mottled black and light flecks. It has nasolabial grooves with a pale diagonal line from eye to angle of jaw. They are found in cool, spring-fed headwater streams flowing through forests. It is listed as state endangered and has only two known occurrences in Johnson County 24.8 miles from the project area in Jug Spring and 25.9 miles from the project area in the Shawnee National Forest. The Spotted dusky salamander is not likely to occur on the permit area due to distance to known occurrences as well as difference in physiographic regions from known occurrence. Furthermore, the preferred habitat is not present within the project area.

Eastern Narrowmouth Toad (*Gastrophryne carolinensis*)

The eastern narrowmouth toad is small amphibian of the *Microhylidae* family. It is up to 3.3 cm in length. It has olive, dark gray, reddish brown or nearly black skin with a darkly mottled belly. The skin is smooth without warts or ridges. The legs are stubby and the toes are without webbing or toe pads. The male has a dark throat. It has a squat body with a narrow pointed head and a fold of skin across the top of its head behind the eyes. It is inhabits open, moist areas with abundant ground cover. It breeds in temporary or permanent waters such as ponds, lakes, swamp edges, marshy fields, and roadside ditches. It is listed as state threatened and has one known occurrence in Jackson County 40.7 miles from the project area on the Mississippi River-Grand Tower Island, one occurrence in Union County 43.6 miles from the project area in the Shawnee National Forest, and two occurrences in Pope County 32.0 miles from the project area in the Shawnee National Forest and 52.7 miles from the project area. The eastern narrowmouthed toad is not likely to occur on the permit area due to distance to known occurrences, difference in physiographic regions from known occurrence and all known occurrences are in natural protected areas or occur in the Mississippi River.

Bird-voiced Treefrog (*Hyla avivoca*)

The bird-voiced treefrog is a small amphibian of the *Hylidae* family. It has smooth gray-brown or greenish skin with a dark "x" or star shaped mark in the middle the back. It has a pale belly,

while the males have a dark throat. The arms and legs have dark bar with green to yellowish green patches in groin and inner thigh. The eyes are relatively large with a light spot under each eye. The pustule underneath joint the outer finger of hand is usually divided (INHS). The bird-voiced treefrog is found in bald cypress-tupelo swamps and nearby wet hardwood forests. It is listed as state threatened Bird-voiced treefrog has one known occurrence in Jackson County 34.9 miles from the project area in the Shawnee National Forest, one occurrence in Pope County 31.9 miles from the project area in the Shawnee National Forest, one occurrence on the Pope/Johnson County border 34.6 miles from the project area in the Shawnee National Forest, two occurrences in Union County 35.1 miles from the project area and 38.8 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, one occurrence on the Johnson/Union County border 28.8 miles from the project area in Cypress Pond and five occurrences in Johnson County closest being 29.0 miles from the project area in Deer Pond. Bird-voiced treefrog is not likely to occur on the permit area due to distance to known occurrence as well as difference in physiographic regions from known occurrence. The bird-voiced treefrog is not likely to occur on the permit area due to distance to known occurrences, as well the lack of preferred bald cypress-tupelo swamps habitat within or adjacent to the permit area.

Alligator Snapping Turtle (*Macrochelys temminickii*)

The alligator snapping turtle is a large freshwater turtle of the *Chelydridae* family. It is the largest turtle in North America and can get up to 80 cm long (carapace length). Wild individuals reach up to 70 kg in weight. The carapace is sculptured, dull black or brown, and strongly serrated posteriorly. There are three (3) carapacial keels formed by pyramid-shaped elevations of vertebral and pleural scutes. The plastron in reduced and cross-shaped. The head cannot be retracted into the shell. The chin, neck and throat have long pointed tubercles. The tail is nearly as long as shell. It is mainly riverine, but can be found in oxbow lakes, cypress swamps, and canals. It is state listed as endangered (INHS). The alligator snapping turtle has only one occurrence in Union County 40.2 miles from the project area in the Shawnee National Forest. It is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Mud Puppy (*Necturus maculosus*)

The mud puppy is a large salamander of the *Proteidae* family. It normally ranges in length from 22.5-35 cm. It has a brownish-gray, rust brown or black stout body with scattered round black spots or various sizes. Its belly is gray with dark spots, or plain gray. It has a blunt snout, flattened head which is widest behind the eyes. The tail is short, with tail fins that do not extend onto the body. It has 15-16 costal groves, bushy external gills, and four (4) toes on the hind feet. It inhabits lakes, ponds, rivers, and large creeks. It prefers clear water but can withstand turbid, mud-banked streams if gravel substrate is available (INHS). It is state listed as threatened (ILDNR). The mud puppy has only one known occurrence in Union County 44.2 miles from the project area in the Shawnee National Forest in Clear Creek. Mud puppy is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Mississippi Green Watersnake (*Nerodia cyclopin*)

The Mississippi green watersnake is a large watersnake of the *Natricidae* family. It is a stout snake, adults average from 76-114 cm, with greenish black or olive brown back and sides. It has fifty barely visible, crossbands above vague alternating dark blotches. The belly is dark brown or black with off-white hald moons. It has a subocular scale between the eye and supralabial scales. The back keels are strongly keeled and the anal plate is divides. It is found in quiet backwater sloughs and cypress-tupelo swamps (INHS). It is state listed as threatened. It has only one known occurrence in Union County 38.6 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area. Mississippi green water snake is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

River Cooter (*Pseudemys concinna*)

The river cooter is a large reptile of the *Emydidae* family. It is up to 32 cm long with a striped head. It has an intricately patterned olive to dark brown carapace and an unpatterned or sparsely patterned plastron. The patterns are yellow or orange lines or swirls. There are no dark smudges on plastral scutes. The river cooter is a turtle found in the east from Virginia to northern Florida west to Oklahoma and Kansas, and north to southern Illinois and Indiana (HDR). The river cooter is found in backwaters and oxbow lakes of large rivers and reservoirs (HDR). River cooter has only one known occurrence in Franklin County 14.7 miles from the project area. The river cooter is not likely to occur due to the lack of preferred habitat.

Flathead Snake (*Tantilla gracilis*)

The flathead snake is in the *Colubridae* family (IUCN). This snake is small snake, only reaching 20 cm in length, and is tan or yellow-brown in color. It has a pointed flat head and the belly is salmon-orange in the middle and white on the sides. The flathead snake mates in the spring and has 2-4 eggs that hatch in September. It eats scorpions, spiders, centipedes and other arthropods. This snake kills its prey using rear fangs and venom glands, which are no threat to humans. The flathead snake is found in the spring and autumn usually under logs, rocks, and forest debris. It is found in rocky, wooded limestone hillsides. The flathead snake is considered threatened in Illinois (INHS). The flathead snake has only one known occurrence in Union County 37.6 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area. Flathead snake is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and lack of preferred habitat.

Ornate Box Turtle (*Terrapene ornata*)

The ornate box turtle is a small reptile of the *Emydidae* family. It has a moderately high dark brown carapace that is flattened along the yellow midline and is without a keel. It has a hinged plastron patterned with yellow lines radiating from the center of each scute. It ranges up to 13cm and the head is sometimes spotted. The ornate box turtle can be found from South Dakota to Arizona with the Mississippi Valley on the most eastern edge of its territory (HDR). The habitat

of the turtle includes prairies and open fields in former prairies (HDR). Ornate box turtle has only one known occurrence in Franklin County 19.2 miles from the project area in Wayne Fitzgerrell State Park. Ornate box turtle is not likely to occur on the permit area due to distance to known occurrence. The ornate box turtle was not identified during the field survey; however, habitat exists that could be utilized by this species. Therefore, presence is assumed and a protection and enhancement plan has been prepared.

Eastern Ribbon Snake (*Thamnophis sauritus*)

The eastern ribbon snake is a medium sized snake of the *Colubridae* family. It grows up to 80 cm long, is slender, black with a yellow stripe on each side. A brown stripe on scale rows 1-2 extends onto the sides of the belly scales; the remainder of belly is plain greenish white. Two rows of black spots occur between the back and side stripes. It has a long tail about one-third of its body length. The back scales are keeled and the anal plate is not divided. It is found in lowland forests, in vegetation along banks of sloughs, cypress-tupelo swamps, and other similar bodies of water (INHS). Eastern ribbon snake has one known occurrence in Pope County 52.7 miles from the project area and two occurrences in Johnson County 32.5 miles from the project area in the Little Black Slough-Heron Pond Area and 37.9 miles from the project area in Lower Cache River Swamp. Eastern ribbon snake is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

INVERTEBRATES

Anomalous Spring Amphipod (*Crangonyx anomalus*)

The anomalous spring amphipod is a crustacean belonging to the family *Crangonyctidae* (USDA). It is distinguished by its strongly expanded posterior margins of the pereopod bases. It is known only from two collections in Illinois, made in 1974 and 1992, in springs in Pope County (Page, 2002). It inhabits shallow groundwater habitat-seeps, spring, caves and subsurface caves in limestone. Anomalus spring amphipod has two known occurrences in Pope County in the Shawnee National Forest, 32.4 miles from the project area in Lusk Creek, and 33.5 miles from the project area in Simmons Creek-Hurricane Hollow Area. Anomalus spring amphipod is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Packard's Cave Amphipod (*Crangonyx packardi*)

The Packard's cave amphipod is a crustacean belonging to the family *Crangonyctidae* (USDA). Although scientific research has been done on the species, very little is actually known about this Amphipod. The eyes of the Packard's cave amphipod are few to absent entirely, and it is unpigmented and appears white/clear in life. These crustaceans length ranges 5.5-8.0 mm. Identification must be performed by a specialist under a compound microscope. Preferred habitat for the Packard's cave amphipod is primarily caves, with occasional populations showing in springs, seeps, and wells (USDA). This species is considered endangered within the state of Illinois (USDA). Packard's cave amphipod has one know occurrence in Pope County 34.4 miles

from the project area in the Shawnee National Forest, one occurrence in Saline County 24.1 miles from the project area in the Shawnee National Forest in the Cave Hill Research Natural Area, one occurrence in Union County 39.1 miles from the project area in Roaring Spring Area, and three occurrences in Johnson County 31.1 miles from the project area in Shawnee National Forest in Grantsburg Swamp, 31.5 miles from the project area in Firestone Creek Cave, and 37.0 miles from the project area in White Hill Cave. Packard's cave amphipod is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Ebonyshell (*Fusconaia ebena*)

The ebonyshell is a freshwater mussel of the family *Unionidae*. Its shell is solid, heavy, rounded or oval, and inflated and reaches about 10.2 cm in length. The anterior end is rounded, posterior and rounded or bluntly pointed. The Dorsal margin is slightly rounded, ventral margin curved, occasionally straight. The umbos are low, inflated, about even with hinge line and curved downward. Beak sculpture consists of a few very weak ridges, which are apparent only in small shells. The shell is smooth with sighlty elevated ridges. It is rayless, light brown in young shells becoming dark brown to black in older shells. It is found in large rivers in sand and gravel. This species is listed as state threatened (USDA). Ebonyshell has two known occurrences in Pope County in the Shawnee National Forest along the Ohio River, 36.0 and 42.3 miles from the project area. Ebonyshell is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Cobweb Skipper (*Hesperia Metea)*

The Cobweb skipper is a butterfly of the *Hesperiidae* family. The cobweb skipper ranges from southern Main west to Wisconson, south to central Georgia, the Gulf States and Central Texas. This species is apparently secure globally, though it might be quite rare in parts of its range. This species relies on Beard grasses such as little bluestem (andropogon scoparius) and big bluestem (A. Gerardi) as host plants for the larval life stage. The habitat for adult animals consists of dry, grassy openings in woods, pine barrens, oak savannah, open sandy scrub, burned areas and old pastures. (Butterflies and Moths of North America). This species is found in very few locations in Illinois and appears to be dependent upon early successional stages of regrowth often associated with fire. The cobweb skipper has only one known occurrence in Pope County 21.2 miles from the project area in the Shawnee National Forest. Cobweb skipper is not likely to occur on the permit area due to distance to known occurrence as well as difference in physiographic regions from known occurrence. Furthermore, early successional habitat is not found within the project area and therefore this species is not likely to occur within the project area or adjacent area.

Indiana Crayfish (*Orconectes indianensis*)

The Indiana crayfish is of the family *Cambaridae* (ILDNR). The mouth parts are long and wide and the acumen is one third-one half the length and is triangular. The upper section of the shell has spines and a deep grove near the head region. The shell is spotted. The ridges below the

shell are also grooved and end in spines. Their bodies are covered with hair. The abdomen is a little longer or the same size of the head and throat area. This area is narrower in the male than the female. In the spring the female has eggs and in late spring the eggs hatch (USFWS). The Indiana crayfish is found in rocky riffles and pools of small-medium freshwater streams (ILDNR). This crayfish is considered endangered in the state of Illinois (ILDNR). Indiana crayfish has two known occurrences in Johnson County 18.6 miles from the project area in the Shawnee National Forest in the Little Saline River and 21.0 miles from the project area, two occurrences in Pope County in the Shawnee National Forest in the Little Saline River, 18.4 and 20.8 miles from the project area, one occurrence on the Saline/Pope County border 20.0 miles from the project area in Rocky Branch Battle Ford Creek in the Shawnee National Forest, four occurrences in Saline County the closest is 18.3 miles from the project area in the Shawnee National Forest in the Little Saline River, and eight occurrences in Williamson County the closest being 11.4 miles from the project area in the South Fork Saline River. The Indiana crayfish is not likely to occur on the permit area due to distance to known occurrences, and the lack of rocky stream habitat preferred by this species.

Bigclaw Crayfish *(Orconectes placidus)*

The bigclaw crayfish is a large crustacean of the family *Cambaridae* (ILDNR). As the name specifies, this crayfish, when grown possesses very large pinching claws. This species of crayfish range in colors of black, brown, and green. Occurring only with in the southeastern portion of the state of Illinois, this crayfish is only found within the Big Creek drainage watershed (ILDNR). Habitat of the bigclaw crayfish include gravel and rubble riffles, along rocky banks and backwater areas (ILDNR). This species is considered endangered within the state of Illinois (USDA). The bigclaw crayfish has one known occurrence in Jackson County 40.7 miles from the project area in the Mississippi River-Grand Tower Island and one occurrence in Pope County 37.8 miles from the project area in the Shawnee National Forest along the Ohio River. The bigclaw crayfish is not likely to occur in the project area due to distance to known occurrences, difference in physiographic regions from known occurrence, and lack of the species preferred rocky stream habitat.

Fat Pocketbook (*Potamilus capax*)

Fat pocketbook is a member of the *Unionidae* family. It is found in sand, mud, and fine gravel in flowing water, man-made ditches, existing bayous, sloughs, and streams in the St. Francis watershed. It also inhabits large rivers in slow-flowing water in mud or sand. It is tolerant of depositional areas and is intolerant of high sedimentation rates (ICUN). Fat pocketbook is listed as endangered in the state of Illinois (ILDNR). The fat pocketbook has only one known occurrence in Pope County 54.7 miles from the project area in the Ohio River. Fat pocketbook is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence and a lack of preferred habitat.

Central Forestfly (*Prostoia completa*)

Central forestfly is a stonefly of the Nemouridae family (DeWalt). This fly is small in size, has no gills, and has diagonal banding on its wings (Ricker). This species range is in the Ozark

Mountains east to the Atlantic Ocean and North to the Canadian Maritime Provinces. Formerly, it was only found in one place in southwest Illinois, but since it has been discovered in other places in Illinois. It is found in gravel bottom rivers and streams (INHS). Central forestfly is listed as endangered in the state of Illinois (DeWalt). This fly has only two known occurrences in Union County in the Shawnee National Forest 38.1 and 38.3 miles from the project area. Central forestfly is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Purple Lilliput (*Toxolasma lividus*)

The purple lilliput is a small, dark mussel, approximately 1.2 inches in size, that is found in small to medium sized rivers and lakes. This species can be distinguished from other mussels its size by its robust hinge teeth and from other members of *Toxolasma* by its purple nacre (INHS). The purple lilliput has only two known occurrences in Pope County in the Shawnee National Forest, 28.9 miles from the project area and 29.3 miles from the project area in Big Grand Pierre Creek. Purple lilliput is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

Little Spectaclecase (*Villosa lienosa*)

The little spectaclecase is a small freshwater mussel of the *Unionidae* family. The shell is small (26.4 cm) slightly elongated, thin to moderately thick, compressed in males and inflated in females. The anterior end is rounded, posterior end bluntly pointed (males) or truncated (females). The dorsal margin is straight, ventral margin straight to slightly curved. The umbos are elevated above the hinge line. Periostracum green to dark brown, with green rays (often obscure). It is found in small to medium streams in sand or gravel (INHS). The little spectaclecase has one known occurrence in Pope County 28.9 miles from the project area in the Shawnee National Forest in Big Grand Pierre Creek and three occurrences in Union County 29.5, 30.7, 30.3 miles from the project area. Little spectaclecase is not likely to occur on the permit area due to distance to known occurrence, difference in physiographic regions from known occurrence, and a lack of preferred habitat.

LITERATURE CITED

Bannor, Brett K. and Erik Kiviat. 2002. Common Moorhen (*Gallinula chloropus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.eomell.edu/bna/species/685. Accessed September 2014.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University Press Kentucky, Lexington. 286 pp.

BCI (Bat Conservation International). Species Profiles – Myotis austroriparius. [Internet]. 2014. Bat Conservation International, Inc. [cited 2014 August 1]. Available from http://www.batcon.org/index.php/all-about-bats/species-profiles.html?task=detail&species=1693&country=11&state=53&family=all&limitstart=0.

Brack, W., Jr., and R.K. LaVal. 1985. Food habits of the Indiana bat in Missouri. Journal of Mammalogy. 66:308-315.

Butterflies and Moths of North America (BAMONA), available at http://www.butterfliesandmoths.org/. Data accessed 9/16/2014

CLO (The Cornell Lab of Ornithology). All About Birds. [Internet]. The Cornell Lab of Ornithology. [cited 2014 August 1]. Available from http://www.allaboutbirds.org/guide/search.aspx

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRue. 1979. Classifications of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79/31.

CPC (Center for Plant Conservation). National Collection of Imperiled Plants. [Internet]. Missour Botanical Garden. [cited 2014 August 1]. Available from http://www.centerforplantconservation.org/Collection/NationalCollection.asp

DeWalt R, Grubbs S (2011) Updates to the stonefly fauna of Illinois and Indiana. Illiesia 7: 31–50.http://www2.pms-lj.si/illiesia/papers/Illiesia07-03.pdf. Accessed September 2014.

Edgin, Bob and Anne Mankowski. 2013. Final Recovery Planning outline with Listing Status Review Triggers for the Illinois Endangered Leatherflower (Cleamtis viorna) Illinois Department of Natural Resources (ILDNR). http://www.dnr.illinois.gov/espb/documents/recovery%20docs/recovery%20planning%20outline%20clematis%20viorna%20082213%20-%20final022014.pdf. Accessed September 2014.

Esely, Jeff. No date. Loggerhead Shrike (*Lanius ludovicianus*). Mecklenburg County Division of Natural Resources.

FNAA (Flora of North America Association). Flora of North America. [Internet]. [cited 2014 August 1]. Available from http://www.efloras.org/flora_page.aspx?flora_id=1

Gardner and Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Bat Conservation International. Austin, Texas.

Gillespie, R.N. & Methven, A.S. PHAEOPHYSCIA LEANA-A LICHEN SPECIES AT THE EDGE. 2002. Eastern Illinois University. [2014 September 18] Available from http://www.eiu.edu/biology/posters/2002-03.pdf.

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition. The New York Botanical Garden Press. Bronx, NY.

Go Botany. Simple Key for Plant Identification. [Internet]. 201-2013. New England Wild Flower Society. [cited 2014 August 1]. Available from https://gobotany.newenglandwild.org/simple/

Godfrey, Robert K. and Jean W. Wooten. 1981. Aquatic and Wetland Plants of Southeastern United States, Dicotyledons. University of Georgia Press. Athens, GA.

HDR (HDR Engineering, Inc). Illinois Threatened and Endangered Species Review. September 2013.

Hill, Steven R. 2002. Conservation Assessment for French's Shootingstar (Dodecatheon frenchii). Technical Report 2002 (27). Illinois Natural History Survey. Chanpaign, IL.

Hoffman, J. E., and J. E. Gardner. 1992. A radiotelemetric study of home range size and dispersal of the marsh rice rat (*Oryzomys palustris*) in southern Illinois: progress report. Division of Natural Heritage, Illinois Department of Conservation and Bureau of Environment, Illinois Department of Transportation.

Hofmann, J. E., J. E. Gardner, and M. J. Morris. 1990. Distribution, abundance, and habitat of the marsh rice rat (*Oryzomys palustris*) in southern Illinois. Transactions Illinois State Academy of Science 83:162-180.

Hoffmeister, D. F. 2002. Mammals of Illinois. University of Illinois Press. 384 pp.

ILDNR (Illinois Department of Natural Resources). Checklist of Endangered and Threatened Animals and Plants of Illinois. [Internet]. February 22, 2011. Illinois Endangered Species Protection Board. [cited 2014 August 1]. Available from http://www.dnr.illinois.gov/ESPB/Documents/ETChecklist2011.pdf

Illinois Department of Natural Resources. 2008. Illinois Threatened and Endangered Species by County. http://dnr.state.il.us/ORC/list_tande_bycounty.pdf. Accessed 20 September 2008.

Illinois Natural History Survey (INHS). 2014. Ornate Box Turtle Species Bio available at www.inhs.illinois.edu/animals_plants/herps/species/te_ornata.html. Accessed 8/28/14.

Illinois Natural History Survey (INHS). 2014. River Cooter Turtle Species Bio available at http://www.inhs.illinois.edu/animals_plants/herps/species/ps_concinn.html. Accessed 9/4/14.

Illinois Natural History Survey (INHS). 2014. Smooth Softshell Turtle Species Bio available at http://www.inhs.illinois.edu/animals_plants/herps/species/ap_mutica.html. Accessed 9/4/14.

Illinois Natural History Survey. 2007. Conservation Assessment Green Wood Orchis (Poa clavellata (Michx.) Luer). https://www.ideals.illinois.edu/bitstream/handle/2142/18131/INHS2007_11.pdf?sequence=1. Accessed September 2014.

Illinois Natural History Survey. 2007. Conservation Assessment Grove Bluegrass (Poa alsodes A. Gray). https://www.ideals.illinois.edu/bitstream/handle/2142/18150/INHS2007_25.pdf?sequence=1. Accessed September 2014.

Illinois Natural History Survey. 2007. Conservation Assessment Joor's Panicgrass (Dichanthelium commutatun subsp. joorii (Vasey Freckmann & Lelong). https://www.ideals.illinois.edu/bitstream/handle/2142/18161/INHS2007_14.pdf?sequence=1 Accessed September 2014.

Illinois Natural History Survey. 2007. Conservation Assessment Yadkin Panicgrass (Dichanthelium dichotomum subsp. Vadkunense (Ashe) Freckmann & Lelong). https://www.ideals.illinois.edu/bitstream/handle/2142/18135/INHS2007_18.pdf?sequence=1 Accessed September 2014.

Illinois Natural History Survey. 2006. Conservation Assessment for Cypress-knee Sedge (Carex decomposita Muhl.). https://www.ideals.illinois.edu/bitstream/handle/2142/9963/inhscwpev02006i00009_opt.pdf?sequence=2 Accessed September 2014.

Illinois Natural History Survey. 2006. Conservation Assessment for Fairy-wand (Chamaelirium luteum (L.) A.Gray). https://www.ideals.illinois.edu/bitstream/handle/2142/34820/SBSM2006_05.pdf?sequence=2 Accessed September 2014.

Illinois Natural History Survey. 2006. Conservation Assessment for Giant Sedge (Carex gigantea Rudge.). http://www.researchgate.net/publication/32963831_Conservation_Assessment_for_Giant_Sedge_(Carex_gigantea_Rudge). Accessed September 2014.

Illinois Natural History Survey. 2003. Conservation Assessment for Black-stem Spleenwort (Asplenium resiliens Kunze). http://hdl.handle.net/2142/10069 Accessed September 2014.

Illinois Natural History Survey. 2003. Conservation Assessment for Hay-scented Fern (Dennstaedtia punctilobula (MichX) T.Moore). https://www.ideals.illinois.edu/bitstream/handle/2142/10502/inhsbiodv02003i00003_opt.pdf?sequence=2 Accessed September 2014.

Illinois Natural History Survey (ILHS). Yellow-crowned Night Heron Species Bio-Accessed - 9/4/14. Available at http://wwx.inhs.illinois.edu/collections/birds/ilbirds/77/. Accessed September 2014.

INHS (Illinois Natural History Survey). INHS Biological Collections. [Internet]. 2014. University of Illinois Board of Trustees. [cited 2014 August 1]. Available from http://wwx.inhs.illinois.edu/collections Accessed September 2014.

IUCN (International Union for Conservation of Nature and Natural Resources). The IUCN Red List of Threatened Species. [Internet]. 2014. International Union for Conservation of Nature and Natural Resources. [cited 2014 August 1]. Available from http://www.iucnredlist.org/

Kent, Thomas H. Carex intumescens (Bladder Sedge). [Internet]. August 16, 2013. FloraFinder.com. [cited 2014 August 1]. Available from http://www.florafinder.com/Species/Carex_intumescens.php

Macwhirter, R. Bruce and Keith L. Bildstein. 1996. Northern Harrier (Circus cyaneus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http:/lbna.birds.cornell.edu/bna/species/21. Accessed September 2014.

MNDNR (Minnesota Department of Natural Resources). Species Profile: Minnesota DNR. [Internet]. 2014. Minnesota Department of Natural Resources. [cited 2014 August 1]. Available from Virginia Tech. Dendrology at Virginia Tech. [Internet]. June 2014. Virginia Tech. [cited 2014 August 1]. Available from http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PMPOA4Z2M0 \

MNH (Smithsonian National Museum of Natural History). North American Mammals: Myotisaustroriparius. [Internet]. Smithsonian Institution. [cited 2014 August 1]. Available from http://www.mnh.si.edu/mna/image_info.cfm?species_id=202

Mohlenbrock, Robert H. 1999. The Illustrated Flora of Illinois Sedges: Carex. Southern Illinois University.

Mohlenbrock, R. H. and J. W. Voigt. 1959. a Flora of Southern Illinois. Southern Illinois University Press. Carbondale and Edwardsville, IL.

Morzillo, A. T., G. A. Feldhamer, and M. C. Nicholson. 2003. Home range and nest use of the golden mouse (Ochrotomys nuttalli) in southern Illinois. Journal of Mammalogy 84:553-560.

NCSU (North Carolina State University) NC Cooperative Extension: *Melothria pendula.* [Internet] 2014. [cited 2014 September 3] Available from http://plants.ces.ncsu.edu/plants/all/melothria-pendula/

NPIN (Native Plant Database) Buffalo Clover *(Trifolium reflexum)*. [Internet]. 2014. Lady Bird Johnson Wildflower Center. [cited 2014 September 2]. Available from http://www.wildflower.org/plants/result.php?id_plant=TRRE2

Nyboer, R. W., J. R. Herkert, and J. E. Ebinger, editors. 2004. Endangered and threatened species of Illinois: status and distribution. Volume 2: Animals. Illinois Endangered Species Protection Board.

ODNR (Ohio Division of Natural Resources). Buffalo Clover (Trifolium reflexum). [Internet] 1993. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. [cited 2014 September 2]. Available from http://naturepreserves.ohiodnr.gov/portals/dnap/pdf/Rare_Plant_Abstracts/Trifolium_reflexum.pdf

Page, Lawrence M. and Micahel E. Retzer. The Status of Illinois' Rarest Fishes and Crustaceans. Illinois Natural History Survey. Transactions of the Illinois State Academy of Science (2002), Volume 95, #4, pp. 311-326.

PNHP (Pennsylvania Natural Heritage Program). Oblique Milkvine (Matelea oblique). [Internet]. 2007. [cited 2014 August 1]. Available from http://www.naturalheritage.state.pa.us/factsheets/12958.pdf

Ricker W (1952) Systematic studies in Plecoptera. Indiana University Publication Science Series 18: 1–200. http://www.nativefishlab.net/library/textpdf/16861.pdf. Accessed September 2014.

Redder, A.J., C.K. Dodd, Jr., and D. Keinath. (2006, May 16). Ornate Box Turtle (Terrapene ornate ornate): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/preojects/scp/assessments/ornateboxturtle.pdf [September 2014].

Robinson, 1997. Birds of Southern Illinois. Southern Illinois University Press, Carbondale, IL

Sibley, D. A. 2003. The Sibley Field Guide to Birds of Eastern North America. Alfred A. Knopf. NY.

Schwegman, J. E. 1973. Comprehensive plan for the Illinois nature preserves system. Part 2. The natural divisions of Illinois. Illinois Nature Preserves Commission, Rockford, Illinois. 32 pp. + map.

Solymar, B. Dand J. D. McCracken. 2002. Draft National Recovery Plan for the Barn Owl and its Habitat.

Tenaglia, Dan. Missouri Flora. [Internet]. February 8, 2007. [cited 2014 August 1]. Available from http://www.missouriplants.com/

U.S. Department of Agriculture (USDA). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

U.S. Department of Agriculture (USDA). 2002. Conservation Assessment Featherbells (Stenanthium gramineum). Forest Service http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm91_054331.pdf. Accessed September 2014.

U.S. Department of Agriculture (USDA). 1996. Barn Owl Nest Box ftp://ftp-fc.sc. egov.usda.gov/CA/news/Publications/wild_habitat/owl_nest.pdf. Accessed January 30, 2012.

U.S. Department of Agriculture (USDA). *Quercus phellos* L. Forest Service http://www.na.fs.fed.us/pubs/silvics_manual/volume_2/quercus/phellos.htm. Accessed September 2014.

U.S. Fish and Wildlife Service (USFWS). 1999. Agency Draft: Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. Region 3 U.S. Fish and Wildlife Service, Ft. Snelling, Minnesota. March 1999.

USFWS (U.S. Fish & Wildlife Service). Ecological Services-Status Assessment. [Internet]. June 30, 2014. Jennifer Szymanski, BFO, Indiana. [cited 2014 August 1]. Available from http://www.fws.gov/midwest/es/soc/crustaceans/icf_sa.html.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Region 3 U.S. Fish and Wildlife Service. Fort Snelling, Minnesota. 258 pp.

U.S. Fish and Wildlife Service (USFWS). 2002. Indiana bat (*Myotis sodalis*) revised recovery plan, Agency Draft. Ft. Snelling, Minnesota. 69 pp.

U.S. Fish and Wildlife Service (USFWS). 2011. Fish and Wildlife Service Unveils National Plan to Combat Deadly White-Nose Syndrome in Bats. http://www.fws.gov/WhiteNoseSyndrome/. Accessed September 2014.

U.S. Fish and Wildlife Service (USFWS). 2009 (Revised 2013). Range-wide Indiana Bat Protection and Enhancement Plan Guidelines.

UWSP (University of Wisconsin Stevens Point). Robert W. Freckman Herbarium. [Internet]. 2012. [cited 2014 September 2]. Available from http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=TOMAUR . Accessed September 2014.

Virginia Tech. Forest Biology and Dendrology Education. Department of Forest Resources and Environmental Conservation. http://dendro.cnre.vt.edu/ . Accessed September 2014.

Wagner, D.M., G. A. Feldhamer, and J. A. Newman. 2000. Microhabitat selection by Golden Mice (*Ochrotomys nuttalli*) at arboreal nest sites. American Midland Naturalist 144:220-225.

Wildscreen Arkive. All Species-videos, photos, and facts. [Internet]. Wildscreen. [cited 2014 August 1]. Available from http://www.arkive.org/species/

Wiggins, D. A., D. W. Holt and S. M. Leasure. 2006. Short-eared Owl (Asio flammeus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/062. Accessed September 2014.

Wisconsin Department of Natural Resources (WIDNR). Pink Milkwort (*Polygala incarnata*). [Internet]. August 2014. Wisconsin Department of Natural Resources. [cited 2014 September 18]. Avaliable from http://dnr.wi.gov/topic/endangeredresources/plants.asp?mode=detail&speccode=pdpgl020p0 . Accessed September 2014.

Wisconsin Department of Natural Resources (WIDNR). 2006. Common Barn Owl (*Tyto alba*). http://www.dnr.state.wi.us/org/LAND/er/factsheets/birds/BARNOWL.HTM. Accessed September 22, 2008.

Site Specific Resource Information and Protection and Enhancement Plan

Wetland Areas

Coal Refuse Disposal Facility No.3
Permit Application No. 417
Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
2.1 Wetland Resources 1
2.2 Summary 1
3.0 PROTECTION AND ENHANCEMENT PLAN 2
3.1 Objective 1-Protection Measures 2
3.1.1 Avoid habitat impacts 2
3.2 Objective 2-Enhancement Measures 2
3.2.1 Post mining land use 2

1.0 INTRODUCTION

1.1 Project Description

The proposed Coal Refuse Disposal Facility No. 3 as proposed would impact 32.56 acres of palustrine forested (PFO) wetland. The applicant proposes permittee responsible compensatory mitigation for impacts associated with the refuse facility at an offsite location. All forested impacts shall be mitigated at ratio of 3:1. The conceptual mitigation plan proposes the creation of approximately 105 acres of forested wetland at one location within the Pond Creek watershed (Drawing Nos. B08-467-A15, B08-467-E21, and B08-467-M26).

Pursuant to 62 Illinois Administrative Code 1780.16 the following discussion outlines site specific resource information for wetland areas and pursuant to 62 Illinois Administrative code 1816.97 explains how riparian areas are to be avoided, enhanced, restored or replaced.

2.0 SITE SPECIFIC RESOURCE INFORMATION

Field investigation of the permit area was conducted on August 3, 2011 and February 28, 2012.

2.1 Wetland Resources

Wetland measurements were conducted by Alliance personnel on August 3, 2011 and February 28, 2012 to determine the total acreage of wetlands within the permit area. One (1) wetland was identified by Alliance personnel within the permit area (Table No. 1). The identified wetland was found to consist of the following wetland habitat type per the classification system developed by Cowardin et al. (1979) for wetland classification:

- Palustrine Forested (PFO) Wetland Habitat is characterized by woody vegetation that is 6m tall or taller (Cowardin, et al., 1979).

Table No. 1

Wetland ID	Hydrologic Connection*	Receiving Waters	8-Digit HUC	Wetland Type (Cowardin)	Est. size in permit area (ac.)	Dominant Wetland Community
Wetland A	Abutting	UNT to UNT to Pond Creek	Big Muddy River / 07140107	PF0	32.56	PF0
How the wetland(s) connects to TNW*:		Wetland A → Drainage patterns →UNT of UNT of Pond Creek (RPW)→UNT of Pond Creek(RPW)→Pond Creek (RPW)→Middle Fork Big Muddy River (TNW)				

2.2 Summary

The project contains forested wetland resources. The wetlands proposed to be affected have been impacted by agricultural land uses in one form or another due to sediment inflow, ditching or piping of water and/or redirection of hydrology sources over time.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the wetlands.

3.1.1 Avoid habitat impacts

The operation, being a surface facility, will need to disturb wetland resources within the project limits. The project, being a surface facility, cannot avoid any onsite wetland habitat and will result in the loss of 32.56 acres of wetland resources (Table No. 2). The facility, as proposed, has been minimized to the greatest extent practical. Wetland resources will be restored, replaced or enhanced in accordance with the Clean Water Act Section 404 permit for the facility at an offsite mitigation area.

Table No. 2

WETLAND	PERMIT AREA (ACRE)
Wetland A	32.56
TOTAL	32.56

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate land for the development of wetland habitat in the operation phase/post operation phase.

3.2.1 Post mining land use

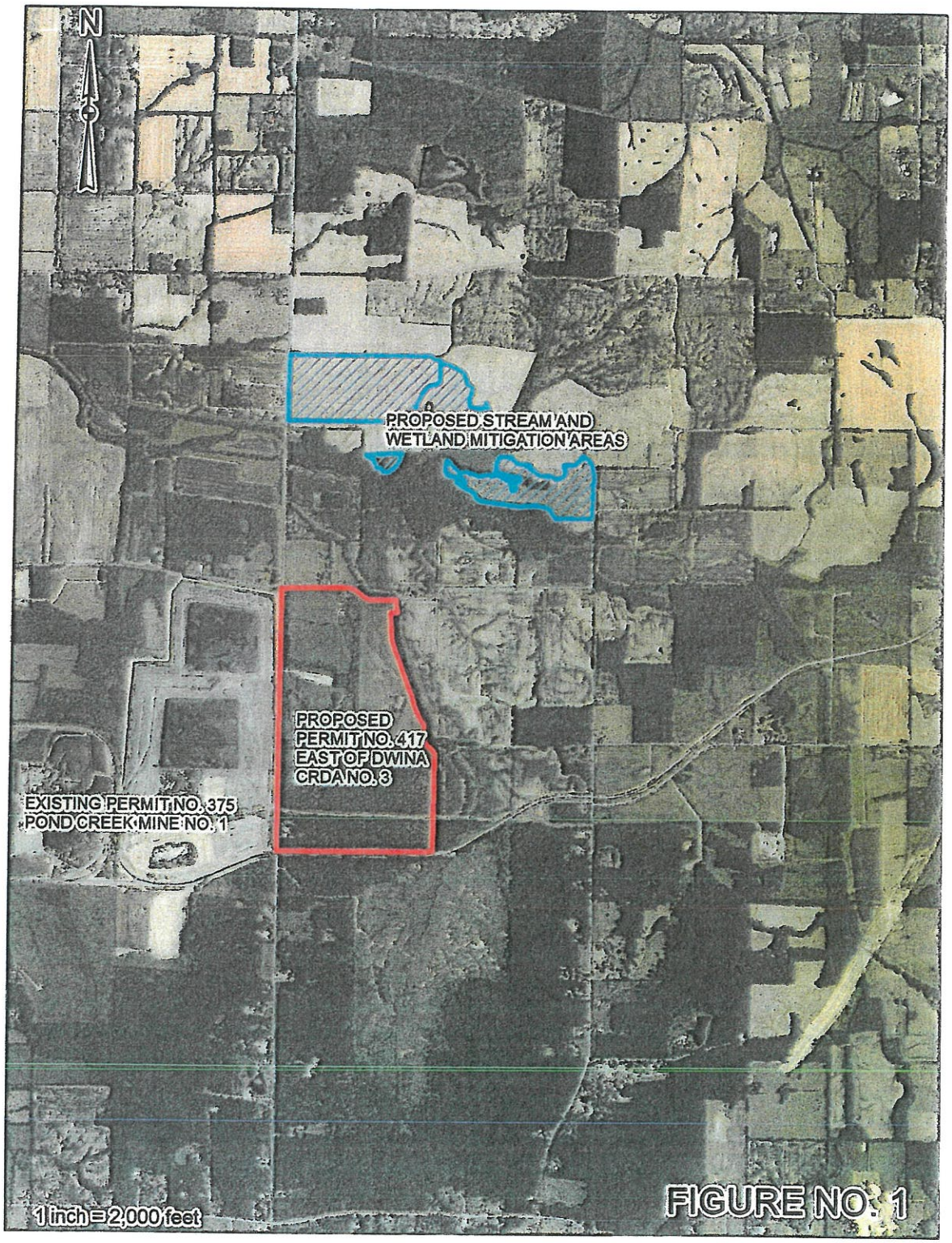
The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. The 3.67 acres of fish and wildlife water could over time develop wetland characteristics and restore some wetland function within the project area.

Offsite wetland mitigation at a site approximately 0.5 mile northeast of the permit area is proposed to compensate for the unavoidable loss of wetland habitat in association with the proposed project (refer to Figure No. 1). The proposed mitigation includes the creation of

approximately 105 acres of forested (PFO) wetland habitat in accordance with the compensatory mitigation plan associated with the project.

Stream and wetland mitigation plans and designs have been included within the Section 404 Joint Permit Application.

Figure No. 1


N
PROPOSED STREAM AND
WETLAND MITIGATION AREAS
PROPOSED
PERMIT NO. 417
EAST OF DWINA
CRDA NO. 3
EXISTING PERMIT NO. 375
POND CREEK MINE NO. 1
1 inch = 2,000 feet
FIGURE NO. 1

Site Specific Resource Information and Protection and Enhancement Plan

Riparian Areas

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
2.1 Definition of Functionally Impaired 2
2.2 Summary 3
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
3.2.2 Specialized Habitat Features 4

1.0 INTRODUCTION

1.1 Project Description

The proposed Coal Refuse Disposal Facility No. 3 would impact 1,517 linear feet of intermittent and ephemeral stream channels. The applicant proposes permittee responsible compensatory mitigation for impacts associated with the refuse facility at an off-site location. The stream impacts associated with the project consist of five intermittent and ephemeral channels. To mitigate for the impacts to 1,517 linear feet of stream channel, the applicant proposes to create 1,525 linear feet of stream channel. The created channel would serve as a hydrological connector between proposed wetland mitigation areas with the Pond Creek flood plain. A fifty foot from top of bank riparian buffer will be established along both sides of the created channel. The applicant has utilized the Illinois Stream Mitigation Method and has determined that 5,401.341 debits will be required to compensate for all stream impacts associated with the project. Based on the Illinois Stream Mitigation Method the applicant will generate 14,411.25 credits for the proposed stream mitigation. The total credits generated by the proposed compensatory mitigation plan will sufficiently compensate the total number of debits generated by the stream impacts for the proposed project.

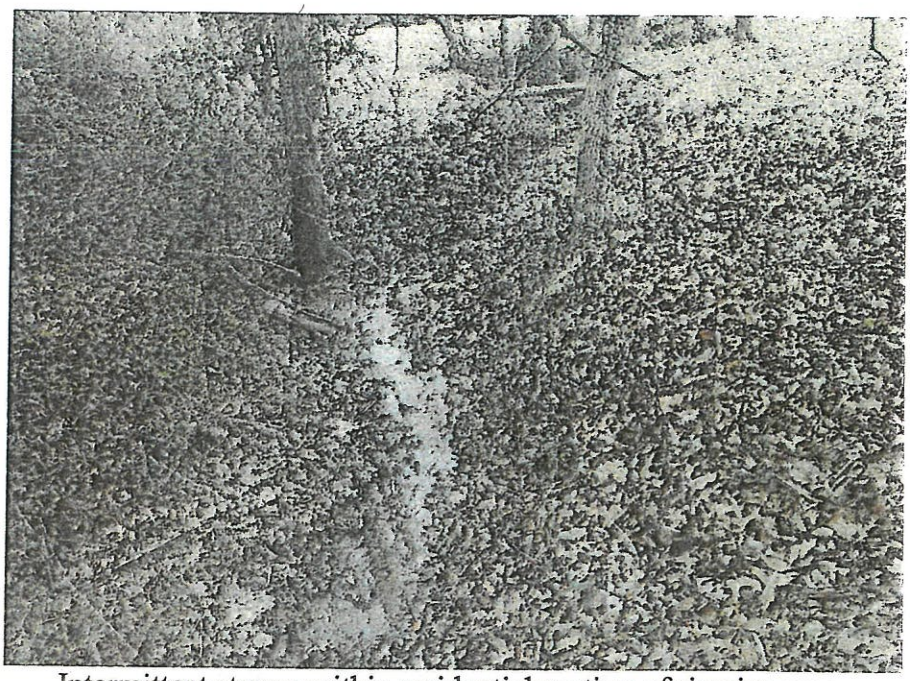
Pursuant to 62 Illinois Administrative Code 1780.16 the following discussion outlines site specific resource information for riparian areas and pursuant to 62 Illinois Administrative code 1816.97 explains how riparian areas are to be avoided, enhanced, restored or replaced.

2.0 SITE SPECIFIC RESOURCE INFORMATION

Stream assessments were completed on representative sections of the impacted streams to be impacted within the proposed project area utilizing multiple stream evaluation methodologies as outlined below:

Illinois Stream Mitigation Method

Based upon the Illinois Stream Mitigation Method, it was determined that the impacted streams were tertiary, functionally impaired streams. Sources of possible impairment were identified as surrounding agricultural practices within the watershed as well a gas pipeline right of way, roadway, and residential property within the permit area. The streams are small low gradient headwater streams with poorly developed pool and riffle structures, low habitat heterogeneity and low trophic complexity. In general, the riparian area is characterized as second growth deciduous forest with a dense vine and scrub/shrub understory; the left bank area is limited to approximately 300 feet due to roadway or residential property; the right bank is greater than 300 feet (See Representative Photographs).



Intermittent stream within residential portion of riparian area.



Ephemeral stream within second growth riparian area.

Based upon the Illinois Stream and Wetland Mitigation protocol, these channels were all identified as functionally impaired. This indicates that "Recovery is unlikely to occur naturally unless substantial rehabilitation/restoration is undertaken". Refer to the definition below.

2.1 Definition of Functionally Impaired

Functionally Impaired describes those streams that have been degraded in one or more

parameters and lacks resilience characterized by loss of one or more integrity functions. Recovery is unlikely to occur naturally unless substantial rehabilitation/restoration is undertaken.

A stream reach is considered functionally impaired if it has any of the following characteristics:

- Has been channelized and shows no evidence of self-recovery, or is leveed, impounded, or artificially constricted.
- Shows bank failure related to incision and not meandering (e.g. both banks failing).
- Shows evidence of sedimentation that contributes to degradation of physical habitat or water quality (e.g. listed in the Illinois Section 303(d) Impaired Waters List).
- Is openly grazed on one or both sides of the stream.
- The stream has little to no (0-25 feet) riparian buffer of deep-rooted vegetation on either side of the stream.
- The stream has one or more stream impacts within 0.5 miles upstream and downstream of the proposed stream impact, including culverts, pipes, or other manmade modifications.

2.2 Summary

The project contains intermittent and ephemeral stream channels as per the USACOE definition. However, they do not meet the Illinois DNR definition of intermittent found in 62 IL Part 1702. "Intermittent stream" means a stream or reach of a stream that drains a watershed of at least one square mile; or a stream or reach of a stream that is below the local water table for at least some part of the year, and obtains flow from both surface runoff and ground water discharge. The streams are small low gradient headwater streams with poorly developed pool and riffle structures, low habitat heterogeneity and low trophic complexity. In general, the riparian area is characterized as second growth deciduous forest with a dense vine and scrub/shrub understory.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the plants.

3.1.1 Avoid habitat impacts

The operation, being a surface facility, will impact approximately 1,517 linear feet of stream resources (Table 1). The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to

Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced through permittee responsible off-site compensatory mitigation.

Table 1. Stream Impact and Avoidance Measures

STREAM	PERMIT AREA (Linear Feet)	AVOIDANCE (Liner Feet)	PERCENT AVOIDANCE
Channel A	693	0	0
Channel A1	600	0	0
Channel A2	64	0	0
Channel A3	75	0	0
Channel A3a	85	0	0
UNT to Pond Creek*	2,400	100	100

*Permit area boundary designed to avoid UNT to Pond Creek

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat in the post operation phase.

3.2.1 Post mining land use

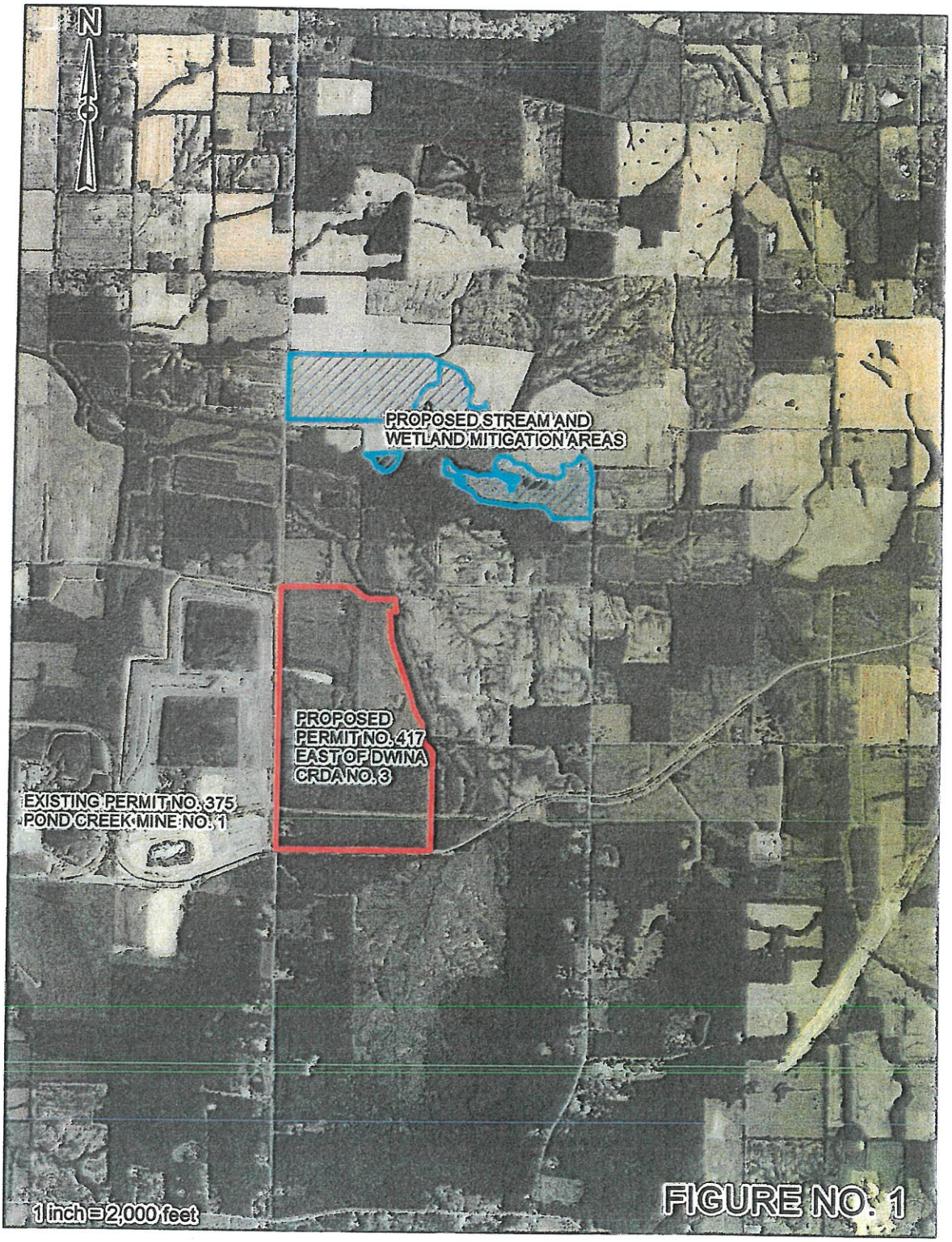
The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Offsite stream mitigation at a site approximately 0.5 mile northeast of the permit area is proposed to compensate for the unavoidable loss of stream habitat in association with the proposed project (refer to Figure No. 1). The proposed mitigation includes the creation of approximately 1,525 linear feet of ephemeral stream habitat in accordance with the compensatory mitigation plan associated with the project.

3.2.2 Specialized Habitat Features

As part of the applicant's compensatory stream mitigation for the proposed project, approximately 1,125 linear feet of stream channel will be created utilizing Natural Stream Design procedures (NSD). These created resources will replace stream function within the Pond Creek watershed at an approximate 3:1 ratio based upon the Illinois Stream and Wetland Valuation Metric.

Figure No. 1


N
PROPOSED STREAM AND
WETLAND MITIGATION AREAS
PROPOSED
PERMIT NO. 417
EAST OF DWINA
CRDA NO. 3
EXISTING PERMIT NO. 375
POND CREEK MINE NO. 1
1 inch = 2,000 feet
FIGURE NO. 1

Site Specific Resource Information and Protection and Enhancement Plan

Tubercled Orchid *(Plantanthera flava var. herbiola)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that tubercled orchid did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to tubercled orchid occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for tubercled orchid using the best available resources and current technology.

1.2 Species Description

The tubercled orchid is a perennial monocot of the family *Orchidaceae* (USDA). This species is a rare orchid has a lobed petal shape with at least one nectar spur present. Flower color is white with the main color of the lower petal being green to brown and yellow. Habitats of this plant is best known to be floodplains, forest edges, forests, fresh tidal marshes or flats, grassland, meadows and fields, riverine (in rivers or streams), shrub-lands or thickets, swamps, wetland margins (edges of wetlands), woodlands (Go Botany). This species is considered endangered within the state of Illinois (USDA). Tubercled Orchid has two known occurrences in Johnson County that are 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp and 33.2 miles from the project area in the Little Black Slough-Heron Pond Area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to tubercled orchid and its habitat. The protection measures include measures that will prevent adverse impacts to palustrine forest/scrub shrub habitat that serve as potential habitat to tubercled orchid.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for tubercled orchid in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide an area preferable for the potential growth of tubercled orchid.

4.0 LITERATURE CITED

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Go Botany. Simple Key for Plant Identification. [Internet]. 201-2013. New England Wild Flower Society. [cited 2014 August 1]. Available from https://gobotany.newenglandwild.org/simple/

Site Specific Resource Information and Protection and Enhancement Plan

Squirting Cucumber *(Melothria pendula)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that squirting cucumber did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to squirting cucumber occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for squirting cucumber using the best available resources and current technology.

1.2 Species Description

The squirting cucumber is a perennial dicot of the family *Cucurbitaceae*. This is a slender climbing vine with tendrils beside the leaves. The leaves of the vine are alternate and occur in 3-5 lobed bunches. The flower is 5 parted, and the fruit appears as a green or black berry with white seeds. The preferred habitat of this species is forest or natural areas, in low woods, fields, thickets, marshes; weedy in disturbed areas such as roadsides and fields (NCSU). This species is considered threatened within the state of Illinois (USDA). Squirting cucumber has two known occurrences in Jackson County in Shawnee National Forest 31.0 miles from the project area in Little Grand Canyon-Cedar Creek Natural Area and 38.3 miles from the project area, four occurrences in Pope County the closest is 23.3 miles from the project area in the Shawnee National Forest in Bell Smith Springs, three occurrences in Union County 40.7 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area, 43.0 and 44.0 miles from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to squirting cucumber and its habitat. The protection measures include measures that will prevent adverse impacts to upland forest, upland scrub shrub, upland forest/scrub shrub, and palustrine scrub/shrub habitats that serve as potential habitat to squirting cucumber.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site

through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for squirting cucumber in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential habitat for squirting cucumber.

4.0 LITERATURE CITED

FNAA (Flora of North America Association). Flora of North America. [Internet]. [cited 2014 August 1]. Available from http://www.efloras.org/flora_page.aspx?flora_id=

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Site Specific Resource Information and Protection and Enhancement Plan

Southern Grape Fern *(Botrychium biternatum)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that southern grape fern did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to southern grape fern occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for southern grape fern using the best available resources and current technology.

1.2 Species Description

Southern grape fern is a perennial fern of the family *Ophioglossaceae* (USDA). This fern has a stalk of 4-20 cm with 2-3 green pinnate blades that are 18x28 cm. Pinnae are in 7 horizontal pairs. Pinnules are elongated lanceolate with almost parallel fine-toothed margins and branching vein pattern. Leaves are green in winter and new leaves appear in spring-summer. *Spores* occur seasonally and there are 1-2 sori per pinnate. Leaves are green in winter and new leaves appear in spring-summer (FNAA). The southern grape fern grows in low woods and brushy fields and is considered threatened in the state of Illinois (FNAA; USDA) and is most commonly found in open oak-hickory woodlands. It is listed as state threatened and has listed occurrences in: Jackson County pre-1986, Pope County 1994, and Saline County 1997. Southern grape fern has three known occurrences in Pope County in the Shawnee National Forest 32.5 and 30.6 miles from the project area and 49.9 miles from the project area in Poco Cemetery Barrens. There are three known occurrences in Jackson County 25.4 miles from the project area, 34.0 and 31.0 miles from the project area in the Shawnee National Forest in Little Grand Canyon – Cedar Creek Natural Area. There is only one known occurrence in Saline County that is 14.9 miles from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field

identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management (. Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to southern grape fern and its habitat. The protection measures include measures that will prevent adverse impacts to grassland/herbaceous, upland scrub shrub, and scrub shrub/grassland/herbaceous habitats that serve as potential habitat to southern grape fern.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for southern grape fern in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential habitat for southern grape fern.

4.0 LITERATURE CITED

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

FNAA (Flora of North America Association). Flora of North America. [Internet]. [cited 2014 August 1]. Available from http://www.efloras.org/flora_page.aspx?flora_id=1

Site Specific Resource Information and Protection and Enhancement Plan

Short Eared Owl *(Asio flammeus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1 - Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2 - Enhancement Measures 3
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered species and protection and enhancement plans for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the short-eared owl did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the short-eared owl occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the short-eared owl using the best available resources and current technology.

1.2 Species Description

The short-eared owl is one of the world's most widely distributed owls (Wiggins et al. 2006). The owl's range extends across all of North America with breeding populations present in Canada and the northern U.S., and wintering populations present in the southern U.S. and Mexico (Wiggins et al. 2006). In southern Illinois the short-eared owl is considered an uncommon migrant and winter resident, and a very rare summer visitor (Robinson 1997). In southern Illinois, short-eared owls utilize large grassy fields and wetlands, especially those with tall vegetation (Robinson 1997). There are grassland habitats that represent potential foraging habitat for the short-eared owl in and adjacent to the proposed permit area. Given habitat conditions, a potential exists that the short-eared owl may occur in and adjacent to the proposed permit area. The short-eared owl has only one known occurrence in Saline County 15.7 miles away from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1-Protection Measures

The first objective of the protection and enhancement plan is to provide protective measures during the operation that will help the operator minimize disturbances to the short eared owl and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the short eared owl in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Offsite stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the short eared owl.

4.0 LITERATURE CITED

Robinson, 1997. Birds of Southern Illinois. Southern Illinois University Press, Carbondale, IL

Wiggins, D. A., D. W. Holt and S. M. Leasure. 2006. Short-eared Owl *(Asio flammeus),* The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/062

Site Specific Resource Information and Protection and Enhancement Plan

Northern Harrier *(Circus cyaneus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 3
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T &E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and to determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the northern harrier did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the northern harrier occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the northern harrier using the best available resources and current technology.

1.2 Species Description

Northern Harriers are medium-sized migratory raptors from the family *Accipitridae* (INHS; CLO). Their face is flat and round like an owls and a hooked bill (CLO). Their wings span 102-118 cm and have black tips (CLO). Their slim body is grey on top and white underneath, if male, or brown on top and white with brown streaks below, if female (CLO). They all have a white rear patch (CLO). They soar low with their wings in a V-shape (CLO). They feed mostly on small mammals and nest on the ground (CLO). The northern harrier's habitat consists of the arctic tundra, prairie grasslands, wetlands, meadows, fields and marshes (CLO). They are considered endangered in the state of Illinois (INHS). This species has been found in Saline County 23.1 miles from the project area, one occurrence in Pope County 31.9 miles from the project area in the Shawnee National Forest, and one occurrence in Johnson County 17.3 miles from the project area. The northern harrier is not likely to occur on the permit area due to distance to known occurrences.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1- Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the northern harrier and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 -Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the northern harrier in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. The herbaceous area will provide foraging habitat for the northern harrier.

Offsite stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the northern harrier.

4.0 LITERATURE CITED

CLO (The Cornell Lab of Ornithology). All About Birds. [Internet]. The Cornell Lab of Ornithology. [cited 2014 August 1]. Available from http://www.allaboutbirds.org/guide/search.aspx

INHS (Illinois Natural History Survey). INHS Biological Collections. [Internet]. 2014. University of Illinois Board of Trustees. [cited 2014 August 1]. Available from http://wwx.inhs.illinois.edu/collections

Site Specific Resource Information and Protection and Enhancement Plan

Manna Grass *(Glyceria arkansana)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that manna grass did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to manna grass occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for manna grass using the best available resources and current technology.

1.2 Species Description

Manna grass is a perennial monocot of the *Poaceae* family. It has culms 10-15 dm, rather soft often decumbent and rooting from the lower nodes. The leaves are 6-10 mm wide with a prominent ligule. The inflorescence is narrow at 2-4 dm. The spikelets are subsessile or short pedicelled, 1-2 cm, 8-16 flowered. The sheaths are closed and the lemmas are elliptic, 3.7-5.3 mm, blunt or rounded and are minutely short-hairy and nerved (Gleason). Manna grass flowers in May to June and forms a perfect flower (INHS). It is found in shallow water or very wet soil, along roadside ditches (Gleason). Manna grass is listed as state endangered. Manna grass has two know occurrences in Jackson County in the Shawnee National Forest, 31.0 miles from the project area in the Little Grand Canyon-Cedar Creek Natural Area and 38.4 miles from the project area, and two occurrences in Union County 38.8 miles from the project area in the Shawnee National Forest in LaRue-Pine Hills Research Natural Area and 51.8 miles from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to manna grass and its habitat. The protection measures include measures that will prevent adverse impacts to palustrine emergent habitat that serve as potential habitat to manna grass.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for manna grass in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide an area preferable for the potential growth of manna grass.

4.0 LITERATURE CITED

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Go Botany. Simple Key for Plant Identification. [Internet]. 201-2013. New England Wild Flower Society. [cited 2014 August 1]. Available from https://gobotany.newenglandwild.org/simple/

3001-15
part 3

R09075

Site Specific Resource Information and Protection and Enhancement Plan

Yellow-crowned Night Heron *(Nyctanassa violacea)*

Coal Refuse Disposal Facility
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 3
3.2.1 Post mining land use 3
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the yellow-crowned night heron did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the yellow-crowned night heron occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a PEP has been prepared for the yellow-crowned night heron using the best available resources and current technology.

1.2 Species Description

The yellow-crowned night heron is a nocturnal member of the family *Ardeidae*. This heron is medium in size and stocky. The body is primarily gray with yellow legs. The face and bill of the heron is black, cheeks are white, and the crown is marked with a bright yellowish stripe. Preferred habitat of the yellow-crowned night heron is within or near wetlands, on the coast along islands, mangroves, and barrier beaches; farther inland in wooded swamps, forested uplands, and lakes and rivers, sometimes near residential areas. Nesting usually occurs in small colonies, even with other wading birds. Primary prey for this species includes crustaceans and aquatic insects (CLO). This species is considered endangered within the state of Illinois (USDA). This species is known to occur in Williamson County 8.1 miles from the project area and four occurrences in Johnson County the closest being 29.2 miles in Deer Pond. The yellow-crowned night heron was not identified during the field survey of the site; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern

United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous

The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest

The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub

The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub

The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous

The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest

The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub

The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub

The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent

The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).
Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).
Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the yellow-crowned night heron and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the yellow-crowned night heron in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the

best available resources and current technology to ensure successful revegetation of the permit area.

Offsite stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the yellow-crowned night heron.

4.0 LITERATURE CITED

CLO (The Cornell Lab of Ornithology). All About Birds. [Internet]. The Cornell Lab of Ornithology. [cited 2014 August 1]. Available from http://www.allaboutbirds.org/guide/search.aspx

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Site Specific Resource Information and Protection and Enhancement Plan

American Strawberry Bush *(Euonymus americanus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that American strawberry bush did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to American strawberry bush occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for American strawberry bush using the best available resources and current technology.

1.2 Species Description

American strawberry bush is a perennial shrub of the *Celastraceae* family. It is a loose, suckering, sprawling shrub usually between 2 and 10 feet tall. It has opposite, simple, ovate to elliptical, 2-4 inches, finely toothed, bright green from above leaves. The flowers are perfect, small at 1/3 inch across, with five greenish-purple petals on clusters, appearing in late spring. The fruit is 4-lobed, pink to purple and open to reveal orange seeds. The bark is green but splits and becomes darker. The twigs are slender, square and green with a terminal reddish orange bud (Virginia Tech). It is found in deciduous woods, low sandy thickets, and swamps and prefers light shade. It is listed as state endangered (USDA). American strawberry bush has one occurrence in Pope County 49.1 miles from the project area in the Shawnee National Forest in the Poco Cemetery Barrens and three occurrences in Johnson County 31.9 miles from the project area, 34.3 miles from the project area in the Little Black Slough-Heron Pond Area, and 37.3 miles from the project area in Lower Cache River Swamp.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to American strawberry bush and its habitat. The protection measures include measures that will prevent adverse impacts to upland forest, upland scrub shrub, upland forest/scrub shrub and palustrine scrub shrub habitats that serve as potential habitat to American strawberry bush.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site

through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for American strawberry bush in the post mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. The establishment of forest habitat may provide an area preferable for the potential growth of the American strawberry bush.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide an area preferable for the potential growth of the American strawberry bush.

4.0 LITERATURE CITED

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/.

Go Botany. Simple Key for Plant Identification. [Internet]. 201-2013. New England Wild Flower Society. [cited 2014 August 1]. Available from https://gobotany.newenglandwild.org/simple/

Site Specific Resource Information and Protection and Enhancement Plan

Bald Eagle *(Haliaeetus leucocephalus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 3
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the bald eagle did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the bald eagle occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a PEP has been prepared for the bald eagle using the best available resources and current technology.

1.2 Species Description

The bald eagle isn't on the Illinois threatened and endangered species list, however it is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The bald eagle is a common migrant and winter resident along the Illinois and Mississippi Rivers and in southern Illinois on wildlife refuges (Nyboer 2004). It is considered an uncommon summer resident, but the number of nests in Illinois has been increasing in recent years (Nyboer 2004). In Illinois, bald eagles prefer relatively undisturbed areas along rivers and lakes (Nyboer 2004). They typically nest in the high branches of old trees and usually reuse nests in subsequent years (Nyboer 2004).

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous

The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management. Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures,

Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the bald eagle and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the bald eagle in the post-operation phase.

The applicant will utilize raptor safe suspension configurations and maintain at least 60" of clearance between lines, as well as raptor safe insulators and, if necessary, utilize perch guards on poles. It is important to note that existing electrical lines currently crosses the proposed permit area and no raptor fatalities are known to have occurred.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will serve as an area to allow for foraging and nesting habitat of the bald eagle.

4.0 LITERATURE CITED

Nyboer, R. W., J. R. Herkert, and J. E. Ebinger, editors. 2004. Endangered and threatened species of Illinois: status and distribution. Volume 2: Animals. Illinois Endangered Species Protection Board.

Site Specific Resource Information and Protection and Enhancement Plan

False Bugbane *(Cimicifuga racemosa)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that false bugbane did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to false bugbane occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for false bugbane using the best available resources and current technology.

1.2 Species Description

False bugbane, also known as black cohosh is a perennial herb of the *Ranunculaceae* family (USDA). It is a tall plant at 3-8 feet in height; the stem is glabrous and usually not grooved. It has alternate compound leaves with a serrate margin and oblong to ovate in shape. The flower is one to several racemes 6 inches or more long. The flower is white and appears to be all stamens since the petals are small. It blooms from June to July. The species prefers mesic deciduous woodlands (often where Sugar Maple is dominant) and the bases of bluffs along rivers (HDR). *Cimicifuga racemosa* is listed as state endangered (USDA). *Cimicifuga racemosa* has only one occurrence in Franklin County 7.7 miles from the project area in the Franklin County Country Club.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to false bugbane and its habitat. The protection measures include measures that will prevent adverse impacts to upland forest habitat that serve as potential habitat to false bugbane.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for false bugbane in the postmining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. The establishment of forest habitat may provide an area preferable for the potential growth of the false bugbane.

4.0 LITERATURE CITED

HDR (HDR Engineering, Inc). Illinois Threatened and Endangered Species Review. September 2013.

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/.

Site Specific Resource Information and Protection and Enhancement Plan

Cerulean Warbler (*Dendrioica cerulean*)

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 2
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 4
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the cerulean warbler did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the cerulean warbler occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a PEP has been prepared for the cerulean warbler using the best available resources and current technology.

1.2 Species Description

The cerulean warbler is a small warbler of the *Parulidae* family. It has a solidly colored back (sky-blue in males and blue-green in females) with stripes of same color down sides of white chest and has two broad white wingbars. It is 11 cm in lenagth has a 20 cm wingspan and weighs 8-10 grams (CLO). It is long winged and short tailed. Nesting birds prefer mature deciduous forests in both wet lowland and mountain slopes (Sibley). It nests and forages higher in the forest treetops than most other warblers. Its primary food is insects with some plant material (CLO). The cerulean warbler listed as state threatened for Illinois (INHS) and has two known occurrences in Union County in the Shawnee National Forest, 39.8 miles from the project area in LaRue-Pine Hills Research Natural Area and 41.5 miles from the project area and two occurrences in Jackson County 33.2 miles from the project area in the Shawnee National Forest in Little Grand Canyon-Cedar Creek Natural Area and 33.7 miles from the project area in Post Oak Glade. The cerulean warbler was not identified during the field survey of the site; however, habitat exists within the project area that could be used by this species. Therefore, presence has been assumed and a protection and enhancement plan prepared.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the cerulean warbler and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the cerulean warbler in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the cerulean warbler.

4.0 LITERATURE CITED

CLO (The Cornell Lab of Ornithology). All About Birds. [Internet]. The Cornell Lab of Ornithology. [cited 2014 August 1]. Available from http://www.allaboutbirds.org/guide/search.aspx

INHS (Illinois Natural History Survey). INHS Biological Collections. [Internet]. 2014. University of Illinois Board of Trustees. [cited 2014 August 1]. Available from http://wwx.inhs.illinois.edu/collections

Sibley, D. A. 2003. The Sibley Field Guide to Birds of Eastern North America. Alfred A. Knopf. NY.

Site Specific Resource Information and Protection and Enhancement Plan

Sedge *(Carex bromides)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that *C. bromides* did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to *C. bromides* occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for *C. bromides* using the best available resources and current technology.

1.2 Species Description

Carex bromides is a perennial monocot of the family *Cyperaceae* (INHS). It is a tussock forming sedge that reaches 8 dm, with main stem taller than leaves. The leaves are very slender, erect or ascending, 1.3-3.1 mm wide. Top spike contain both staminante and carpellate flowers. The perigynium has no hairs, the beak is bidentate and is 3.3-6.7 mm long Go-Botany). They flower from May to July and are found in forests, river or stream floodplains, shores of rivers or lakes, and swamps (INHS). It is considered threatened in the state of Illinois with a listed occurrence in Pope County 2009 and Johnson County 1996 (ILDNR). Sedge (*Carex bromoides*) has two known occurrences in Pope County in the Shawnee National Forest 45.7 miles from the project area in Cretaceous Hills Nature Preserve and 48.8 miles from the project area in Snow Springs and Kickasola Cemetery Barrens and Sweeps. It has one known occurrence in Johnson County 30.2 miles from the project area in the Shawnee National Forest in Grantsburg Swamp.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management. Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation

Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to *C. bromides* and its habitat. The protection measures include measures that will prevent adverse impacts to the palustrine forest and palustrine forest/scrub shrub habitat that serve as potential habitat to *C. bromides*.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for *C. bromides* in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide an area preferable for the potential growth of *C. bromides*.

4.0 LITERATURE CITED

ILDNR (Illinois Department of Natural Resources). Checklist of Endangered and Threatened Animals and Plants of Illinois. [Internet]. February 22, 2011. Illinois Endangered Species Protection Board. [cited 2014 August 1]. Available from http://www.dnr.illinois.gov/ESPB/Documents/ETChecklist2011.pdf

Illinois Department of Natural Resources. 2008. Illinois Threatened and Endangered Species by County. Available from http://dnr.state.il.us/ORC/list_tande_bycounty.pdf> Accessed 20 September 2008.

Site Specific Resource Information and Protection and Enhancement Plan

Barn Owl *(Tyto alba)*

Coal Refuse Disposal Facility No. 3

Permit Application No. 417

Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1 - Protection Measures 3
3.1.1 Avoid habitat impacts 4
3.2 Objective 2 - Enhancement Measures 4
3.2.1 Post mining land use 4
3.2.2 Specialized Habitat Features 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1784.21(a)(2)(A) and 1784.21(b)(2), the Illinois Department of Natural Resources (Department) requires an assessment of threatened and endangered species and protection and enhancement plans for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted and the barn owl was not identified. However, the habitat survey completed by Alliance determined that the barn owl *(Tyto alba)* could occur on the proposed permit area and adjacent area. Therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the barn owl using the best available resources and current technology.

1.2 Species Description

The barn owl is one of the most widespread vertebrate species on Earth, occurring on every continent except Antarctica (WDNR 2006). In southern Illinois, the barn owl is considered a rare year round resident. Barn owls inhabit open areas, including agricultural fields, grasslands and marshes. Their diet is dominated by voles and other small mammals (WDNR 2006). Barn owls nest and roost in a variety of places including hollows or natural cavities in trees, manmade structures, caves, and cliffs. Barn owl populations have been documented within Franklin County 5.8, 5.8 and 21.5 miles from the project area, three occurrences in Jackson County 18.7, 19.6, and 22.2 miles from the project area, five occurrences in Johnson County the closest is 23.7 miles from the project area, six occurrences in Pope County the closest being 19.5 miles from the project area in the Shawnee National Forest, two occurrences in Saline County 14.8 and 17.2 miles from the project area, ten occurrences in Union County the closest is 27.3 miles from the project area in the Shawnee National Forest, and three occurrences in Williamson 9.0, 10.0, and 15.9 miles from the project area.

Populations are stable in some parts of their range, but in the United States seven Midwestern states, including Illinois, list barn owls as threatened or endangered. The most often cited cause of these declines has been the loss of nesting, roosting, and foraging sites resulting from changing agricultural practices and urbanization (WDNR 2006). As agriculture has increased in scale and modern farming techniques have been implemented many farm buildings have disappeared from the landscape, rows of trees have been removed, and production has shifted from mixed grain and forage such as oats and hay to row crop monocultures dominated by com and soybeans.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed refuse area includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub

The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-operation phase to develop appropriate habitat for the species.

3.1 Objective 1- Protection Measures

The first objective of the protection and enhancement plan is to provide protective measures during the operation that will help the operator minimize disturbances to the barn owl and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2-Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the barn owl in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential foraging, roosting, and nesting habitat for the barn owl.

3.2.2 Specialized Habitat Features

Barn owls may use alternate structures such as barns, silos, and abandoned buildings that have an appropriately-sized cavity (USDA 1996). Constructing barn owl nest boxes near areas of foraging habitat may be an effective management strategy (Matteson and Petersen 1988, Schneider and Pence 1992). In order to enhance potential habitat for the barn owl, barn owl boxes will be incorporated into the post-mine reclamation plan. At least 2 barn owl boxes will be erected on the permit area after reclamation has occurred. Design and placement will be done in conjunction with IDNR biologists at the time of installation.

The USDA (1996) reports that wooded areas or open fields and meadows with few trees can provide appropriate conditions for owl nest box sites. Oaks *(Quercus spp.)* and the American sycamore *(Platanus occidentalis)* are ideal tree species. The barn owl nest boxes can face any direction and should be hung 3 feet below a stout tree limb suspended by cables or mounted on poles 15 to 30 feet above the ground. The entrance should be unobstructed and boxes should be positioned so they do not attract human attention. USDA (1996) recommends placing approximately 6 boxes per square mile. Boxes mounted high in barns or abandoned buildings also are readily occupied by owls. If the nest box is placed on a post, special caution should be taken by wrapping the post with an 18-inch metal, conical predator guard.

4.0 LITERATURE CITED

Solymar, B. Dand J. D. McCracken. 2002. Draft National Recovery Plan for the Barn Owl and its Habitat.

U.S. Department of Agriculture. 1996. Barn Owl Nest Box ftp://ftp-fc.sc. egov.usda.gov/CA/news/Publications/wild_habitat/owl_nest.pdf. Accessed January 30, 2012.

Wisconsin Department of Natural Resources. 2006. Common Barn Owl (Tyto alba). http://www.dnr.state.wi.us/org/LAND/er/factsheets/birds/BARNOWL.HTM. Accessed September 22, 2008.

EXAMPLE NEST BOX DESIGN

Example Barn Owl Nest Box Design

BARN OWL NEST BOX

Plans and Instructions

United States Department of Agriculture

Natural Resources Conservation Service
Davis, CA 95616

The barn owl (Tyto alba) is one of the most beneficial owls in the world. Farmers who know the merits of the barn owl strive to keep this "cat with wings" around their crops. One of the common resident owls, the barn owl has, a white heart-shaped face and is distinguished by whitish or pale cinnamon underparts (that look ghostly at night) and buffy or rusty upper plumage. Average barn owls weigh about 1 pound, and are approximately 15 inches long with a wingspan of about 40 inches.

Barn owls frequently are seen near roads, vacant fields, and wooded areas at night. Their call is a long, raspy scream. They hunt from perched or flying positions. Velvety feathers with soft fringes allow them to silently approach their prey, which they can find in total darkness. A barn owl's diet consists mainly of rodents, such as gophers, ground squirrels, and meadow mice.

The female lays 1 to 11 white eggs between November and July. Incubation is about 30 days. One to two broods are reared during the season with the young leaving the nest after about 8 weeks.

NESTING SITES

Barn owls do not build nests but lay eggs in holes in rotted trees, rocky cliffs, or bluffs. Alternatively, they may use structures with an appropriate cavity, including barns, silos, and abandoned buildings. You can encourage barn owls by building a nesting box and by establishing perching sites.

PICKING A NEST SITE

Good locations for barn owl nest boxes are wooded areas or in open fields and meadows with a few trees. Oak and sycamore are ideal tree species. The box can face any direction and should be hung 3 feet below a stout tree limb suspended by cables or mounted on poles 15 to 30 feet above the ground. The entrance should be unobstructed and the box positioned so it does not attract human attention. Place about 6 boxes per square mile. Boxes mounted high in barns or abandoned buildings also are readily occupied by owls. If the nest box is placed on a post, the post should be wrapped with an 18-inch metal, conical predator guard.

IMPORTANT FACTS TO CONSIDER

Honey bees frequently take over barn owl nest boxes, making them useless for nesting. About one fourth of the nest boxes in coastal southern California are used by honey bees.



About 65 percent of barn owl nesting attempts produce fledging young. Reasons for mortality include human disturbance, limb breakage, and attacks by raccoons, opossums, skunks, and bobcats.

Summer is the best time to erect a barn owl nest box. Boxes should not be disturbed during the nesting season or owls may desert them.

Barn owl nest boxes can be especially useful on farms and ranches where rodent control is desired.

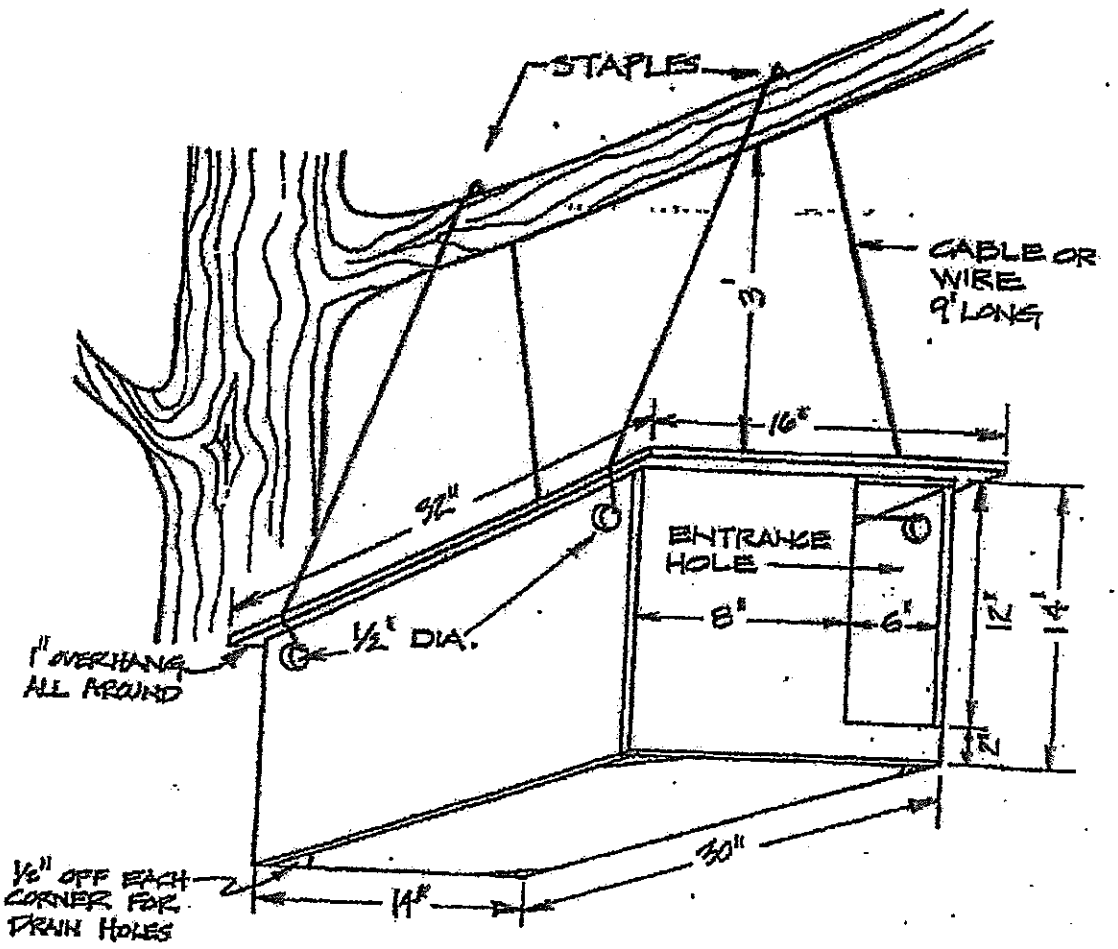
BUILDING A NEST BOX

Barn owl nest boxes are easy to build. Ideal material is 3/8-inch or 1/2-inch plywood. Nest boxes should be painted using a camouflage pattern or drab green, black, and brown to minimize human disturbance. Painting also helps prevent warping. Place a 2-inch layer of sawdust or wood chips in the bottom of the box and replace each year.

GUIDE

1. Make the entrance hole 6 inches wide by 12 inches high.
2. Hang or mount the box 15 to 30 feet above the ground and, if in a tree, 3 feet below a sturdy branch.
3. Use scrap exterior grade 3/8-inch or 1/2-inch ply wood.
4. Use #4 or #5 galvanized hot dipped box nails.
5. Use a marine grade plastic resin or exterior wood glue for assembly.
6. Make the roof 16 inches by 26 inches to give a 1-inch overhang all around.
7. Use wire staples to keep the cable from moving on the branch.
8. Use at least a 9-foot long piece of wire to hang boxes.

BARN OWL NEST BOX
Plans



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

Site Specific Resource Information and Protection and Enhancement Plan

Little Blue Heron *(Egretta caerulea)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 3
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T &E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and to determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that little blue heron did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to little blue heron occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for little blue heron using the best available resources and current technology.

1.2 Species Description

Little blue herons range from New England south to Florida along the Gulf Coast and north to Illinois (HDR). The little blue heron winters on the Gulf and the Atlantic Coasts north to New Jersey and can also be found in the tropics (HDR). This animal makes its home in freshwater swamps, lagoons, coastal thickets, and islands; where its diet consists of fish, crustaceans, amphibians, insects, and reptiles (HDR). Little blue heron has only one known occurrence in Franklin County 19.5 miles from the project area in Wayne Fitzgerrell Lake.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous

The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management. Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures,

Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1- Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to little blue heron and its habitat. The protection measures include measures that will prevent adverse impacts to the palustrine emergent and palustrine scrub shrub/emergent habitats that serve as potential habitat to the little blue heron.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 -Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for little blue heron in the post-

operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Offsite stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the little blue heron.

4.0 LITERATURE CITED

HDR (HDR Engineering, Inc). Illinois Threatened and Endangered Species Review. September 2013.

Site Specific Resource Information and Protection and Enhancement Plan

Loggerhead Shrike *(Lanius ludovicianus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operations in Franklin County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered species and protection and enhancement plans for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the loggerhead shrike within the project does not currently occur within the project area; however, it may occur on the adjacent area. This survey also indicated that habitat conducive to the shrike occurs both within and adjacent to the permit area. Therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the loggerhead shrike using the best available resources and current technology.

1.2 Species Description

The loggerhead shrike is native to North America and ranges from southern Canada to northern Mexico. In southern Illinois the loggerhead shrike is considered a fairly common year-round resident (Robinson 1997).

Loggerhead shrikes occupy many types of grassland habitats, but those containing shorter grasses interspersed with small trees and shrubs are generally preferred (Esely no date). Small trees and shrubs are necessary to provide suitable nest sites, hunting perches, and access to a wide variety of prey species (Esely). Alternately, grasslands devoid of adequate perches are not suitable for this species. The natural habitat of shrikes included such communities as prairies, savannas, and scrublands. However, the species is now largely dependent on human- created landscapes including agricultural pastures and hayfields, mowed roadways, and power line right-of-ways (Esely). Loggerhead shrike has two known occurrences in Jackson County in the Shawnee National Forest 35.1 and 37.7 miles from the project area, one occurrence in Union County 45.1 miles from the project area, two occurrences in Saline County 12.9 and 20.5 miles from the project area, one occurrence in Pope County 33.0 miles from the project area in the Shawnee National Forest, and one occurrence in Johnson County 21.1 miles from the project area in the Shawnee National Forest.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub,

palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1-Protection Measures

The first objective of the protection and enhancement plan is to provide protective measures during the operation that will help the operator minimize disturbances to the loggerhead shrike and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area

boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 -Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the loggerhead shrike in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential foraging habitat for the loggerhead shrike.

4.0 LITERATURE CITED

Esely, Jeff. No date. Loggerhead Shrike (Lanius ludovicianus). Mecklenburg County Division of Natural Resources.

Robinson, 1997. Birds of Southern Illinois. Southern Illinois University Press, Carbondale, IL

Site Specific Resource Information and Protection and Enhancement Plan

Climbing Milkweed *(Matelea decipiens)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that climbing milkweed did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to climbing milkweed occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for climbing milkweed using the best available resources and current technology.

1.2 Species Description

Climbing milkweed is of the *Aslepiadaceae* family. Climbing milkweed is a perennial vine with a complete regular flower that is violet with a brownish-purple corolla. Leaves are opposite, simple, entire and ovate to cordate in shape. Climbing milkweed typically grows in valleys and thickets along streams, open woods, and upland thickets. It is listed as state threatened for Illinois. Climbing milkweed (*Matelea decipiens*) has one occurrence in Johnson County 25.0 miles from the project area at Cedar Bluff in Ferne Clyffe State Park, one occurrence in Jackson County 30.2 miles from the project area, one occurrence in Williamson County 14.5 miles from the project area in Colp bottoms, and one occurrence on the Williamson/Union County border 22.4 miles from the project area in the Crab Orchard National Wildlife Refuge.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous

The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to climbing milkweed and its habitat. The protection measures include measures that will prevent adverse impacts to upland scrub shrub and upland forest/scrub shrub habitat hat serve as potential habitat to climbing milkweed.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for climbing milkweed in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential habitat for climbing milkweed.

4.0 LITERATURE CITED

Tenaglia, Dan. Eryngium prostratum. [Internet]. February 8, 2007. [cited 2014 August 1]. Available from http://www.missouriplants.com/Blueopp/Eryngium_prostratum_page.html.

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Site Specific Resource Information and Protection and Enhancement Plan

Common moorhen *(Gallinula chloropus)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the common moorhen did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the common moorhen occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the common moorhen using the best available resources and current technology.

1.2 Species Description

The common moorhen breeds throughout much of the eastern United States and locally in the West (Bannor et al. 2002). In the winter, it migrates to the southeastern and southwestern states with the largest concentration in Florida. The common moorhen is a very rare migrant and summer resident of southern Illinois (Robinson 1996). The habitat of the common moorhen includes wetlands such as, marshes, ponds, and ditches, where pools with deep water are interspersed with emergent or shoreline vegetation (Bannor et al. 2002). Common moorhen has one known occurrence in Perry County 42.3 miles from the project area in the Shawnee National Forest and one occurrence in Jackson County 39.8 miles from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to the common moorhen and its habitat. The protection measures include measures that will prevent adverse impacts to the downstream lakes that serve as potential habitat to the common moorhen.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the common moorhen in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the common moorhen.

4.0 LITERATURE CITED

Bannor, Brett K. and Erik Kiviat. 2002. Common Moorhen *(Gallinula chloropus),* The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://www.allaboutbirds.org/guide/Common_Moorhen/id .

Robinson, 1997. Birds of Southern Illinois. Southern Illinois University Press, Carbondale, IL

Site Specific Resource Information and Protection and Enhancement Plan

Dull Meadow Beauty *(Rhexia mariana)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that dull meadow beauty did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to dull meadow beauty occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for dull meadow beauty using the best available resources and current technology.

1.2 Species Description

Dull meadow beauty is a perennial dicot of the family *Melastomataceae* (USDA). The leaves of this plant are simple, opposite, and the edge of the leaf blade is entire. The flower of the dull meadow beauty possesses four petals and is purple in color with bright yellow stamens. This species' interpreting wetland status within the Midwest is obligate (OBL), meaning that it only grows with wetland habitats, shores of rivers or lakes, and sandplains/barrens (Go Botany). This species is considered endangered within the state of Illinois (USDA). Dull meadow beauty has one known occurrence in Saline County 14.5 miles from the project area, two occurrences in Pope County in the Shawnee National Forest, 45.2 miles from the project area in Cretaceous Hills Nature Preserve and Klondike Springs and 48.7 miles from the project area in Kickasola Cemetery Barrens and Sweeps. It has one known occurrence in Jackson County 23.1 miles from the project area and five occurrences in Williamson County 14.3 and 17.4 miles from the project area in Crab Orchard National Wildlife Refuge and 9.5, 15.1, and 16.8 miles from the project area.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern

United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to dull meadow beauty and its habitat. The protection measures include measures that will prevent adverse impacts to palustrine emergent habitat that serve as potential habitat to dull meadow beauty.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the

immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for dull meadow beauty in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide an area preferable for the potential growth of the dull meadow beauty.

4.0 LITERATURE CITED

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Go Botany. Simple Key for Plant Identification. [Internet]. 201-2013. New England Wild Flower Society. [cited 2014 August 1]. Available from https://gobotany.newenglandwild.org/simple/

Site Specific Resource Information and Protection and Enhancement Plan

Eryngo *(Eryngium prostratum)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that eryngo did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to eryngo occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for eryngo using the best available resources and current technology.

1.2 Species Description

Eryngo is a perennial dicot of the family *Apiaceae* (USDA). The stems can grow 40 cm long or longer and creep along the ground. The stems are hairless and ribbed. Leaves vary in shape in size, but are around 2 cm long and are oval and elliptic shaped. Some leaves are 3-lobed and all are hairless and have serrated margins. The inflorescence is 7-8 mm x 4mm and contains abundant clusters flowers that occur spring-fall. The flowers each measure .8-1 mm x .3 mm and have five hairless purple to blue petals. The habitat of eryngo consists of low wet woods, borders of swamps and ponds, and moist prairies (Tenaglia). It is listed as state endangered (USDA). Eryngo has one occurrence in Saline County 9.6 miles from the project area, one occurrence in Williamson County 17.7 miles from the project area in the Crab Orchard National Wildlife Refuge in Cambira Neck, and one occurrence in Pope County 22.6 miles from the project area in the Shawnee National Forest in Teal Pond.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to eryngo and its habitat. The protection measures include measures that will prevent adverse impacts to palustrine forest, palustrine scrub shrub, palustrine forest/scrub shrub, palustrine emergent, and palustrine scrub shrub/emergent habitats that serve as potential habitat to eryngo.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for eryngo in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Off-site stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation area may provide area preferable for the potential growth of eryngo.

4.0 LITERATURE CITED

Tenaglia, Dan. Eryngium prostratum. [Internet]. February 8, 2007. [cited 2014 August 1]. Available from http://www.missouriplants.com/Blueopp/Eryngium_prostratum_page.html

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Site Specific Resource Information and Protection and Enhancement Plan

Green Trillium *(Trillium viride)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that green trillium did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to green trillium occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for green trillium using the best available resources and current technology.

1.2 Species Description

Green trillium is a perennial monocot in the *Liliaceae* family (USDA). This plant had bluish-green mottled lance shaped leaves. It produces a green-yellow erect flower in the spring whose petals are sometimes streaked with purple. It is found in rich woods, bluffs, rocky hillsides with limestone outcrops, in woodsy, humus rich soil over a stiff clay substrate (FNAA). Green trillium is considered endangered in Illinois (USDA). Green trillium has one known occurrence in Franklin County 12.4 miles from the project area, one occurrence in Williamson County 15.0 miles from the project area, and one occurrence in Union County 26.2 miles from the project area in the Shawnee National Forest.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during mining that will help the operator minimize disturbances to green trillium and its habitat. The protection measures include measures that will prevent adverse impacts to upland forest habitat that serve as potential habitat to green trillium.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for green trillium in the post-mining phase of the operation.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide for potential habitat for green trillium.

4.0 LITERATURE CITED

FNAA (Flora of North America Association). Flora of North America. [Internet]. [cited 2014 August 1]. Available from http://www.efloras.org/flora_page.aspx?flora_id

USDA (United States Department of Agriculture). Plants Database. [Internet]. July 30, 2014. [cited 2014 August 1]. Available from http://plants.usda.gov/java/

Site Specific Resource Information and Protection and Enhancement Plan

Least Bittern (*Ixobrychus exilis*)

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:
Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1-Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2-Enhancement Measures 3
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres located northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1780.16(a)(2)(A) and 1780.16(b)(2), the Illinois Department of Natural Resources (Department) requires as assessment of threatened and endangered (T & E) species and Protection and Enhancement Plans (PEP) for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted. The survey completed by Alliance determined that the least bittern did not currently occur within the project area; however, it may occur within the adjacent area. This survey also indicated that habitat conducive to the least bittern occurs both within and adjacent to the permit area; therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a PEP has been prepared for the least bittern using the best available resources and current technology.

1.2 Species Description

Least bittern is the smallest heron and is of the *Ardeidae* family (INHS). It has buff wing patches with a dark crown and back and a wingspan of only 41-46 cm. Its sides are orange and the fonts of its neck and chest have orange and white stripes (INHS; CLO). The least bittern feeds on small fish and insects and nests on the ground (CLO). It makes a platform and canopy for the nest from vegetation and lays 2-7 eggs (CLO). Its habitat is in freshwater or brackish marshes with tall vegetation (CLO). It is considered endangered in Illinois (INHS). This species has one known occurrence on the Saline/Williamson County border 14.1 miles from the project area, one occurrence in Jackson County 38.6 miles from the project area in the Shawnee National Forest, and one occurrence in Union County 42.3 miles from the project area on the Shawnee National Forest border. The least bittern is not likely to occur on the permit area due to distance to known occurrences.

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed surface operation includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management . Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active mining phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-mining phase of the operation to develop appropriate habitat for the species.

3.1 Objective 1 - Protection Measures

The first objective of the PEP is to provide protective measures during the operation that will help the operator minimize disturbances to the least bittern and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2 - Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the least bittern in the post-operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area.

Offsite stream and wetland mitigation is proposed to compensate for the unavoidable loss of stream and wetland habitat in association with the proposed project. The proposed mitigation includes the creation of approximately 105 acres of forested (PFO) wetland habitat as well as approximately 1,525 linear feet of ephemeral stream channel in accordance with the compensatory mitigation plan associated with the project. This stream and wetland mitigation will provide foraging and nesting habitat for the least bittern.

4.0 LITERATURE CITED

CLO (The Cornell Lab of Ornithology). All About Birds. [Internet]. The Cornell Lab of Ornithology. [cited 2014 August 1]. Available from http://www.allaboutbirds.org/guide/search.aspx

INHS (Illinois Natural History Survey). INHS Biological Collections. [Internet]. 2014. University of Illinois Board of Trustees. [cited 2014 August 1]. Available from http://wwx.inhs.illinois.edu/collections

Site Specific Resource Information and Protection and Enhancement Plan

Ornate Box Turtle *(Terrapene ornata)*

Coal Refuse Disposal Facility No. 3
Permit Application No. 417
Williamson County, IL

Prepared for:

Williamson Energy, LLC

Project No. B08-467-1413

Prepared by:

Alliance Consulting, Inc.
124 Philpott Lane
Beaver, WV 25813

September 2014

Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 1
1.2 Species Description 1
2.0 SITE SPECIFIC RESOURCE INFORMATION 1
3.0 PROTECTION AND ENHANCEMENT PLAN 3
3.1 Objective 1 - Protection Measures 3
3.1.1 Avoid habitat impacts 3
3.2 Objective 2 - Enhancement Measures 4
3.2.1 Post mining land use 4
4.0 LITERATURE CITED 4

1.0 INTRODUCTION

1.1 Project Description

Williamson Energy, LLC (Williamson Energy), has proposed to permit an area for a coal refuse disposal operation in Williamson County, Illinois. The proposed permit area consists of 229 acres northeast of Johnston City in Williamson County, Illinois. Pursuant to Sections 1784.21(a)(2)(A) and 1784.21(b)(2), the Illinois Department of Natural Resources (Department) requires an assessment of threatened and endangered species and protection and enhancement plans for those deemed likely to occur in or adjacent to the proposed permit area. Williamson Energy obtained assistance from Alliance Consulting, Inc. (Alliance) to document the habitat and land use conditions on the proposed mine site and determine the likelihood of occurrence of T&E species. Species specific surveys were conducted and the ornate box turtle was not identified. However, the habitat survey completed by Alliance determined that the ornate box turtle *(Terrapene ornata)* could occur on the proposed permit area and adjacent area. Therefore, presence of the species is assumed. As a result, pursuant to 1780.16(b), a Protection and Enhancement Plan has been prepared for the ornate box turtle using the best available resources and current technology.

1.2 Species Description

The ornate box turtle is an uncommon to rare species within much of its range in Illinois (INHS 2014). In Illinois, the ornate box turtle is most commonly associated with prairie habitat. The ornate box turtle inhabits open areas, including agricultural fields, grasslands and pastures. Their diet is dominated by insects, although they also eat gnats, worms, tadpoles, and bird eggs (INHS 2014). Ornate box turtle populations have been documented within Franklin County 19.2 miles from the project area in Wayne Fitzgerrell State Park..

Ornate box turtles remain relatively common throughout much of their range, but in the United States seven Midwestern states, including Illinois, list ornate box turtles as threatened or endangered. The most often cited cause of these declines has been the destruction, degradation and fragmentation of its grassland habitat and anthropogenic affects due to collection or vehicle mortally (Redder et al 2006).

2.0 SITE SPECIFIC RESOURCE INFORMATION

The proposed refuse area includes 229 acres as shown on the permit maps. Eleven (11) habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

Grassland/Herbaceous
The majority of the project area (34%) exists as grassland/herbaceous (GH) habitat (77.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4).

Upland Forest
The project area contained 45.2 acres (20%) of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4).

Upland Scrub Shrub
The project area contained 5.6 acres (2%) of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management . Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4).

Upland Forest/Scrub Shrub
The project area contained 43.6 acres (19%) of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Scrub Shrub/Grassland/Herbaceous
The project area contained 3.2 acres (1%) of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Figures, Drawing No. B08-467-D4).

Palustrine Forest
The project area contained 20.0 acres (9%) of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer.

Palustrine Scrub Shrub
The project area contained 1.1 acres (<1%) of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall.

Palustrine Forest/Scrub Shrub
The project area contained 9.3 acres (4%) of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

Palustrine Emergent
The project area contained 2.0 acres (<1%) of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants.

Palustrine Scrub Shrub/Emergent
The project area contained 7.4 acres (3%) of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Figures, Drawing No. B08-467-D4).

Open Space Developed
The project area contained 14.4 acres (6%) of disturbed habitat which consists predominately of disturbance tolerant grasses and forbs, subject to regular management (mowing) as well as abandoned roadway (Figures, Drawing No. B08-467-D4).

Stream and Wetland Delineation
Aquatic resource delineations were submitted December 2010 and December 2012. One (1) palustrine forested wetland at 32.56 acres and five (5) intermittent and ephemeral streams at a total of 1,517 linear feet were delineated within the proposed Permit Area No. 417.

The grassland/herbaceous habitats on the site provide potential foraging and nesting areas for the ornate box turtle. Adjacent areas contain similar habitats. No potential nesting sites were found during site investigations and the likelihood of such sites being present is low due to the frequent soil saturation of the project area.

3.0 PROTECTION AND ENHANCEMENT PLAN

According to 62 Ill. Adm. Code Section 1780.16b)3)A) and B) a "Protection and Enhancement Plan" should include "protective measures" and "enhancement measures". The "protective measures" are to be used during the active phase of the operation and will help the operator to minimize disturbances and adverse impacts to the species or resource. The "enhancement measures" are to be used during reclamation and the post-operation phase to develop appropriate habitat for the species.

3.1 Objective 1- Protection Measures

The first objective of the protection and enhancement plan is to provide protective measures during the operation that will help the operator minimize disturbances to the ornate box turtle and its habitat.

3.1.1 Avoid habitat impacts

The proposed permit area was designed to avoid stream habitat that is associated with the immediate property boundary. To avoid potential impacts to stream habitat, the permit area

boundary was offset by a 100 foot from top of bank of an unnamed tributary to Pond Creek. This riparian buffer area provides those species that prefer riparian habitat an area to forage and nest. Where avoidance of potential habitat is not practical, habitat will be replaced either on-site through reclamation or off-site through compensatory mitigation.

3.2 Objective 2-Enhancement Measures

The second objective of the PEP is to provide appropriate habitat for the ornate box turtle in the post- operation phase.

3.2.1 Post mining land use

The post mining reclamation plan includes 91.08 acres of fish and wildlife herbaceous (cool season grasses), 117.45 acres of fish and wildlife herbaceous (warm season grasses), 17.65 of fish and wildlife woody and 3.67 acres fish and wildlife water. The applicant will utilize the best available resources and current technology to ensure successful revegetation of the permit area. This reclamation plan will provide approximately 208.53 acres for potential foraging, breeding, and nesting habitat for the ornate box turtle.

4.0 LITERATURE CITED

Illinois Natural History Survey (INHS). 2014. Ornate Box Turtle Species Bio available at www.inhs.illinois.edu/animals_plants/herps/species/te_ornata.html. Accessed 8/28/14.

Redder, A.J., C.K. Dodd, Jr., and D. Keinath. (2006, May 16). Ornate Box Turtle (Terrapene ornate ornate): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/preojects/scp/assessments/ornateboxturtle.pdf [September 2014].

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES

AT A PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON COUNTY, ILLINOIS WILLIAMSON ENERGY, LLC

Prepared for

WILLIAMSON ENERGY, LLC
WILLIAMSON COUNTY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
DECEMBER 2011

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES

AT A PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON COUNTY, ILLINOIS WILLIAMSON ENERGY, LLC

Prepared for

WILLIAMSON ENERGY, LLC
WILLIAMSON COUNTY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
DECEMBER 2011

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES AT A PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON COUNTY, ILLINOIS WILLIAMSON ENERGY, LLC

1.0 INTRODUCTION

Alliance Consulting, Inc. (Alliance) was contracted by Williamson Energy, LLC (Williamson) to conduct a survey for potential threatened and endangered bird and plant species at a proposed coal refuse disposal facility site located in Williamson County, Illinois. The proposed area of interest is shown in the Figures section, Drawing Number B08-467-A13. This report is hereby submitted on behalf of Williamson as a response to comments set forth by the Illinois Department of Natural Resources (IDNR) in the November 3, 2011 notice of completeness letter (Appendix A).

The survey for potential threatened and endangered bird and plant species, as listed in item 3 of the notice of completeness, letter was conducted by Alliance from September 19 through September 23, 2011. Survey services were completed in accordance with our proposal for professional ecological services and Williamson's subsequent authorization to proceed.

The purpose of the study was to survey the proposed coal refuse disposal facility site for the presence and/or probable absence of listed threatened and endangered bird and plants species within the project area. The survey was based on Alliance's professional judgment as well as general bird and vegetation survey protocols as modified by Alliance to target listed threated and endangered species.

2.0 SITE LOCATION

The proposed site is located northeast of Johnston City in Williamson County, Illinois and has its approximate center at Latitude 37.844380 and Longitude -88.812612. Drawing Number B08-467-A13, found in the Figures Section, documents the boundaries of the proposed coal refuse facility site. Project area waters flow in a northerly to northwesterly direction to the confluence with Pond Creek of the Big Muddy River of the Mississippi River (Figures, Drawing Numbers B08-467-A13 & B08-467-A8.

2.1 Watershed Information

The project deep mine and associated refuse facilities occur within the Big Muddy watershed in Illinois (Figures, Drawing Numbers B08-467-A6 & B08-467-A7). The primary receiving waterway, Pond Creek is a perennial stream that flows to the Big Muddy River a perennial stream that flows to the Mississippi River, a navigable water of the United States.

3.0 SURVEY METHODS

3.1 Vegetation Survey

Alliance conducted a field survey from September 19 through the 23, 2011 to identify general habitat types located within the project limits. General habitat types were

described and mapped with approximate acreage determined through GIS analysis. Vegetation species observed within each habitat type were recorded and dominant species identified. The plant indicator status and coefficient of conservatism (C of C) were listed to estimate the probability of a species occurring in wetlands versus non-wetlands in the region as well as its relative rank based on behavior and patterns of occurrence in Illinois plant communities (Taft et al., 1997). In general, species given a C of C value of 0-1 are adapted to severe disturbances, particularly anthropogenic disturbances, with only brief periods available for growth and reproduction; C of C value of 2-3 are associated with somewhat more stable, though degraded environments; C of C value of 4-6 include many dominant or matrix species for several habitats with a high consistence of occurrence within given community types; C of C value of 7-8 are taxa associated with mostly natural areas, but can be found persisting where the habitat has been degraded somewhat; and C of C value of 9-10 are considered to be restricted to high quality natural areas (Taft et al., 1997). Representative photographs were taken along with field notes describing the vegetation and habitat characteristics.

3.2 Sensitive Habitat Survey

Alliance conducted aerial and field surveys to determine if suitable or preferred habitat for listed threatened and endangered bird species occurred within the project limits. Additionally, an absence/presence survey was completed for those areas that potentially could contain listed threatened and endangered plants.

3.3 Migratory Bird Survey

A modified migratory bird survey was conducted on four consecutive days using a point-transect method. Six transects (A, B, C, D, E, F) were established throughout the site, with point intervals at approximately every 200 feet (Figures, Drawing No. B08-467-D1). The point intervals were ten minutes in duration and were conducted from 10:00 a.m. to 4:00 p.m. September 19 through the 22, 2011. All birds seen and heard during the 10-minute period were recorded as well as flight direction and time of observation. Species seen while walking transects were recorded as well. A Cannon EOS 60D camera was used to photograph bird species observed within the project limits. Guides used to aid in field identification and habitat preference for the bird surveys included: The Sibley Field Guide to Birds of Eastern North America, 2003; Birds of Illinois, 2004; and the Field Guide to the Birds of North America, 3rd edition, 1999.

3.4 Dawn & Dusk Bird Survey

Dawn and dusk point surveys were conducted on five consecutive days from September 19 through the 23, 2011. Three dawn (Monday, Wednesday, and Friday) and two dusk surveys (Tuesday and Thursday) were completed from daybreak (approximately 6:30 a.m.) to 10:00 a.m. and 6:00 p.m.to sunset (approximately 7:00 p.m.) respectively (Figures, Drawing No. B08-467-D1). All birds seen and heard during the point survey were recorded as well as flight direction, age, and time of observation. Point surveys were located at preferred habitat type for listed threatened and endangered bird species. A Cannon EOS 60D camera was used to photograph bird species observed within the project limits.

4.0 RESULTS

4.1 Vegetation Survey

Alliance previously conducted a wetland delineation on the site, which was verified by the U.S. Army Corps of Engineers, August 3, 2011 (Appendix A). Two palustrine forested wetlands were identified within the project area. Wetlands were 32.72 acres and 1.25 acres in size for a total of 33.97 acres. Additionally, approximately 978 linear feet of isolated drainage patterns was identified within the project area, individual drainage patterns were 500 linear feet and 478 linear feet in length.

Eleven habitat types were identified as occurring within the project limits: grassland/herbaceous, upland scrub shrub, upland forest, scrub shrub/grassland/herbaceous, upland forest/scrub shrub, palustrine emergent, palustrine scrub shrub, palustrine forest, palustrine emergent/scrub shrub, palustrine forest/scrub shrub, and developed open space. The project site predominately consists of grassland/herbaceous habitat as well as upland forest habitat. Guides used to aid in field identification for the vegetation survey included: Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition, 1991; a Flora of Southern Illinois, 1959; and the Tallgrass Prairie Wildflowers, 2005.

4.1.1 Grassland/Herbaceous

The majority of the project area exists as grassland/herbaceous (GH) habitat (82.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Appendix C, Photograph 1) (Figures, Drawing No. B08-467-D4). Table 1 lists plants species identified within the grassland/herbaceous habitat; dominant species are in bold:

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION

Scientific Name	Common Name	C of C	Indicator Status	Federally Listed	State Listed
Abutilon theophrasti	velvet leaf	*	FACU	NO	NO
Agrostis gigantea	common redtop	0	FACW	NO	NO
Agrostis stolonifera	creeping bentgrass	8	FACW	NO	NO
Ambrosia artemisiifolia	common ragweed	0	FACU	NO	NO
Ambrosia trifida	giant ragweed	0	FAC	NO	NO
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Apocynum cannabinum	Indian hemp	2	FAC	NO	NO
Arctium minus	burdock	*	UPL	NO	NO
Asclepias syriaca	common milkweed	0	UPL	NO	NO
Campsis radicans	trumpet creeper	2	FAC	NO	NO

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION					
Scientific Name	**Common Name**	**C of C**	**Indicator Status**	**Federally Listed**	**State Listed**
Cirsium arvense	Canada thistle	*	FACU	NO	NO
Cirsium vulgare	bull thistle	*	FACU	NO	NO
Conoclinium coelestinum	blue mistflower	3	FAC	NO	NO
Conyza canadensis	common horsetail	0	FAC	NO	NO
Cyperus esculentus	yellow nut sedge	0	FACW	NO	NO
Cyperus strigosus	straw-color sedge	0	FACW	NO	NO
Daucus carota	wild carrot	*	FACU	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Elymus glaucus	blue wild rye	--	FACU	NO	NO
Elymus hystrix	bottlebrush grass	5	NI	NO	NO
Eupatorium perfoliatum	common boneset	4	FACW	NO	NO
Eupatorium serotinum	lateflower boneset	1	FAC	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO
Helianthus tuberosus	Jerusalem artichoke	3	FAC	NO	NO
Ipomoea lacunosa	small-flower white morning glory	*	FACW	NO	NO
Juncus tenuis	path rush	0	FAC	NO	NO
Juncus torreyi	Torey's rush	3	FACW	NO	NO
Juniperus virginiana	eastern red cedar	1	FACU	NO	NO
Lactuca canadensis	wild lettuce	1	FACU	NO	NO
Lactuca serrioloa	prickly lettuce	*	FAC	NO	NO
Lamium amplexicaule	henbit	*	UPL	NO	NO
Lolium perenne	rye grass	*	FACU	NO	NO
Oenothera biennis	common evening primrose	1	FACU	NO	NO
Panicum capillare	witch grass	0	FAC	NO	NO

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION					
Scientific Name	Common Name	C of C	Indicator Status	Federally Listed	State Listed
Phleum pratense	timothy	*	FACU	NO	NO
Phytolacca americana	poke weed	1	FAC	NO	NO
Polygonum lapathifolium	nodding smartweed	0	FACW	NO	NO
Polygonum pensylvanicum	pinkweed	1	FACW	NO	NO
Polygonum persicaria	lady's thumb	*	FACW	NO	NO
Portulaca oleracea	common purslane	*	FAC	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rumex crispus	curly dock	*	FAC	NO	NO
Scirpus cyperinus	wool grass	5	OBL	NO	NO
Setaria faberi	foxtail	*	FACU	NO	NO
Setaria glauca	yellow foxtail	*	FAC	NO	NO
Solidago canadensis	tall goldenrod	1	FACU	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Sorghum halepense	Johnson grass	*	FACU	NO	NO
Symphyotrichum lateriflorum	small white aster	2	FACW	NO	NO
Symphyotrichum novae-angliae	New England aster	4	FACW	NO	NO
Tridens flavus	grease grass	1	UPL	NO	NO
Trifolium pratense	red clover	*	FACU	NO	NO
Trifolium repens	white clover	*	FACU	NO	NO
Vernonia gigantea	tall ironweed	4	FAC	NO	NO
Xanthium strumarium	cocklebur	0	FAC	NO	NO

4.1.2 Upland Forest

The project area contained 31.4 acres of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management (Appendix C, Photograph 2). Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4). Table 2 lists plant species identified within the upland forest habitat; dominant species are in bold:

TABLE 2. UPLAND FOREST HABITAT VEGETATION

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Acer saccharum	sugar maple	4	FACU	NO	NO
Ageratina altissima	white snakeroot	2	FACU	NO	NO
Agrimonia parviflora	common agrimony	5	FAC	NO	NO
Albizia julibrissin	silk tree	*	UPL	NO	NO
Arisaema triphyllum	Jack in the pulpit	4	FACW	NO	NO
Campsis radicans	trumpet creeper	2	FAC	NO	NO
Carya laciniosa	pignut hickory	7	FACW	NO	NO
Celtis occidentalis	hackberry	3	FAC	NO	NO
Commelina communis	Asiatic dayflower	*	FAC	NO	NO
Cornus florida	flowering dogwood	5	FACU	NO	NO
Desmodium canadensis	showy tick trefoil	5	FAC	NO	NO
Diospyros virginiana	common persimmon	2	FAC	NO	NO
Fraxinus americana	white ash	4	FACU	NO	NO
Gleditsia triacanthos	honey locust	2	FAC	NO	NO
Juglans nigra	black walnut	4	FACU	NO	NO
Leersia virginica	common cutgrass	3	FACW	NO	NO
Liquidambar styraciflua	sweet gum	6	FACW	NO	NO
Liriodendron tulipifera	tulip tree	5	FACU	NO	NO

TABLE 2. UPLAND FOREST HABITAT VEGETATION					
Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Lonicera japonica	Japanese honeysuckle	*	FACU	NO	NO
Morus alba	white mulberry	*	FAC	NO	NO
Oxydendrum arboreum	sourwood	*	NI	NO	NO
Parthenocissus quinquefolia	Virginia creeper	2	FAC	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Prunus serotina	black cherry	1	FACU	NO	NO
Pycnanthemum tenifolium	narrowleaf mountainmint	4	FAC	NO	NO
Quercus alba	white oak	5	FACU	NO	NO
Quercus coccinea	scarlet oak	7	UPL	NO	NO
Quercus imbricaria	shingle oak	2	FAC	NO	NO
Quercus macrocarpa	bur oak	5	FAC	NO	NO
Quercus rubra	red oak	5	FACU	NO	NO
Quercus velutina	black oak	5	UPL	NO	NO
Robinia pseudoacacia	black locust	1	FACU	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rubus allegheniensis	Allegheny blackberry	2	FACU	NO	NO
Rubus pennsylvanicus	blackberry	2	FAC	NO	NO
Sassafras albidum	sassafras	2	FACU	NO	NO
Smilax rotundifolia	greenbrier	4	FAC	NO	NO
Tilia americana	American basswod	5	FACU	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Ulmus rubra	slippery elm	3	FAC	NO	NO
Vitis aestivalis	summer grape	4	FACU	NO	NO

4.1.3 Upland Scrub Shrub

The project area contained 5.6 acres of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management (Appendix C, Photograph 3). Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4). Table 3 lists plant species identified within the upland scrub shrub habitat; dominant species are in bold:

TABLE 3. UPLAND SCRUB SHRUB HABITAT VEGETATION

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Cornus florida	flowering dogwood	5	FACU	NO	NO
Diospyros virginiana	common persimmon	2	FAC	NO	NO
Elaeagnus umbellata	autumn olive	*	FACU	NO	NO
Gleditsia triacanthos	honey locust	1	FAC	NO	NO
Juniperus virginiana	eastern red cedar	1	FACU	NO	NO
Lonicera japonica	Japanese honeysuckle	*	FACU	NO	NO
Lonicera tatarica	Tartarian honeysuckle	*	FACU	NO	NO
Morus alba	white mulberry	*	FAC	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Rhus copallinum	winged sumac	3	UPL	NO	NO
Robinia pseudoacacia	black locust	1	FACU	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rubus allegheniensis	Allegheny blackberry	2	FACU	NO	NO
Rubus pennsylvanicus	blackberry	2	FAC	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Vitis aestivalis	summer grape	4	FACU	NO	NO

4.1.4 Upland Forest/Scrub Shrub

The project area contained 45.9 acres of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Appendix C, Photograph 4) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.5 Scrub Shrub/Grassland/Herbaceous

The project area contained 3.2 acres of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Appendix C, Photograph 5) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.6 Palustrine Forest

The project area contained 21.3 acres of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Appendix C, Photograph 6) (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and an herbaceous layer. Table 4 lists plants species identified within the palustrine forest habitat; dominant species are in bold:

TABLE 4. PALUSTRINE FOREST HABITAT VEGETATION TABLE

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Arisaema triphyllum	Jack in the pulpit	4	FACW	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Bidens cernua	nodding stick-tight	2	OBL	NO	NO
Bidens coronata	tickseed sunflower	7	OBL	NO	NO
Bidens frondosa	beggar's ticks	1	FACW	NO	NO
Bidens polylepis	awnless beggar's ticks	1	FACW	NO	NO
Boehmeria cylindrica	false nettle	3	OBL	NO	NO
Carex annectens	yellow fruit sedge	3	FACW	NO	NO
Carex lacustris	lakebank sedge	6	OBL	NO	NO
Carex squarrosa	squarrosa sedge	5	OBL	NO	NO

TABLE 4. PALUSTRINE FOREST HABITAT VEGETATION TABLE					
Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Carex tribuloides	blunt broom sedge	3	FACW	NO	NO
Carex vulpinoidea	fox sedge	3	OBL	NO	NO
Cinna arundinacea	wood reed grass	5	FACW	NO	NO
Fraxinus pennsylvanica	green ash	5	FACW	NO	NO
Impatiens capensis	spotted jewelweed	2	FACW	NO	NO
Leersia oryzoides	rice cutgrass	3	OBL	NO	NO
Leersia virginica	common cutgrass	4	FACW	NO	NO
Ludwigia alternifolia	seedbox	5	OBL	NO	NO
Lycopus americanus	water horehound	3	OBL	NO	NO
Onoclea sensibilis	sensitive fern	5	FACW	NO	NO
Penthorum sedoides	ditch stonecrop	2	OBL	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Quercus palustris	pin oak	4	FACW	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Ulmus americana	American elm	5	FACW	NO	NO
Ulmus rubra	slippery elm	3	FAC	NO	NO

4.1.7 Palustrine Scrub Shrub

The project area contained 1.1 acres of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Appendix C, Photograph 7) (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall. Table 5 lists plant species identified within the palustrine scrub shrub habitat; dominant species are in bold:

TABLE 5. PALUSTRINE SCRUB SHRUB HABITAT VEGETATION TABLE					
Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO
Fraxinus pennsylvanica	green ash	5	FACW	NO	NO
Ipomoea lacunosa	small-flower white morning glory	*	FACW	NO	NO
Paspalum pubiflorum	hairy-seed paspalum	3	FACW-	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Ulmus americana	American elm	2	FACW	NO	NO
Ulmus rubra	slippery elm	2	FAC	NO	NO

4.1.8 Palustrine Forest/Scrub Shrub

The project area contained 9.7 acres of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Appendix C, Photograph 8) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.9 Palustrine Emergent

The project area contained 2.0 acres of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Appendix C, Photograph 9) (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants. Table 6 lists plant species identified within the palustrine emergent habitat; dominant species are in bold:

TABLE 6. PALUSTRINE EMERGENT HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Acer rubrum	red maple	5	FAC	NO	NO
Agrimonia parviflora	common agrimony	5	FAC	NO	NO
Agrostis gigantea	common redtop	0	FACW	NO	NO
Agrostis stolonifera	creeping bentgrass	8	FACW	NO	NO
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Apocynum cannabinum	Indian hemp	2	FAC	NO	NO
Betula nigra	River birch	4	FACW	NO	NO
Bidens cernua	nodding stick-tight	2	OBL	NO	NO
Bidens coronata	tickseed sunflower	7	OBL	NO	NO
Bidens frondosa	beggar's ticks	1	FACW	NO	NO
Carex tribuloides	blunt broom sedge	3	FACW	NO	NO
Carex vulpinoidea	fox sedge	3	OBL	NO	NO
Cyperus esculentus	yellow nut sedge	0	FACW	NO	NO
Cyperus strigosus	straw-color sedge	0	FACW	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Eupatorium perfoliatum	common boneset	4	FACW	NO	NO
Eupatorium serotinum	lateflower boneset	1	FAC	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO
Impatiens capensis	spotted jewelweed	2	FACW	NO	NO
Juncus effusus	soft rush	4	OBL	NO	NO
Juncus tenuis	path rush	0	FAC	NO	NO
Juncus torreyi	Torey's rush	3	FACW	NO	NO
Leersia oryzoides	rice cutgrass	3	OBL	NO	NO

TABLE 6. PALUSTRINE EMERGENT HABITAT VEGETATION TABLE					
Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Leersia virginica	common cutgrass	4	FACW	NO	NO
Ludwigia alternifolia	seedbox	5	OBL	NO	NO
Ludwigia palustris	marsh seedbox	4	OBL	NO	NO
Panicum capillare	witch grass	0	FAC	NO	NO
Penthorum sedoides	ditch stonecrop	2	OBL	NO	NO
Phragmites australis	common reed	0	FACW	NO	NO
Polygonum lapathifolium	nodding smartweed	0	FACW	NO	NO
Polygonum pensylvanicum	pinkweed	1	FACW	NO	NO
Polygonum persicaria	lady's thumb	*	FACW	NO	NO
Polygonum sagittatum	tear thumb	5	OBL	NO	NO
Rumex verticillatus	swamp dock	5	OBL	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Scirpus atrovirens	green bulrush	4	OBL	NO	NO
Scirpus cyperinus	wool grass	5	OBL	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Symphyotrichum lateriflorum	small white aster	2	FACW	NO	NO
Symphyotrichum novae-angliae	New England aster	4	FACW	NO	NO
Typha angustifolia	narrow leaved cattail	*	OBL	NO	NO
Typha latifolia	broad leaved cattail	1	OBL	NO	NO
Ulmus americana	American elm	5	FACW	NO	NO
Verbena hastata	blue vervain	3	FACW	NO	NO

4.1.10 Palustrine Scrub Shrub/Emergent

The project area contained 7.4 acres of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Appendix C, Photograph 10) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.11 Open Space Developed

The project area contained 6.9 acres of vegetation which consists predominately of disturbance tolerant grasses and forbs and is subject to regular management (mowing) (Appendix C, Photograph 11) (Figures, Drawing No. B08-467-D4). Table 7 lists plant species identified within the open space developed habitat; dominant species are in bold:

TABLE 7. OPEN SPACE DEVELOPED HABITAT VEGETATION TABLE

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Cirsium arvense	Canada thistle	*	FACU	NO	NO
Cirsium vulgaris	bull thistle	*	FACU	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Glechoma hederacea	ground ivy	*	FACU	NO	NO
Lamium amplexicaule	henbit	*	--	NO	NO
Lolium perenne	rye grass	*	FACU	NO	NO
Medicago lupulina	black medic	*	FAC	NO	NO
Oxalis stricta	common yellow wood sorrel	0	FACU	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Portulaca oleracea	common purslane	*	FAC	NO	NO
Setaria faberi	foxtail	*	FACU	NO	NO
Setaria glauca	yellow foxtail	*	FAC	NO	NO
Sorghum halepense	Johnson grass	*	FACU	NO	NO
Taraxacum officinale	dandelion	*	FACU	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Tridens flavus	grease grass	1	UPL	NO	NO
Trifolium pratense	red clover	*	FACU	NO	NO
Trifolium repens	white clover	*	FACU	NO	NO

4.2 Sensitive Habitat Survey for Listed Plant Species

Eleven listed threatened and endangered plant species for Williamson and surrounding counties (Appendix B) were determined to potentially occur within the permit area. Those natural communities with the potential to contain the eleven listed species were further investigated for the presence of listed threatened and endangered species.

4.2.1 Palustrine Forest

Four listed threatened and endangered species for Williamson and surrounding counties were identified within the literature to prefer palustrine forested wetland habitat. Species investigated included: *Eryngium prostratum, Plantago cordata, Carex oxylepsis,* and *Carex intumescens.*

Eryngium prostratum – eryngo is of the *Apiaceae* family and is listed as state endangered for Williamson, Saline, and Pope Counties. Eryngo is a perennial dicot which grows prostrate with roots at nodes so leaves appear basal. The flower is blue-violet with simple, entire to serrate leaf margins and lanceolate to ovate leaf shape. Eryngo is typically found within palustrine forest wetland habitat, muddy and sandy shores, and edges of artificial impoundments. Field investigations did not reveal the presence of eryngo within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Plantago cordata – heart-leaved plantain is of the *Plantaginaceae* family and is listed as state endangered for Jackson, Saline, Pope and Johnson Counties. Heart-leaved plantain is a perennial dicot with spike inflorescence. Leaves are simple, entire to undulate and ovate to cordate in shape with a basal arrangement. Heart-leaved plantain typically grows outside of direct sun on the gravel beds along slow moving intermittent streams and occasionally in fine textured soils of wet woodlands. Field investigations did not reveal the presence of heart-leaved plantain within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Carex oxylepsis – sharp-scaled sedge is of the *Cyperaceae* family and is listed as state threatened for Saline, Union and Johnson Counties. Sharp-scaled sedge is a perennial monocot with a terminal spike inflorescence. Leaves are simple, entire and linear in shape. Sharp-scaled sedge typically grows in wet woodlands with an open understory (out of direct sunlight). Field investigations did not reveal the presence of sharp-scaled sedge within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Carex intumescens – swollen sedge is of the *Cyperaceae* family and is listed as state threatened for Saline, Pope and Johnson Counties. Swollen sedge is a perennial monocot with a terminal spike inflorescence that is globose or ovoid in shape. Leaves are simple, entire and linear in shape. Swollen sedge typically grows wet to moist deciduous woodlands, swamps, low shaded areas along streams or rivers, and shady seeps. Field investigations did not reveal the presence of swollen sedge within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

4.2.2 Palustrine Emergent

One listed threatened and endangered species for Williamson County was identified within the literature to prefer palustrine emergent habitat. Species investigated included: *Paspalum dissectum.*

Paspalum dissectum – bead grass is of the *Poaceae* family and is listed as state endangered for Williamson County. Bead grass is a perennial monocot which grows in a creeping, branching characteristic and often forms mats. Bead grass is typically found within palustrine emergent wetland habitat, shallow water, muddy shores, and ditches. Field investigations did not reveal the presence of bead grass within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

4.2.3 Upland Forest

Four listed threatened and endangered species for Williamson and surrounding counties were identified within the literature to prefer upland forested habitat. Species investigated included: *Cimicifuga racemosa, Carex communis, Trillium viride,* and *Spiranthes vernalis.*

Cimicifuga racemosa – black cohosh (syn. *Actaea racemosa*) is of the *Ranunculaceae* family and is listed as state endangered for Williamson County. Black cohosh is a perennial dicot that grows up to 6 ½ feet tall. The inflorescene is terminal and axillary. Flowers consist of many white stamens and have no petals and sepals. The leaves are basal, alternate, ternately divided with serrate margin leaflets. Black cohosh is typically found within mesic deciduous woodlands. Field investigations did not reveal the presence of black cohosh within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Carex communis – fibrous-rooted sedge is of the *Cyperaceae* family and is listed as state threatened for Saline, and Pope Counties. Fibrous-rooted sedge is a perennial monocot with both staminate and pistillate spikes on each inflorescence that is elongate in shape. Leaves are simple, entire and linear in shape, often purple at the base. Fibrous-rooted sedge is densely cespotose and typically grows in mesic to dry-mesic upland forest communities. Field investigations did not reveal the presence of fibrous-rooted sedge within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Trillium viride – green trillium is of the *Liliaceae* family and is listed as state endangered for Williamson, Franklin, and Union Counties. Green trillium is a perennial monocot with leaves that are oblong to broadly ovate. The flowers are sessile and typically bright green. Green trillium is typically found on rich or rocky wooded slopes, generally in limestone areas. Field investigations did not reveal the presence of green trillium within the project boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

Spiranthes vernalis – spring ladies tresses is of the *Liliaceae* family and is listed as state endangered for Johnson County. Spring ladies tresses is a perennial monocot with leaves that are entire, simple; linear in shape and arranged alternate/basal. The inflorescence is a raceme spike and typically yellow to white in color. Spring ladies tresses is typically found on rich or rocky wooded slopes, generally in limestone areas. Field investigations did not reveal the presence of spring ladies tresses within the project boundaries.

Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

4.2.4 Upland Scrub Shrub

One listed threatened and endangered species for Williamson and surrounding counties was identified within the literature to prefer upland scrub shrub habitat. Species investigated included: *Matelea decipiens;* field investigations did not reveal the presence of this plant species.

Matelea decipiens – climbing milkweed is of the *Aslepiadaceae* family and is listed as state endangered for Williamson, Jackson and Union Counties. Climbing milkweed is a perennial vine with a complete regular flower that is violet with a brownish-purple corolla. Leaves are opposite, simple, entire and ovate to cordate in shape. Climbing milkweed typically grows in valleys and thickets along streams, open woods, and upland thickets. Field investigations did not reveal the presence of climbing milkweed within the permit boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

4.2.5 Grassland/Herbaceous

One listed threatened and endangered species for Williamson and surrounding counties was identified within the literature to prefer grassland/herbaceous habitat. Species investigated included *Scleria pauciflora*; field investigations did not reveal the presence of this plant species.

Scleria pauciflora – Carolina whipgrass is of the *cyperaceae* family and is listed as state endangered for Saline, Johnson and Pope Counties. Carolina whipgrass is a perennial monocot with an inflorescence that is mostly composed of small terminal clusters. Leaves are simple, entire and linear in shape. Carolina whipgrass is typically found on exposed sandstone ledges, chert, or granite of glades and barrens; open woodlands and prairies, and bluff edges. Field investigations did not reveal the presence of Carolina whipgrass within the permit boundaries. Therefore, in our professional opinion, this species is not likely to occur within the permit limits. No adverse effect is expected.

4.3 Birds

Thirty-four species of birds were identified as occurring within the project limits by sightings and calls (Table 8). All species observed were determined to be common and breeding season or year-round residents. Representative photographs of typical bird species encountered during bird surveys are included in Appendix C.

TABLE 8. OBSERVED BIRD SPECIES

Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Agelaius phoeniceus	red-winged blackbird	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PEM
Aix sponsa	wood duck	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PFO

TABLE 8. OBSERVED BIRD SPECIES						
Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Ardea alba	great egret	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	DS
Ardea herodias	great blue heron	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH
Anas platyrhynchos	mallard	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	PEM
Atchilochus colubris	ruby throated hummingbird	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	GH, SS
Bombycilla cedrorum	cedar waxwing	9/20/2011	Year-Round Resident	Not Listed	Not Listed	PFO, FOR
Branta canadensis	Canada goose	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH
Buteo jamaicenis	red-tailed hawk	9/22/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Buteo lineatus	red-shouldered hawk	9/20/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Butoides virescens	green heron	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	PFO, PSS/PEM
Cardinalis cardinalis	northern cardinal	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Carduelis tristis	American goldfinch	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Carpodacus mexicanus	house finch	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Cathartes aura	turkey vulture	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, DS
Ceryle alcyon	belted kingfisher	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH
Charadrius vociferus	killdeer	9/19/2011	Year-Round Resident	Not Listed	Not Listed	DS, PEM

TABLE 8. OBSERVED BIRD SPECIES						
Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Colinus virginianus	northern bobwhite	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH
Contopus virens	eastern wood-pewee	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR
Corvus brachyrhynchos	American crow	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, DS
Cyanocitta cristat	blue jay	9/20/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Dumetella carolinensis	gray catbird	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR, SS
Melanerpes carolinus	red-bellied woodpecker	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO
Melanerpes erythrocephalus	red-headed woodpecker	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO
Mimis polyglottos	northern mockingbird	9/19/2011	Year-Round Resident	Not Listed	Not Listed	FOR
Passerina cyanea	indigo bunting	9/19/2011	Breeding Season Resident	Not Listed	Not Listed	FOR, SS
Picoides pubescens	downy woodpecker	9/20/2011	Year-Round Resident	Not Listed	Not Listed	FOR, PFO
Sialia sialis	eastern bluebird	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, SS
Strix varia	barred owl	5/24/2011*	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Sturnus vulgaris	European starling	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR
Tachycineta bicolor	tree swallow	9/20/2011	Breeding Season Resident	Not Listed	Not Listed	GH, FOR
Turdus migratorius	American robin	9/20/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR

TABLE 8. OBSERVED BIRD SPECIES						
Scientific Name	Common Name	Date of Observation	Typical Illinois Range	Federally Listed:	State Listed:	Location
Tyrannus tyrannus	eastern kingbird	9/20/2011	Breeding Season Resident	Not Listed	Not Listed	FOR
Zenaida macroura	mourning dove	9/19/2011	Year-Round Resident	Not Listed	Not Listed	GH, FOR

*Species observed during a previous field investigation May 2011.

4.4 Sensitive Habitat Survey for Listed Bird Species

Nine listed threatened and endangered bird species for Williamson and surrounding counties (Appendix B) were determined to potentially occur within the project area. Those natural communities with the potential to contain the nine listed species were further investigated.

4.4.1 Palustrine Emergent

Four listed threatened and endangered species for Williamson and surrounding counties were identified within the literature to prefer palustrine emergent habitat among others. *Gallinula chloropus* (common moorhen), *Ixobrychus exilis* (least bittern), *Egretts caerulea* (little blue heron), and *Circus cyaneus* (northern harrier), were further investigated as potential to occur within the Permit Area.

Gallinula chloropus – the common moorhen is a waterbird of the *Rallide* family. It is listed as state threatened for Williamson, Jackson, and Union Counties. The common moorhen has a reddish forehead shield; yellow-tipped bill; gray black body with white streaks on sides and flanks. The legs are greenish yellow. The moorhen breeds in northeastern Illinois and is a rare migrant from mid-April to mid-May and from mid-August to mid-November statewide. The preferred habitat of the common moorhen includes wetland marshes with open water and dense vegetation, especially cattail. Field investigations did not reveal the presence of the common moorhen or evidence of nesting within the Permit Area. Additionally, because the Permit Area does not contain suitable preferred habitat, it is unlikely to occur within the Permit Area and therefore no adverse effect is expected.

Ixobrychus exilis – the least bittern is a waterbird of the *Ardeidae* family. It is listed as state threatened for Williamson, Jackson, Saline and Union Counties. The least bittern has rich buff flanks and sides; streaking on foreneck; white underparts; mostly pale bill, yellowish legs, short tail and dark primary and secondary feathers. The least bittern breeds across the state of Illinois and is a rare to uncommon migrant and breeder from late April to early October. The Least Bittern appears to have fairly narrow habitat requirements. The preferred habitat of the least bittern includes wetland marshes with dense vegetation, especially cattail and bulrush, with open water containing woody vegetation. Field investigations did not reveal the presence of the least bittern or evidence of nesting within the Permit Area. Additionally, because the Permit Area does not contain suitable preferred habitat, it is unlikely to occur within the Permit Area and therefore no adverse effect is expected.

Egretts caerulea – the little blue heron is a waterbird of the *Ardeidae* family. It is listed as state endangered for Franklin County. The little blue heron is medium sized with a rich

slate blue color. During breeding it has a shaggy maroon colored head and neck as well as black legs and feet. During non-breeding it has a purplish head and neck and dull green legs and feet. The little blue heron breeds in southwest Illinois and is a rare to uncommon summer wanderer in the rest of the state. The species typically nests in association with other herons, in stands of young trees that form dense thickets. The preferred habitat of the little blue heron includes wetland marshes, ponds, sloughs, lakes, and streams. Field investigations did not reveal the presence of the little blue heron or evidence of nesting within the Permit Area. Additionally, because no evidence of colonial nesting was observed, it is unlikely to occur within the Permit Area and therefore no adverse effect is expected.

Circus cyaneus – the northern harrier is a hawk of the *Accipitridae* family. It is listed as state endangered for Saline, Pope and Johnson Counties. The northern harrier has long wings and tail; a white rump; and an owl-like facial disc. It is one of the few raptors in which the sexes differ in features: the male is white below with a light gray back and hood, the female is mottled in browns. The northern harrier is a fairly common migrant from late February to early May in Illinois. Fall migrants arrive by late August and are difficult to discern from wintering populations. The preferred habitat of the northern harrier includes wetland meadows and marshes, open fields, and croplands. Nesting is usually restricted to large (at least 148 acres in size) undisturbed grasslands and marshes with tall-dense vegetation. Wintering communal roosts include wheat stubble fields overgrown with ragweed, stubble fields, prairie grasses, fescue, weedy old field, and cool season grass fields with dense cover up to about 45 cm. Field investigations for the northern harrier focused on wetland and grassland habitat within the project area. Investigations did not reveal the presence of the northern harrier within the Permit Area. Additionally, suitable wintering habitat was not was not found within the Permit Area; therefore no adverse effect is expected.

4.2.2 Upland Scrub Shrub

Two listed threatened and endangered species for Williamson and surrounding counties was identified within the literature to prefer upland scrub shrub habitat among others. *Thryomanes bewickii* (Bewicks's wren) and *Lanius ludovivianus* (loggerhead shrike) were further invested as potential to occur within the project limits.

Thryomanes bewickii – the Bewick's wren is a perching bird of the *Troglodytidae* family. It is listed as state endangered for Williamson, Pope, and Johnson Counties. The Bewick's wren is a medium-sized wren with a slender body and a strikingly long tail trimmed with white spots and often held upright. It has a long bold white eyebrow and a very long tail. It has dull gray or ashy underparts and a slender downcurved bill. The Bewick's wren is a rare migrant from late March to early April through early to mid-May. Most birds leave Illinois by late September or early October and are a rare breeder in southern and western Illinois. The preferred habitat of the Bewick's wren includes brushy areas, scrub and thickets in open country, fence rows, orchards, open woodland, or man-made structures; all with a low, thick undergrowth. Field investigations did not reveal the presence of the Bewick's wren within the project boundaries. Additionally, the Permit Area contains minimal suitable preferred habitat, and is therefore unlikely to occur, thus no adverse effect is expected.

Lanius ludovivianus – the loggerhead shrike is a songbird of the *Laniidae* family. It is listed as state threatened for Jackson, Pope, Saline, Union and Johnson Counties. The loggerhead shrike is a medium-sized songbird with black tail and wings, black bill, gray crown and back, white underparts, and a wide black mask that extends above the hooked bill and onto the forehead. The loggerhead shrike is an uncommon (formally common)

year round resident in southern Illinois. It arrives mid- to late March and departs by mid- to late October. The preferred habitat of the loggerhead shrike includes abandoned farmlands or grazed pasture with fence posts with barbed wire as well as open grasslands with shrubby thorny plant species such as hawthorn, osage orange, multiflora rose, honey locust, and crab apple. Evidence of the loggerhead shrike, which includes the presence of impaled prey (spiders, large insects, rodents, snakes, amphibians, or small birds) on thorny shrubs or barbed wire fence, was not found within the Permit Area; therefore no adverse effect is expected.

4.2.3 Grasslands/Herbaceous

Three listed threatened and endangered species for Williamson and surrounding counties were identified within the literature to prefer grasslands/herbaceous habitat among others. *Tyto alba* (barn owl), *Asio flammeus* (short-eared owl), and *Bartramia longicauda* (upland sandpiper) were further invested as potential to occur within the permit limits.

Tyto alba – the barn owl is a medium sized raptor of the *Tytonidae* family. It is listed as state endangered for Williamson, Franklin, Saline and Union Counties. The barn owl has a heart-shaped, white facial disk; dark eyes and pale bill. It is rusty brown above with white underparts. The barn owl is an extremely rare, year round local resident in southern Illinois. The barn owl roosts and nests in hollow trees, barns, and unoccupied buildings and require grasslands or open areas for hunting. The barn owl was not observed within the Permit Area. Field investigations did not reveal the presence of abandoned buildings or barns within the permit boundaries; therefore no adverse effect is expected.

Asio flammeus – the short-eared owl is a medium sized raptor of the *Strigidae* family. It is listed as state endangered for Saline County. The short-eared owl is tawny above with bold streaks on the breast. The owl has yellow eyes set in dark triangular-shaped sockets and inconspicuous ear tufts. The short-eared owl is a rare to uncommon migrant and winter resident in Illinois. The short-eared roosts on the ground or on open, low perches; short poles, muskrat houses or duck blinds and requires grasslands, wet meadows, agricultural fields, grassy ditches or open areas for hunting. Nest records are from grassland areas at least 124 acres. Wintering roosts are typically communal with abundant dense grassland less than 30 cm high and groves of conifers for shelter. Field investigations did not reveal the presence of the short-eared owl within the permit boundaries. Additionally, suitable wintering habitat was not was not found within the Permit Area; therefore no adverse effect is expected.

Bartramia longicauda – the upland sandpiper is a medium sized sandpiper of the *Scolopacidae* family. It is listed as state endangered for Williamson County. The upland sandpiper has a small head with dark prominent eyes on a long skinny neck. The body is brown mottled on the back; lightly streaked on the chest, sides and flanks and white on the belly and undertail. It has bright yellow legs and a two-toned bill. The upland sandpiper is a rare to uncommon migrant from early April to late May and from mid-July to mid-September in Illinois. The upland sandpiper prefers low prairie, low pasture, or dense medium-height grassy areas; often near airports, school, or roadsides. Field investigations did not reveal the presence of the upland sandpiper within the permit boundaries. Additionally, because the Permit Area does not contain suitable preferred habitat, it is unlikely to occur within the Permit Area and therefore no adverse effect is expected.

5.0 Conclusion

Alliance Consulting, Inc. scientists completed a field survey to identify vegetative communities, including potentially sensitive habitat (suitable or preferred habitat for listed threatened and endangered plant and bird species for Williamson County and surrounding counties) within the permit boundary. Additionally, an absence/presence survey was completed for those areas that potentially could contain listed threatened and endangered vegetation.

Eleven vegetative habitat types were identified as occurring within the permit limits of which grass/herbaceous habitat was the dominant type. Thirty-four species of birds were identified as occurring within the project limits by sightings and calls. The observed plant and bird species were determined to be common and disturbance tolerant species. No threatened or endangered species were identified during the bird and plant surveys. Occurrence of threatened or endangered species within the Permit Area is unlikely; therefore no adverse effects to threatened or endangered species is expected.

In preparing this document, our professional services have been performed with the care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made. We reserve the right to revise or amend our opinion in this report in the event new information, documentation or evidence becomes available.
Respectfully submitted,

ALLIANCE CONSULTING, INC.

Jennifer R. Bazzie
Project Scientist

JRB:mbf

File: \\Aci-zeus\projects\Projects\Williamson Energy (1413)\2008\B08-467-1413\BIOLOGICAL SURVEY\REPORT.Biological Survey.doc

6.0 LITERATURE CITED

DeVore, S., S.D. Bailey, and G. Kennedy. 2004. Birds of Illinois. Lone Pine Publishing. Auburn, WA.

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada; 2nd edition. The New York Botanical Garden Press. Bronx, NY.

Herkert, J.R., and J.E. Ebinger, editors. 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1 – Plants. Illinois Endangered Species Protection Board, Springfield, Illinois. 161 pp.

Ladd, D. and F. Oberle. 2005. A Field Guide to Common Wildflowers and Plants of the Prairie Midwest, 2nd edition. The Globe Pequot Press. Guilford, CT and Helena, MT.

Mankowski, A., editor. 2010. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 4 – 2009 and 2010 Changes to the Illinois List of Endangered and Threatened Species. Endangered Species Protection Board, Springfield, Illinois. . iii+38pp.

Mohlenbrock, R. H. and J. W. Voigt. 1959. a Flora of Southern Illinois. Southern Illinois University Press. Carbondale and Edwardsville, IL.

National Geographic. 1999. Field Guide to the Birds of North America, 3rd edition. National Geographic Society. Washington, D.C.

Nyboer, R.W., J.R. Herkert, and J.E. Ebinger, editors. 2006. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 2 – Animals. Illinois Endangered Species Protection Board, Springfield, Illinois. 181 pp.

Sibley, D. A. 2003. The Sibley Field Guide to Birds of Eastern North America. Alfred A. Knopf. NY.

Taft, J. B., G. S. Wilhelm, D. M. Ladd, and L. A. Masters. 1997. Floristic Quality Assessment for vegetation in Illinois, a method for assessing vegetation integrity. Erigenia 15: 3-95.

Walk, J.W. 1998. *Winter roost sites of northern harriers and short-eared owls on Illinois grasslands*. Journal Raptor Research. 32(2):116-119.

3001-15
part 4

APPENDIX A

AGENCY COORDINATION

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO
ATTENTION OF:

August 3, 2011

Regulatory Branch
File Number: MVS-2009-829

Braden A. Hoffman
Alliance Consulting, Inc.
124 Philpott Lane
Raleigh County Airport Industrial Park
Beaver, West Virginia 25813-9502
Dear Ms. Foust:

We appreciate the opportunity to review the revised Preliminary Jurisdictional Determination dated July 14, 2011, concerning the project known as Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area near Johnston City, Williamson County, Illinois. The proposed project involves the construction of the coal refuse disposal facility. We concur with the wetland determination you submitted .

Section 404 of the Clean Water Act assigns responsibility to the Secretary of the Army to administer a permit program to regulate the placement of dredged or fill material into waters of the United States. The placement of any dredged or fill material or grading within waters of the United States below the ordinary high water elevation, or in wetlands adjacent to these waters, must be authorized by a Section 404 permit.

As a result of the potential impacts to any wetland and waters of the United States, the project will require further permit review from the Corps of Engineers, under Section 404 of the Clean Water Act. The Corps will require the submittal of a 404-permit application, a detailed site plan and a summary of each impact to any wetland or waterway, including temporary crossings, prior to the commencement of project construction.

If you have any questions concerning this matter, do not hesitate to contact Jerry Berning at (314) 331-8372. Please refer to file number MVS-2009-829. The St. Louis District Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete the enclosed postage paid card or go to our Customer Service Survey found on our web site at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Keith A. McMullen

Keith McMullen
Illinois Section Chief
Regulatory Branch

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

November 3, 2011

Mr. Michael Beyer
Williamson Energy, LLC
P.O. Box 99
Johnson City, IL 62951

Re: Permit Application No. 417

Dear Mr. Beyer:

This letter will serve as notice that the surface coal mining and reclamation operations permit Application No. 417 for Creek Pond Mine, submitted under the Surface Coal Mining Land Conservation and Reclamation Act and the promulgated rules and regulations, is **not** administratively complete for review.

The following points must be addressed by the applicant.

1. The location listed on page 3 of the application does not match the map. The area appears to be in Section 7 not in Section 9.

2 The following threatened and endangered species are known to occur in the county to be affected by the proposed operations, or in adjacent counties. Pursuant to 62 Ill. Adm. Code 1780.16(a)(2)(A) and 1780.16(b)(2), the applicant shall supply site specific resource information necessary to address these species and protection and enhancement plans or provide justification why site specific resource information and protection and enhancement plans are not required.

3. Allegany barberry, American orpine, American strawberry bush, Anomalous spring amphipod, Arkansas sedge, Arrowhead (*Sagittaria australis*), Barn owl, Bead grass (*Paspalum dissectum*), Bellow's beak sedge, Bewick's wren, Bigclaw crayfish, Bigeye shiner, Bird voiced treefrog, Black cohosh, Blue jasmine, Bluejoint grass, Blue sage, Bradley's spleenwort, Buffalo clover, Bulrush (*Scirpus polyphyllus*), Bunch flower, Carolina whipgrass, Cliff clubmoss, Climbing milkweed, Clustered beaked rush, Cobweb skipper, Common moorhen, Creeping loosestrife, Crested coralroot orchid, Cynosciadium, Cypress knee sedge, Cypress minnow, Deerberry, Drooping sedge, Dull meadow beauty, Ear leafed foxglove, Eastern narrowmouth toad, Eastern ribbon snake, Eastern wood rat, Ebonyshell, Eryngo, Fairy wand, False bugbane, Fibrous rooted sedge, Filmy fern, Flathead snake, French's shooting star, Galingale, Golden mouse, Grass (*Torreyochloa pallida*), Grass leaved lily, Gray bat, Great chickweed, Green trillium, Grove bluegrass, Hairy synandra, Hale's corydalis, Hay scented fern, Heart leaved plantain, Illinois wood sorrel, Indiana bat, Indiana crayfish, Iowa darter, Large sedge,

Lea's bog lichen, Least bittern, Least brook lamprey, Leather flower, Little blue heron, Log fern, Loggerhead shrike, Manna grass, Mead's milkweed, Mississippi green water snake, Mississippi kite, Mock bishop's weed, Mud plantain, Narrow leaved crabapple, Narrow leaved sunflower, Nettle, New York fern, Northern harrier, One flowered hydrolea, Packard's cave amphipod, Pallid sturgeon, Panic grass (*Dichanthelium joorii*), Panic grass (*Dichanthelium yadkinense*), Pink milkwort, Purple lilliput, Red honeysuckle, Rice rat, River cooter, River redhorse, Rock chestnut oak, Rufinesque's big eared bat, Screwstem, Sedge (*Carex atlantica*), Sedge (*Carex bromoides*), Sharp scaled sedge, Short eared owl, Short leaf pine, Short sepaled beard tongue, Small flower of an hour, Smooth false indigo, Southeastern myotis, Southern grape fern, Spring ladies tresses, Spotted dusky salamander, Spotted wintergreen, Squirting cucumber, Storax, Sturgeon chub, Supplejack, Swainson's warbler, Swollen sedge, Timber rattlesnake, Tubercled orchid, Upland sandpiper, Water elm, Water hickory, Western sand darter, Whorled pogonia, Willdenow's sedge, Willow oak, Winged sedge, Wood orchid, Yellow crowned night heron, Yellow honeysuckle.

Any protection and enhancement plan for the Indiana bat shall be consistent with the July 2009 "Range-wide Indiana Bat Protection and Enhancement Plan Guidelines" prepared jointly by the Office of Surface Mining and the U.S. Fish and Wildlife Service.

4. Review of the "Environmental Resources Map" shows a light yellowish green for cropland and a darker green for forest. The map also shows a lighter green which is not forest or cropland, for which no land use is specified. This needs to be corrected. Vegetation descriptions shall be given for any land uses other than forest and cropland which may be identified.

5. Pursuant to 62 Ill. Adm. Code 1816.97(e), the applicant shall explain how to the extent possible using the best technology currently available, they have ensured that electric power lines and other transmission facilities used for or incidental to surface mining activities on the permit area are designed and constructed to minimize electrocution hazards to raptors, or justify why this requirement does not apply.

6. 62 Ill. Adm. Code 1817.57 prohibits disturbance within 100 feet of an intermittent or perennial stream without specific authorization which involves the Department making specific written findings. Pursuant to 62 Ill. Adm. Code 1817.57 the applicant shall provide all information necessary for the Department to make those findings, or justify why 62 Ill. Adm. Code 1817.57 is not applicable.

7. Review of the application shows that there are some drainageways surrounded by forest habitat. Pursuant to 62 Ill. Adm. Code 1784.21(a)(2)(B), the applicant shall supply site specific resource information regarding these riparian habitats, or justify that this regulation does not apply. Pursuant to 62 Ill. Adm. Code 1784.21(b) the applicant shall provide a protection and enhancement plan for this riparian habitat, or provide justification that this regulation does not apply.

8. No post mining land use map could be located. This needs to be provided.

9. In attachment IV.1.D the applicant proposes to use a number of introduced species for reclamation. Pursuant to 62 Ill. Adm. Code 1816.111(a)(2), the applicant shall explain how use of each of these introduced species is desirable or necessary to achieve the post mining land use, or limit vegetative cover to native species.

10. In attachment IV.1.D the applicant proposes to use the following types of trees: oaks, ashes, maples, dogwoods, hawthorns, and sumacs. The applicant shall list which species within these groups they are proposing to plant.

11. In attachment IV.1.D the applicant proposes to limit black locust to 30% of the planting. Pursuant to LRD Operator Memorandum 2010-01 issued February 8, 2010, black locust shall be limited to 10%.

12. On page 10 of part V the applicant states that the post mining land use will be herbaceous wildlife; however, in attachment IV.1.D the applicant list numerous tree species to be used in reclamation. Explain this apparent discrepancy.

13. Pursuant to 62 Ill. Adm. Code 1777.13 the applicant shall provide the names of persons or organizations and the qualifications of those persons who collected and analyzed technical biological data regarding wildlife, wetlands, and streams, and descriptions of methodologies used to collect and analyze this data

14. Pursuant to 62 Ill. Adm. Code 1784.14(b)(1) and as required by Part III(2)(B)(2), the applicant failed to submit a minimum of six (6) sets of groundwater analytical data from the newly installed wells in the vicinity of the proposed refuse disposal area.

15. On page 5 of Part III, the applicant refers to Map 4 S.F. Hydrologic Information. This map does not exist. Pursuant to 62 Ill. Adm. Code 1784.14(b)(1) and as required by Part III(2)(B)(1), the applicant shall provide this map. Additionally, this map shall depict the locations of the stream sampling points, PC1, PC2 and PC3.

16. Pursuant to 62 Ill. Adm. Code 1784.14(b)(1) and as required by Part III(2)(C)(2), the applicant failed to submit a minimum of six (6) sets of surface water analytical data from the stream sampling points in the vicinity of the proposed refuse disposal area.

17. Pursuant to 62 Ill. Adm. Code 1784.14(b)(2) and as required by Part III(2)(C)(1), the applicant failed to provide the name, location and ownership information of surface water bodies within the proposed permit area. Information depicted on Map 3 S.F. indicates the presence of at least three (3) ponds within the proposed permit area. Additionally, the east boundary of the proposed permit area is an unnamed tributary to Pond Creek and it appears another unnamed tributary passes through the western side of the proposed permit area. These streams must be discussed.

18. Pursuant to 62 Ill. Adm. Code 1784.14(b)(2)(B) and as required by Part III(2)(C)(2)(b) the applicant failed to present flow rate information for each of the stream sampling locations. The applicant refers the reader to Attachment III.2.C.2, but no flow data is presented in this attachment.

19. In Attachment IV.3.A.3, the applicant provides a map depicting the locations of the newly installed boreholes and groundwater monitoring wells. This map references the wells and locations as BH/GW-1, BH/GW-2, etc. The wells in Part III are referenced as GW12, GW13, etc. on the boring logs, well construction diagrams and other maps. All maps, diagrams and text regarding well names must coincide. The applicant shall correct this information.

20. On Page 9 of Part III, the applicant answered Part III(1)(D)(2) with *"This application is for a revision of an existing permit."* This is incorrect. The applicant shall provide a Probable Hydrologic Consequences (PHC) determination, including a discussion of the groundwater and surface water Cumulative Impact Area(s).

21. On Page 11 of Part III, the applicant answered Part III(3)(g) that this proposed permit area is not covered by an IEPA Subtitle D permit, then answers Part III(3)(g)(2) that the permit area boundaries coincide with the IEPA permit boundaries. The applicant shall correct this information.

22. On Page 14 of Part III, the applicant discusses the groundwater monitoring program. However, this information is out of date. Some referenced wells were plugged in 2005, other wells were installed in 2009 and there is no mention of the newly installed wells (GW-12, GW-13 and GW-14). Part III(4)(a) must be updated with the most recent, relevant information available.

23. On Page 15 of Part III, the applicant discusses Proposed Coal Refuse Disposal Facility No. 32. This appears to be an error. The applicant shall correct this information.

24. The applicant provided an incomplete Schedule B. The applicant shall provide a complete schedule B, including all wells currently installed at the facility and to be used in the groundwater monitoring program.

25. The applicant has indicated at Part IV(7)(A)(2) that all affected drainage will be collected and treated before leaving the permit area. There appears to be a large root medium and topsoil stockpile south of Refuse Disposal Area No. 3 which has no drainage control. Pursuant to 62 Ill. Adm. Code 1817.46(b)(2), provide a revised plan to account for all affected area drainage.

26. Part IV(6)(A) addresses the net neutralization potential for all waste materials. Since this application proposes to construct a new refuse disposal area constructed with coal waste, the response provided is not acceptable. Pursuant to 62 Ill. Adm. Code 1817.41(f)(1), the applicant shall provided the appropriate acid/base characterization analysis for each type of waste material.

27. The table found at Part IV(5)(B) includes acreage figures for both Permit No's. 375 and 417 combined. Pursuant to 62 Ill. Adm. Code 1784.23(b), revise the table to include the acreage figures that apply only to Permit No. 417.

28. The table found at Part IV(7)(E) lists all sediment ponds within the Permit No. 375 surface area. Pursuant to 62 Ill. Adm. Code 1817.46(b)(2), revise the table to include only those ponds that are will receive affected drainage from Permit No. 417.

29. The applicant has responded, "Not Applicable," to Part IV(7)(F) which discusses the design basis for sediment pond calculations. Sizing calculations and a demonstration that such a large amount of water can be effectively pumped must be included in order to evaluate the plan. Pursuant to 62 Ill. Adm. Code 1817.46(c), provide the above information in response to the question.

30. Page 10 of Volume 2 refers to a seismic analysis to be submitted under separate cover as additional information. Pursuant to 62 Ill. Adm. Code 1817.84, such analyses shall be included as part of a complete permit application package

31. Pursuant to 62 Ill. Adm. Code 1773.13(a)(1)(A), the applicant must provide a map or description which clearly shows or describes the precise location and boundaries of the proposed permit area in the public notice sufficient to enable local residents to readily identify the proposed permit area. Also, the applicant must identity the application as an application for a surface mining Permit and list No. 417 as the application number.

32. All designations of the application as Revision No. 5 to Permit No. 375 throughout the application including maps must be changed to Permit No. 417. This is necessary to avoid confusion with the public filing of the application with the county clerk's office and with the subsequent reviews of the application.

33. Pursuant to 62 Ill. Adm. Code 1817.22, II 13 C, page II-7 & 8, must be modified to be complete:

    a. The Soil information Chart

    b. Onsite topsoil thickness information, which will correct the information in II 13D

    c. Explanation why the provisions of 62 Ill. Adm. Code 1823.11 are applicable to be exempt from prime farmland.

    d. A narrative description under II 13E of the extent of removal of the B/C horizon to provide for suitable cover for the refuse area.

34. Pursuant to 62 Ill. Adm. Code 1783.12, response II 10, page II-5 must be modified to clarify that the entire permit area has been surveyed. It appears a portion of the application area in the NW ¼ of the SE1/4 of section 7 has not been surveyed.

Upon submission of the above listed information for inclusion in the application, the Department will again review the permit application to determine if it is administratively complete.

Should you have any questions, please contact this office.

Sincerely,

Ernest Ashby
Permit Coordinator
Land Reclamation Division

EA:cl
Enclosure
cc: B. Murphy

11021033.doc

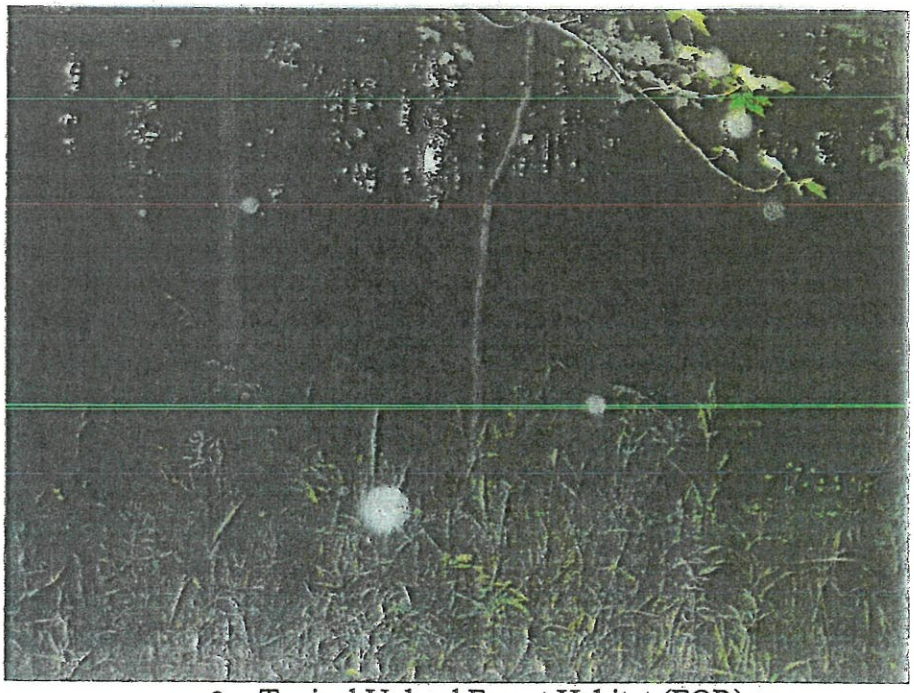
APPENDIX B
PHOTOGRAPHS

Project No. B08-467-1413

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



1. Typical Grassland/Herbaceous Habitat (GH)



2. Typical Upland Forest Habitat (FOR)

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



3. Typical Scrub Shrub Habitat (SS)

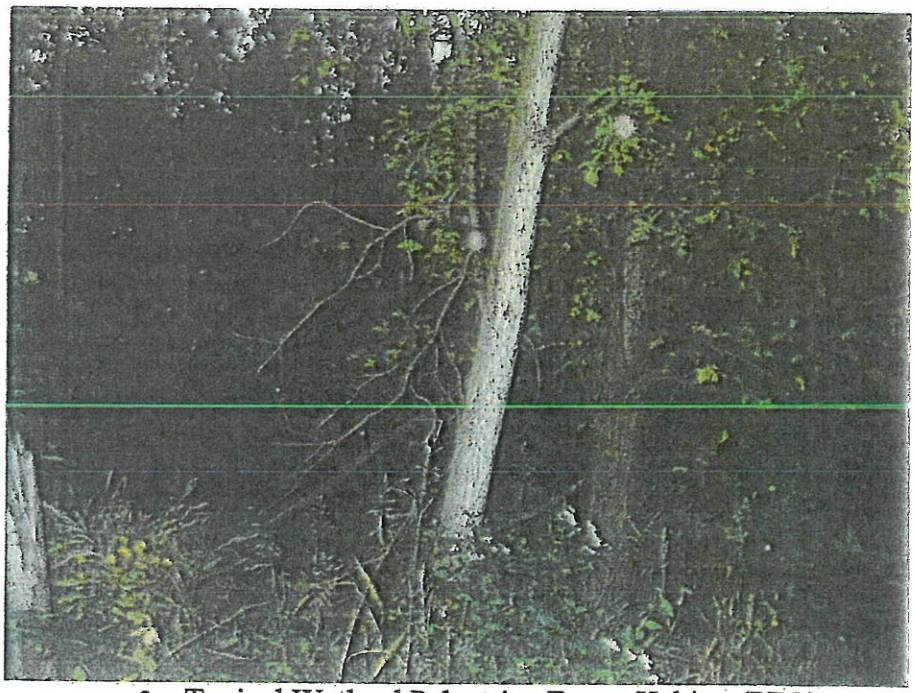


4. Typical Forest/Scrub Shrub Habitat (FOR/SS)

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON ENERGY, LLC



5. Typical Scrub Shrub/Grassland Herbaceous Habitat (SS/GH)



6. Typical Wetland Palustrine Forest Habitat (PFO)

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON ENERGY, LLC

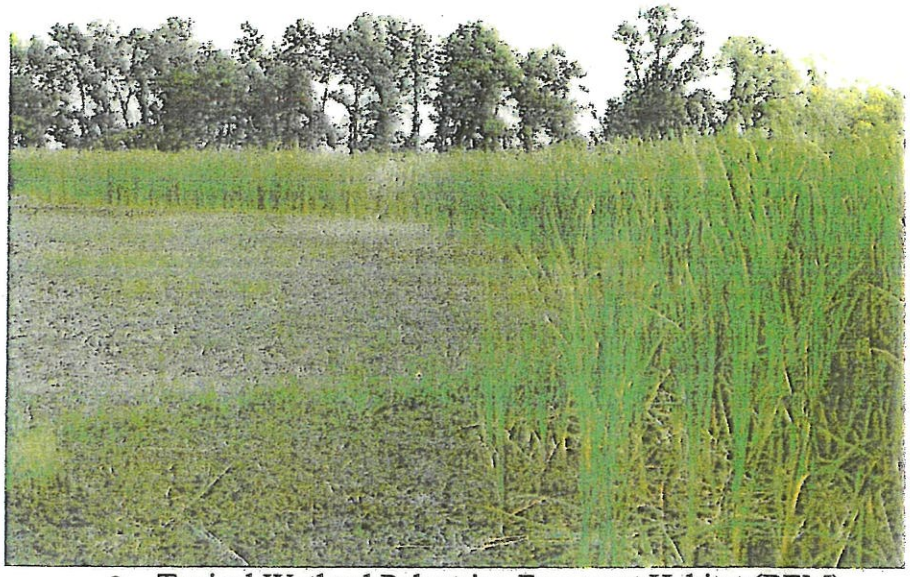


7. Typical Wetland Palustrine Scrub Shrub Habitat (PSS)



8. Typical Wetland Palustrine Forest/Scrub Shrub Habitat (PFO/PSS)

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



9. Typical Wetland Palustrine Emergent Habitat (PEM)



10. Typical Wetland Palustrine Emergent/Scrub Shrub Habitat (PEM/PSS)

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC

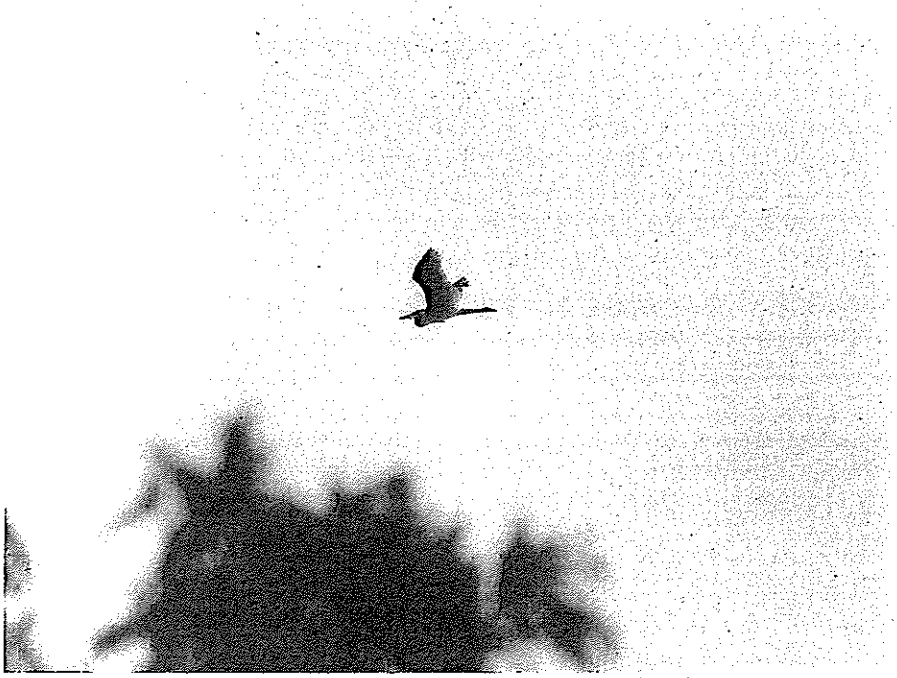


11. Typical Developed Open Space Habitat (DS)

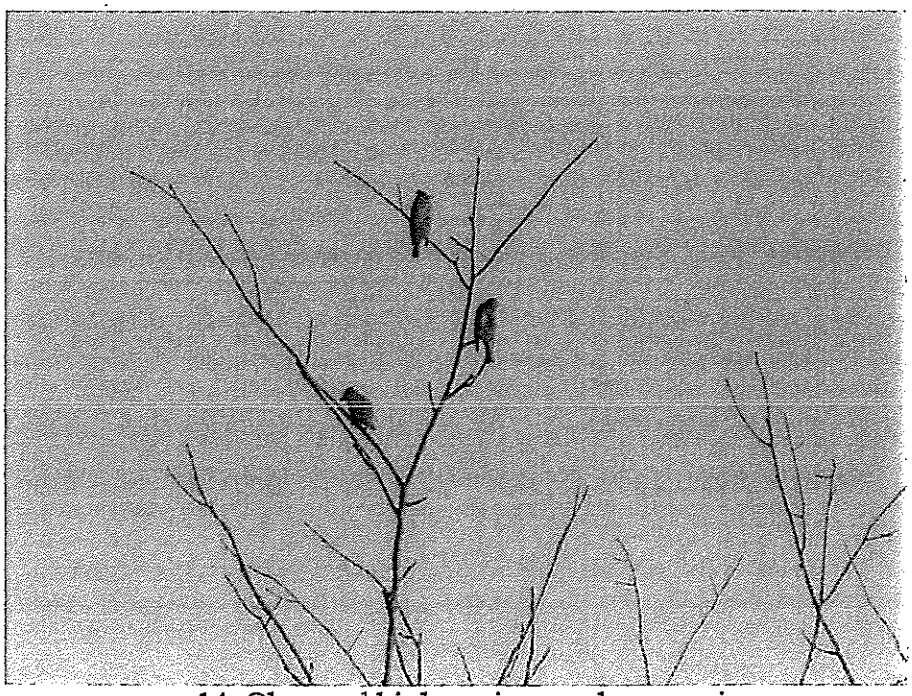


12. Observed bird species - great egret

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON ENERGY, LLC



13. Observed bird species - great blue heron



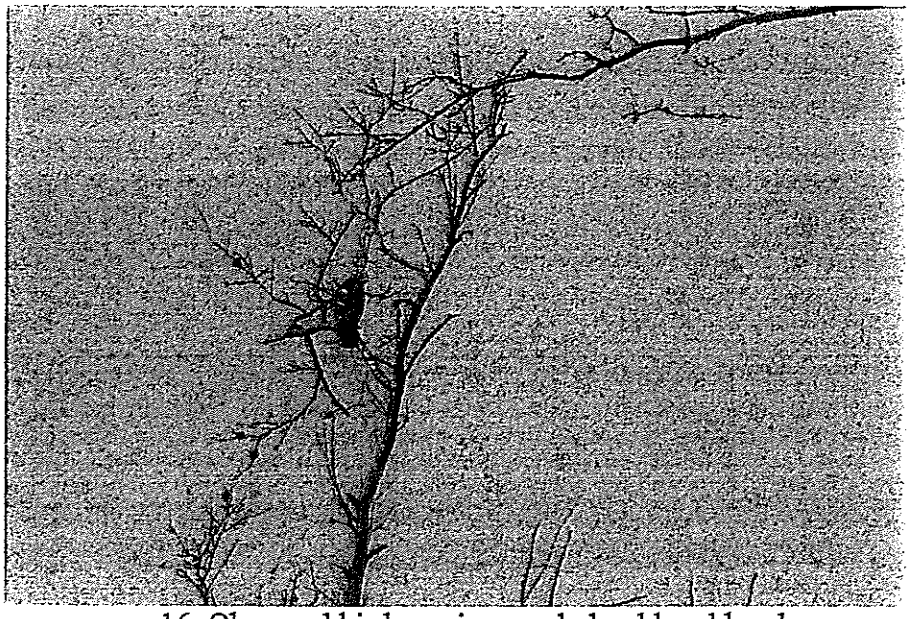
14. Observed bird species – cedar waxwing

Project No. B08-467-1413

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON ENERGY, LLC



15. Observed bird species – Canada goose



16. Observed bird species – red-shouldered hawk

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



17. Observed bird species – green heron



18. Observed bird species – northern cardinal

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC

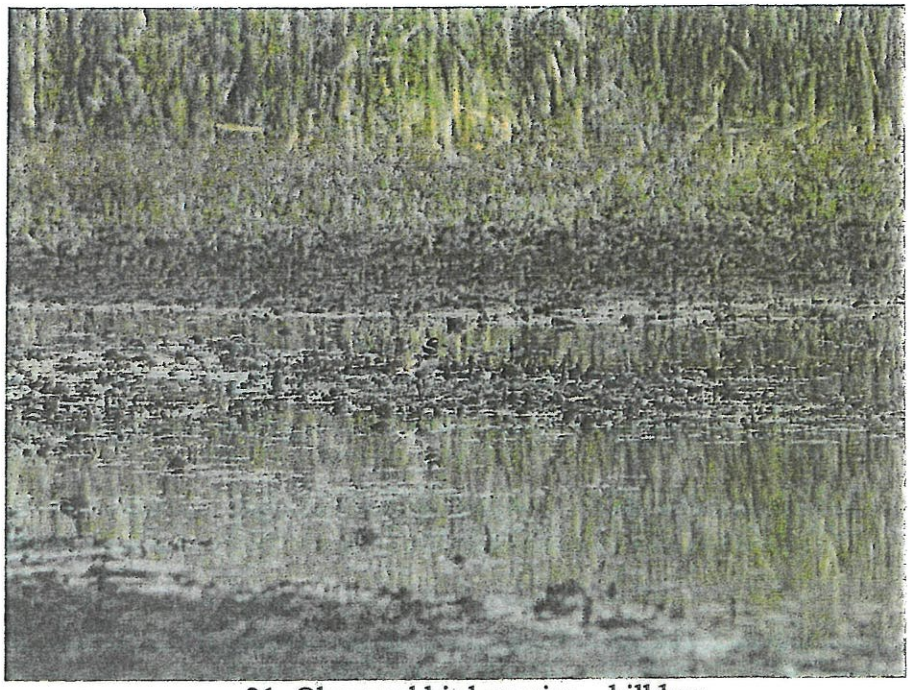


19. Observed bird species – American goldfinch



20. Observed bird species – turkey vulture

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



21. Observed bird species – killdeer



22. Observed bird species – red-bellied woodpecker

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



23. Observed bird species – red-headed woodpecker



24. Observed bird species – indigo bunting

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 WILLIAMSON ENERGY, LLC



25. Observed bird species – downy woodpecker



26. Observed bird species – European starling

SURVEY FOR POTENTIAL THREATENED AND ENDANGERED BIRD AND PLANT SPECIES
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
WILLIAMSON ENERGY, LLC



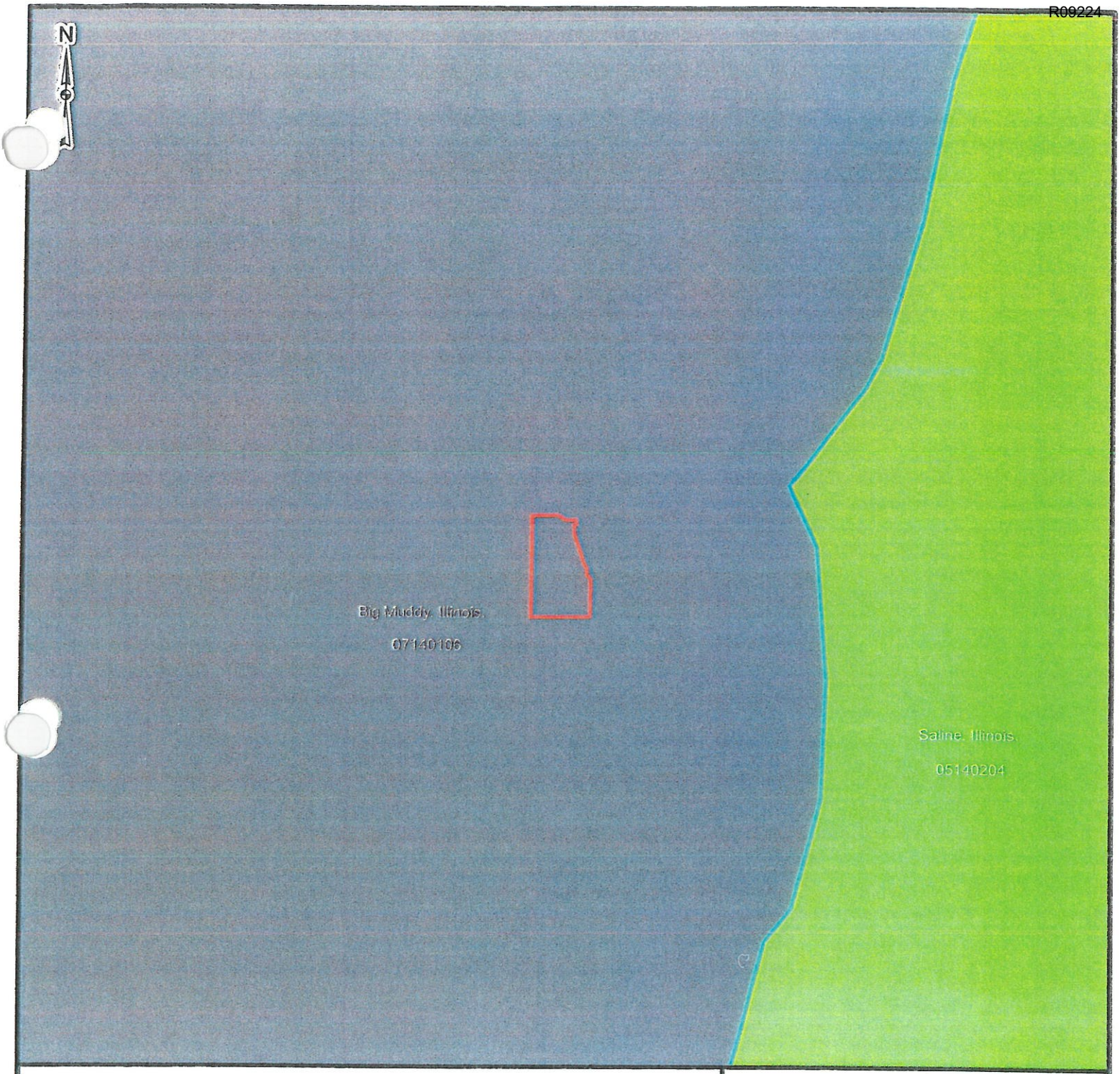
27. Observed bird species – American robin



28. Observed bird species – mourning dove

FIGURES

R09224



REFERENCE:

8 DIGIT HYDROLOGIC UNIT CODE (HUC) OF THE BIG MUDDY AND SALINE RIVER WATERSHEDS

SCALE

0 4,000 8,000 12,000 Feet

Legend

PERMIT 417 BOUNDARY

8 DIGIT HUC

Big Muddy, Illinois

Saline, Illinois

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

8 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	03/23/11
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A6		

R09225



Legend

PERMIT 417 BOUNDARY

HABITAT CATEGORIES

- Developed, Open Space (DS) 14.4ac
- Forest, Upland (FOR) 45.2ac
- Forest/Scrub Shrub, Upland (FOR/SS) 43.6ac
- Grassland/Herbaceous (GH) 77.4ac
- Palustrine Emergent (PEM) 2.0ac
- Palustrine Emergent/Scrub Shrub (PEM/PSS) 7.4ac
- Palustrine Forest (PFO) 20.0ac
- Palustrine Forest/Scrub Shrub (PFO/PSS) 9.3ac
- Palustrine Scrub Shrub (PSS) 1.1ac
- Scrub Shrub, Upland (SS) 5.6ac
- Scrub Shrub/Grassland/Herbaceous (SS/GH) 3.2ac

SCALE

0 250 500 750 1,000 Feet

HABITAT MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV
(304) 255-0491

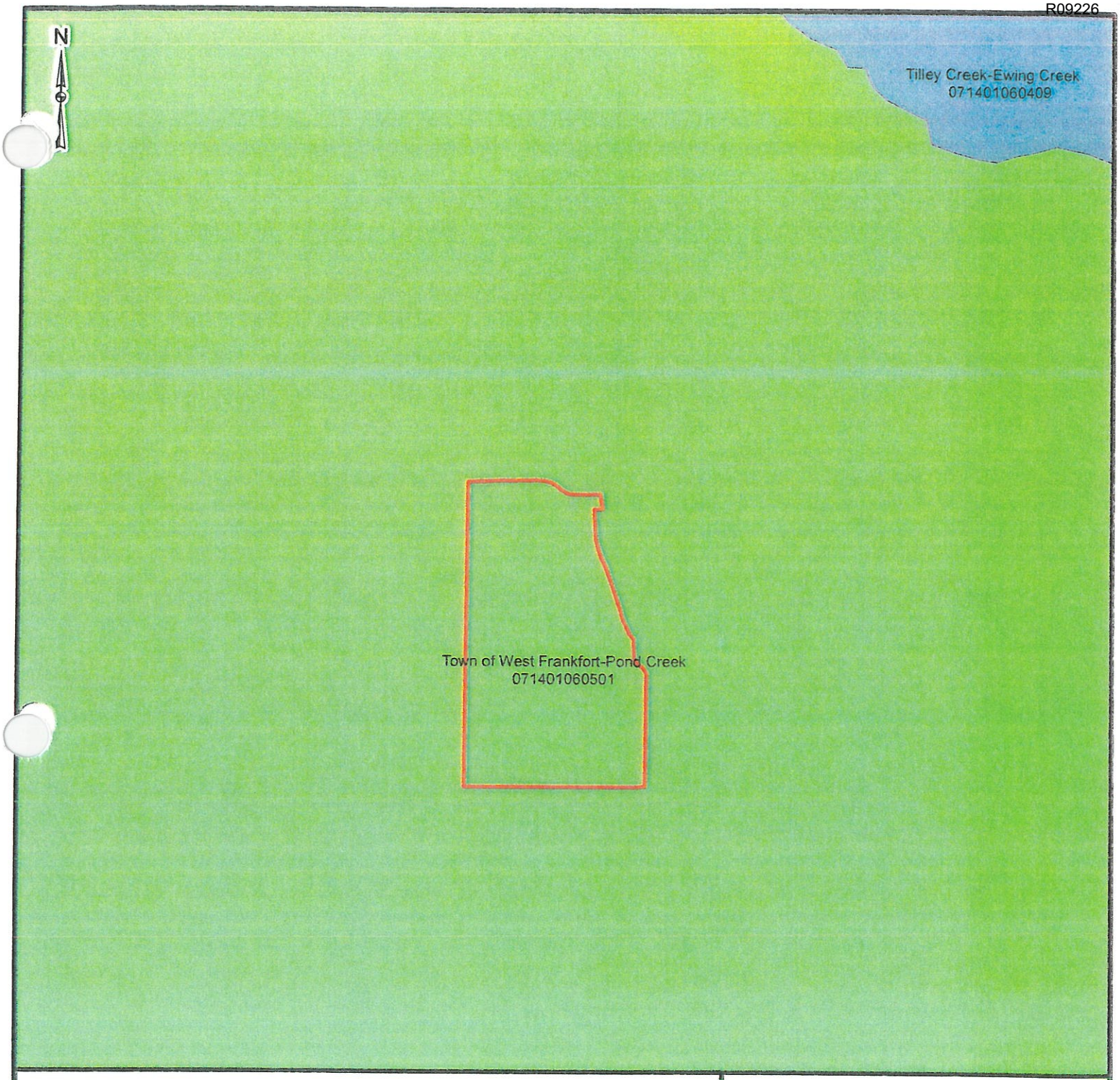
CANONSBURG, PA
(724) 745-3630

SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	10/07/11		B08-467-1413
CHECKED BY	ACL	07/02/12	B08-467-D4	
APPROVED BY				

R09226



REFERENCE:
12 DIGIT HYDROLOGIC UNIT CODE (HUC) OF TILLEY CREEK-EWING CREEK AND TOWN OF WEST FRANKFORT-POND CREEK WATERSHEDS

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

12 DIGIT HUC

Tilley Creek-Ewing Creek

Town of West Frankfort-Pond Creek

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

12 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A7		

R09227



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

FLOODPLAIN

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

124 PHILPOTT LANE

BEAVER, WV 25813

(304) 255-0491

FLOODPLAIN MAP

POND CREEK MINE NO. 1

COAL REFUSE DISPOSAL FACILITY NO. 3

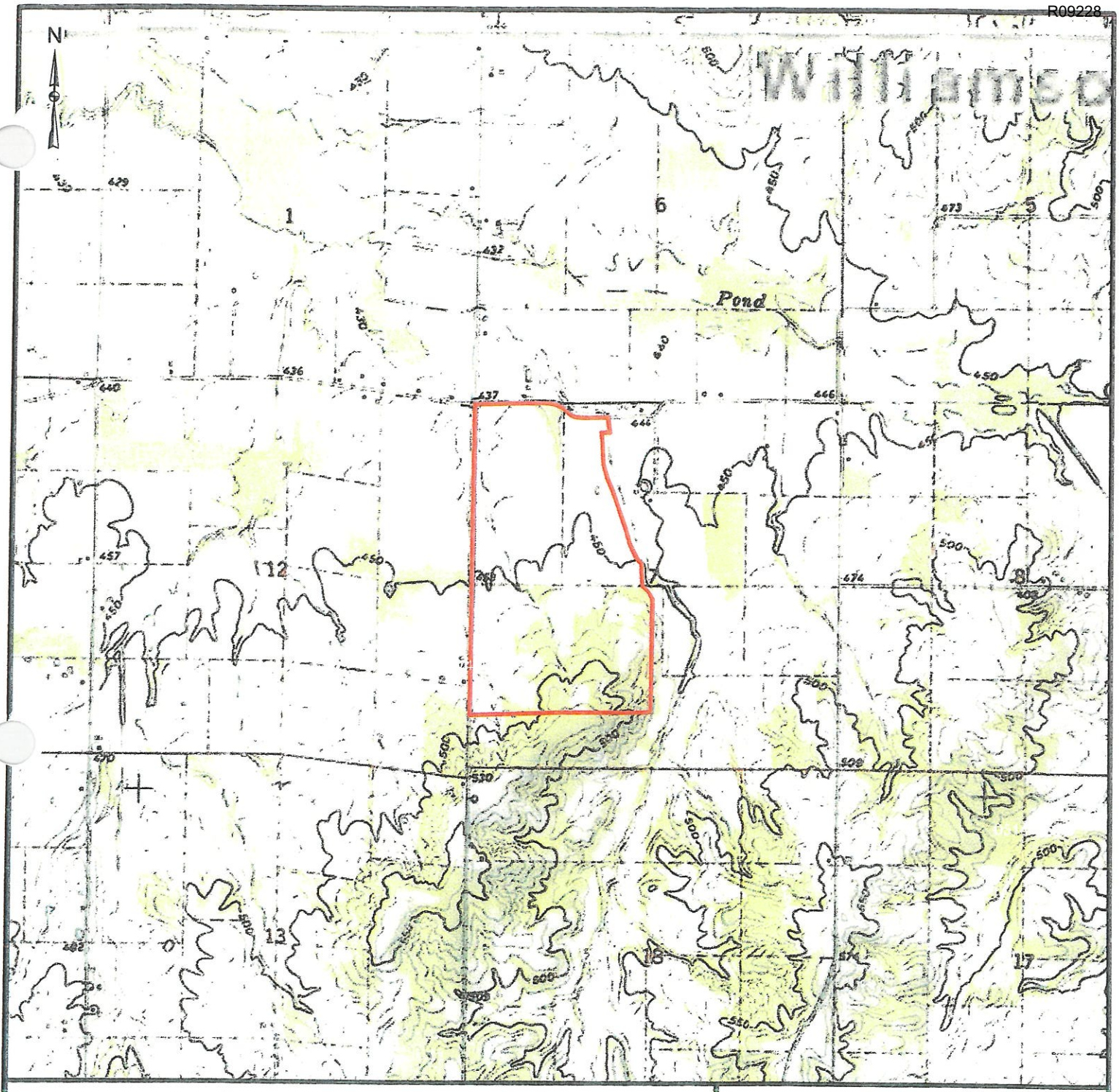
PREPARED FOR

WILLIAMSON ENERGY, LLC.

JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A8		

R09228



REFERENCE:

ArcGIS map service, USA topo maps (USGS 1:24,000 topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

0 1,000 2,000 3,000 Feet

Legend

PERMIT 417 BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

TOPO MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	ACL	11/29/11
CHECKED BY	ACL	11/29/11
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B08-467-A13		

R09229



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)
STREAMS FROM THE NATIONAL HYDROGRAPHY DATASET (NHD)
WETLANDS FROM THE NATIONAL WETLAND INVENTORY (NWI)

0 500 1,000 2,000 3,000 Feet

Legend

- PERMIT 417 BOUNDARY
- NHD STREAMS
- NWI WETLANDS

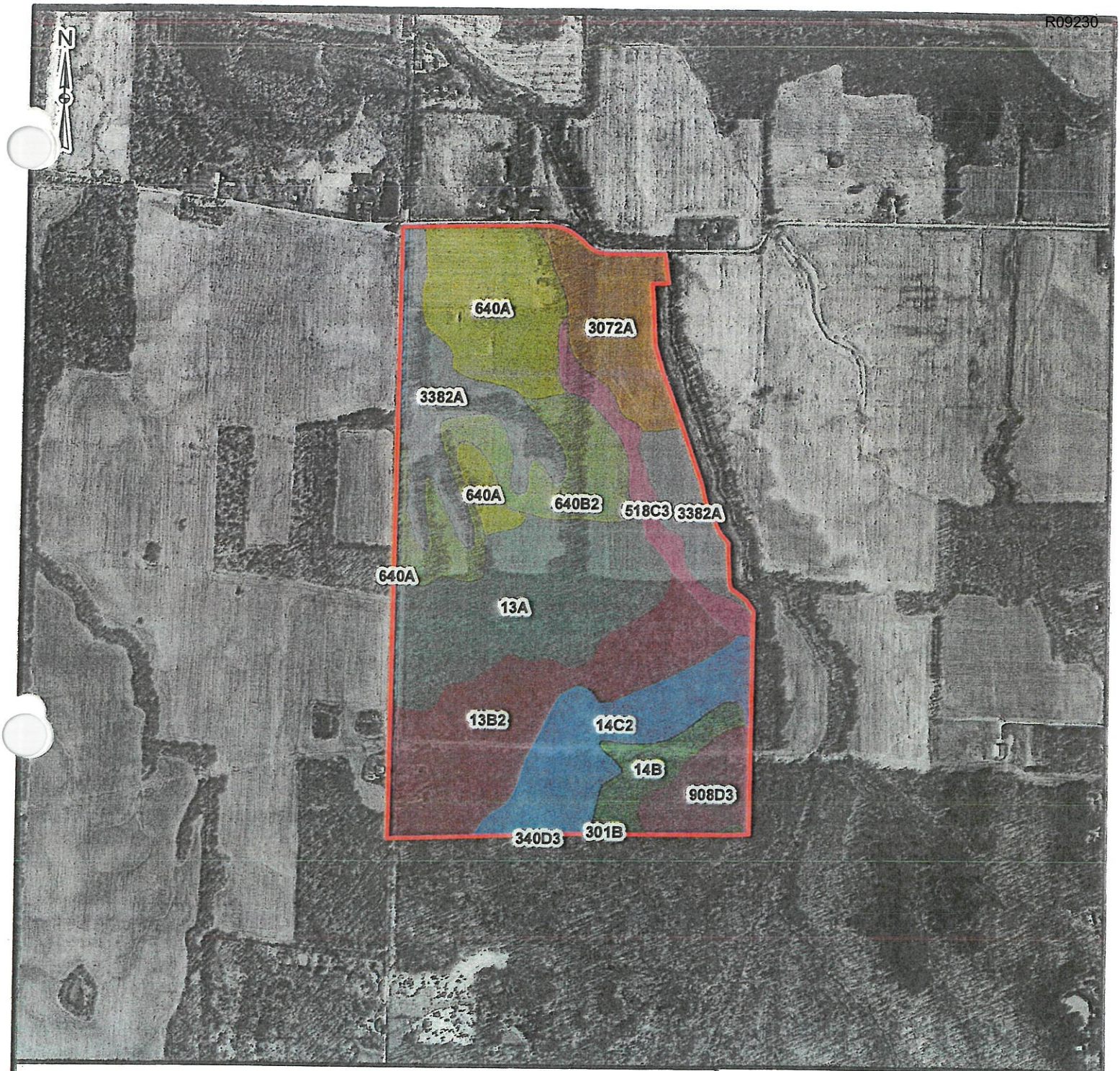
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

NATIONAL WETLAND INVENTORY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A3		

R09230



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)

0 500 1,000 2,000 3,000 Feet

Legend

P417-BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

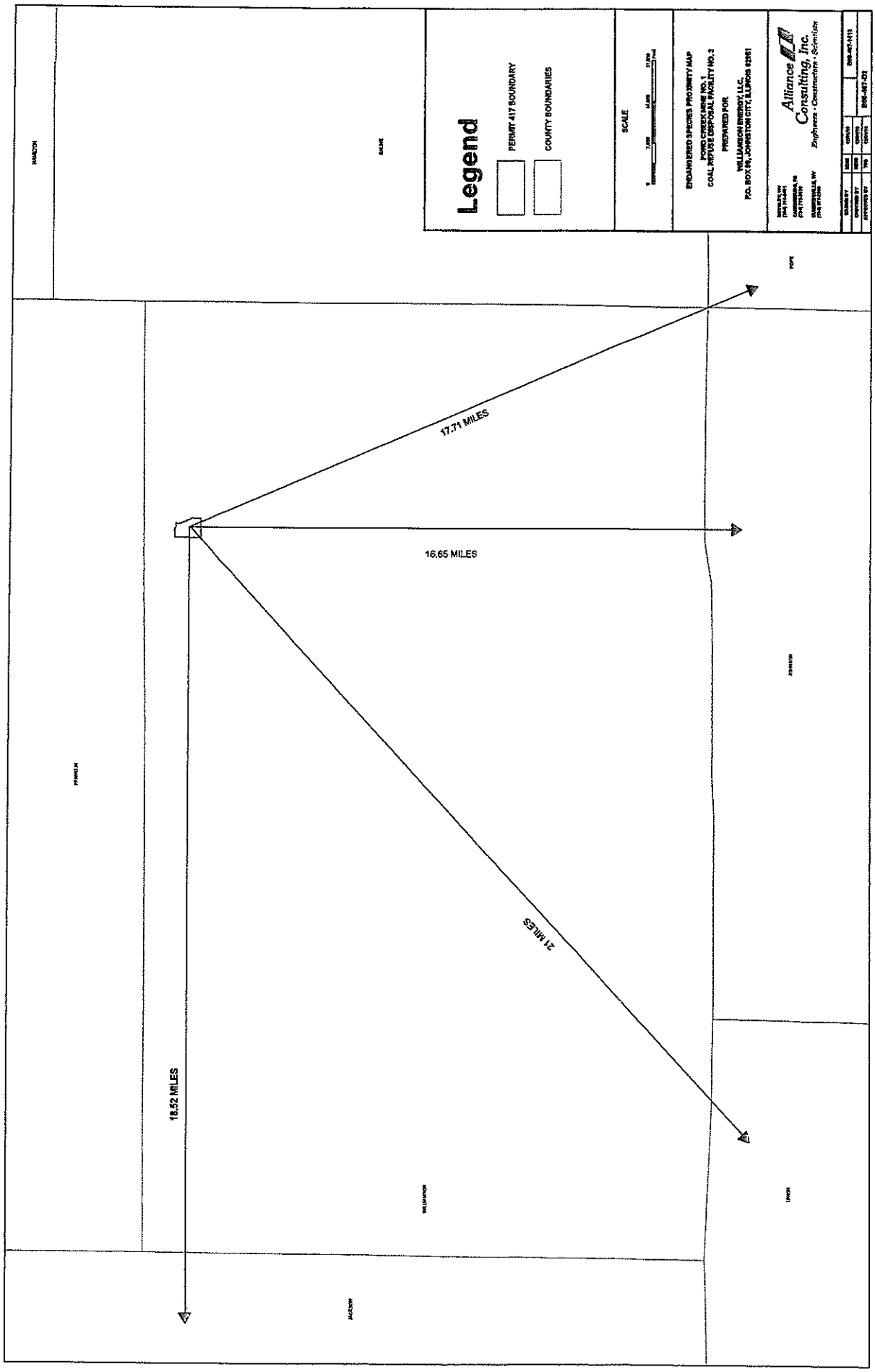
SOILS MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

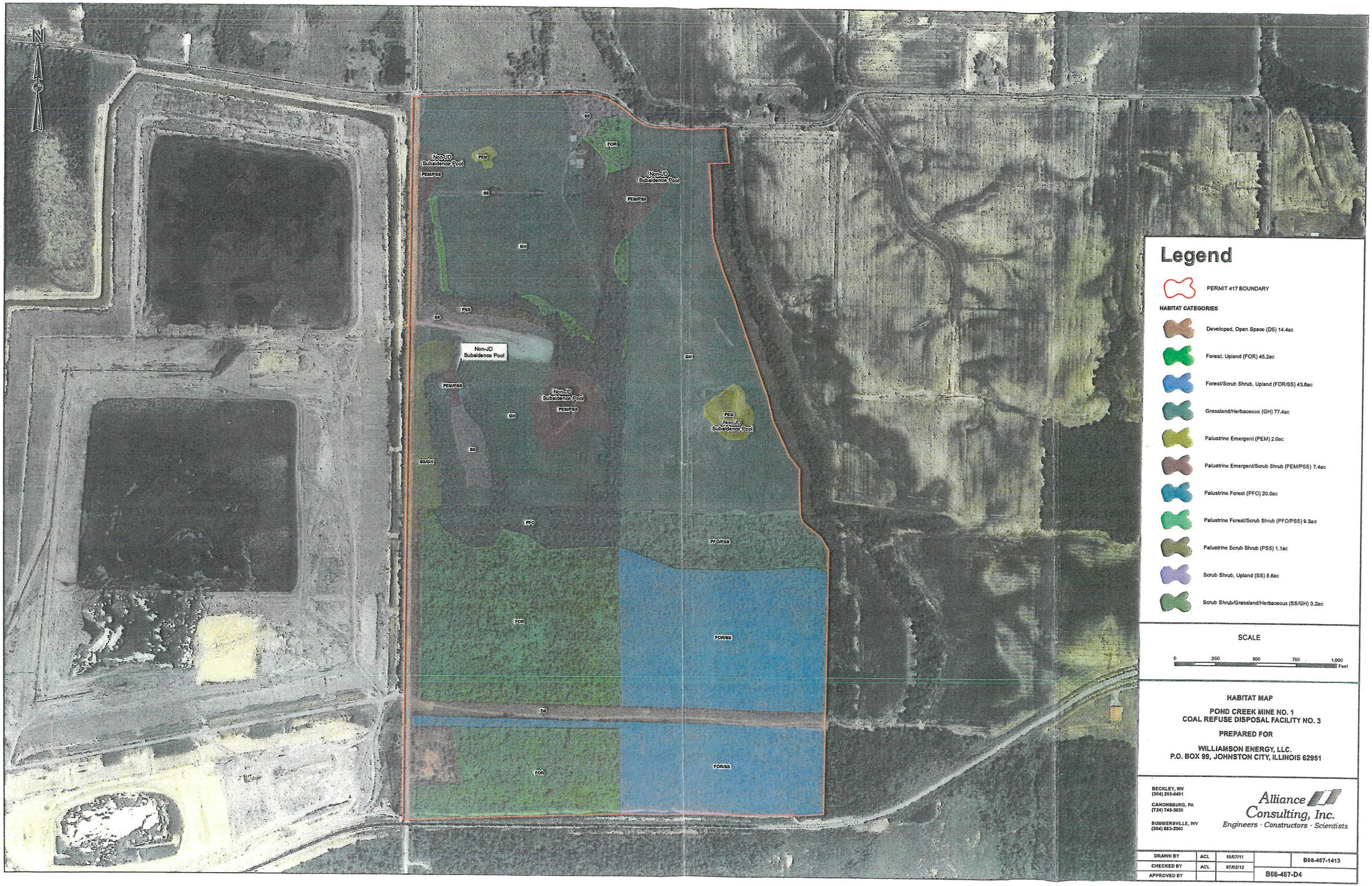
DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A4		


N
SURVEY LOCATIONS
DAWN / DUSK BIRD SURVEY LOCATIONS
BIRD / PLANT POINT SURVEY LOCATIONS
DIURNAL SURVEY TRANSECTS
STREAM RESOURCES
PERMIT 417 BOUNDARY
JURISDICTIONAL WETLANDS
SCALE
0 200 400 600 800 Feet
POTENTIALLY THREATENED / ENDANGERED BIRD AND PLANT SURVEY MAP
POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
B08-467-1413
B08-467-D1

R09231


Legend
PERMIT 417 BOUNDARY
COUNTY BOUNDARIES
SCALE
ENDANGERED SPECIES PROXIMITY MAP
POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Alliance Consulting, Inc.
Engineers · Constructors · Surveyors
17.71 MILES
16.65 MILES
21 MILES
18.52 MILES
HAMILTON
SALINE
FRANKLIN
JOHNSON
WILLIAMSON
UNION
JACKSON
POPE

R09233



Legend

PERMIT 417 BOUNDARY

HABITAT CATEGORIES

- Developed, Open Space (DS) 14.4ac
- Forest, Upland (FOR) 45.2ac
- Forest/Scrub Shrub, Upland (FOR/SS) 43.6ac
- Grassland/Herbaceous (GH) 77.4ac
- Palustrine Emergent (PEM) 2.0ac
- Palustrine Emergent/Scrub Shrub (PEM/PSS) 7.4ac
- Palustrine Forest (PFO) 20.0ac
- Palustrine Forest/Scrub Shrub (PFO/PSS) 9.3ac
- Palustrine Scrub Shrub (PSS) 1.1ac
- Scrub Shrub, Upland (SS) 5.6ac
- Scrub Shrub/Grassland/Herbaceous (SS/GH) 3.2ac

SCALE

0 250 500 750 1,000 Feet

HABITAT MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV
(304) 255-0491

CANONSBURG, PA
(724) 745-3630

SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	10/07/11		B08-467-1413
CHECKED BY	ACL	07/02/12	B08-467-D4	
APPROVED BY				

Alliance Consulting, Inc.
Engineers Constructors Scientists

Jennifer R. Arp-Bazzie, M.S., P.W.S

Project Scientist

Degrees Held

B.S. Biology, Ohio University, Athens, OH
M.S. Biology, University of North Carolina at Wilmington, Wilmington, NC

Professional Licenses and Registration:

Professional Wetland Scientist, Society of Wetland Scientists, PWS #2025, 2010
NS Roadway Worker Protection, 2010
e-railsafe, 2010
BNSF Contractor Orientation, 2010
Amtrak Roadway Worker Protection, 2010 e-railsafe, 2010
CSX, Roadway Worker Protection, 2010 e-railsafe, 2010
Ohio Wildlife Collectors Permit, 2011

Additional Training:

Acoustic Techniques and AnalookW Analysis Course – Bats R Us & Bat Sense
Identification of Sedges, Rushes and Grasses – Ecological Survey Services
Wetland Delineation Certification and Field Practicum –Wetland Training Institute
Wetland Construction and Restoration – Wetland Training Institute
Midwestern Regional Supplement Training for Wetland Delineators
River Processes – Fluvial Geomorphology and Channel Processes - School of Engineering and Applied Sciences, University of Buffalo
Stream Restoration – Function Based Hydraulic Structure and Bioengineering Design - School of Engineering and Applied Sciences, University of Buffalo
ODOT's Project Development Process, Ecological Survey, and Waterway Permits – Ohio DOT
Vegetation Index of Biotic integrity (VIBI) – Ohio EPA
Ohio Rapid Assessment Method (ORAM) – Ohio EPA
Primary Headwater Habitat Evaluation (HHEI) – Ohio EPA
Biocriteria and Qualitative Habitat Evaluation Index (QHEI) – Ohio EPA
FHWA Traffic Noise Model 2.5 – Bowlby and Associates, Inc.
Traffic Noise Fundamentals– Bowlby and Associates, Inc.

Beckley, WV
Raleigh County Airport Industrial Park 124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491

General Background:

June 2011 – Present: Project Scientist, Alliance Consulting Inc., Beckley, West Virginia

In this position, Ms. Bazzie performs environmental testing and sampling (i.e. benthic macroinvertebrate, fisheries, threatened and endangered species, water quality, and flow monitoring), limited geological and hydrological characterization, as well as numerous wetland and stream delineations. Ms. Bazzie has completed environmental state and federal permits including: State 401 Water Quality and U.S. Army Corps of Engineers Section 404 Individual Permits as well as several U.S. Environmental Protection Agency case specific Section 404 projects. She has also participated in the ecological data collection, rapid assessment and Agency coordination associated with the permit process. During her time at Alliance, she has assisted in mist net bat surveys and bat portal surveys as part of the mining permit process. Ms. Bazzie has been involved in the design of pilot bioremediation/engineered wetland wastewater treatment projects associated with mine water outflow.

November 2003 – June 2011: Ecologist / Wetland Scientist, TranSystems, Cleveland Ohio

Jennifer Arp-Bazzie completed aquatic ecology, wetland delineation, site assessment, and stream and wetland mitigation. She is practiced in proper field and laboratory procedure with knowledge in the identification of aquatic and terrestrial plants, micro and macroinvertebrates, and wildlife. Jennifer was involved with project planning and the environmental process associated with the National Environmental Policy Act (NEPA). She has been involved in the preparation of environmental documentation including Categorical Exclusions, Environmental Assessments and section 4(f), noise analysis and abatement, ecological surveys, stream and wetland mitigation, and waterway permitting. Jennifer worked with both the private and public sector in the completion of environmental documentation and waterway permitting in Ohio, Illinois, Indiana, Iowa, Louisiana, Massachusetts, Nebraska, Wyoming, and Texas. She completed numerous federal and state waterway permits including 404 Nationwide and Individual Permits, 401 Water Quality Certifications, Regional General Permits, Isolated Wetland Permits, Notice of Intent, and Chapter 91waterway license.

Project Experience:

Jurisdictional Determination Ecological Survey, Natural Gas and Oil Industry
Field leader to identify wetlands and other ecological resources for an approximate 42 acre gas well pad and impoundment areas in Harrison County, WV. Ms. Arp-Bazzie delineated stream habitat, delineated wetland boundaries, and determined potential adjacency, post construction.

Jurisdictional Determination Ecological Survey, Natural Gas and Oil Industry
Field leader to identify wetlands and other ecological resources for an approximate 32 acre gas well pad and impoundment areas in Harrison County, WV. Ms. Arp-Bazzie delineated stream habitat, delineated wetland boundaries, and determined potential adjacency, post construction.

Jurisdictional Determination Ecological Survey, Coal Mining Industry
Team member to identify wetlands and other ecological resources for an approximate 140 acre surface coal mine and associated impoundment areas in Barbour County, WV. Ms. Arp-Bazzie delineated stream habitat, delineated wetland boundaries, and determined potential adjacency, post construction.

Jurisdictional Determination Ecological Survey, Coal Mining Industry
Team member to identify wetlands and other ecological resources for an approximate 680 acre study area for a proposed deep mine complex and preparation plant with refuse impoundments, access roads, and freshwater impoundments in Barbour County, WV. Ms. Arp-Bazzie delineated stream habitat, delineated wetland boundaries, and determined potential adjacency.

Jurisdictional Determination Ecological Survey, Coal Mining Industry
Team member to identify wetlands and other ecological resources for an approximate 179 acre study area for a new portal opening in Boone County, WV. Ms. Arp-Bazzie delineated stream habitat, delineated wetland boundaries, and determined potential adjacency.

Biological Survey, Coal Mining Industry
Team member to conduct vegetation and bird surveys for potential threatened and endangered bird and plant species at a proposed coal refuse disposal facility for a deep mine complex site located in Williamson County, Illinois.

Portal Survey, Coal Mining Industry
Team member to conduct portal surveys for potential threatened and endangered bat species at four portal locations at a proposed deep mine with associated surface facilities located in Barbour County, West Virginia.

Mist Net Survey, Coal Mining Industry
Team member to conduct mist net surveys for potential threatened and endangered bat species for a proposed surface mine area located in McDowell County, WV. .

Ecological Service Task Order, Ohio Environmental Services Task Order, Ohio Department of Transportation
Project field biologist for ecological service tasks for transportation projects in the State of Ohio. Services included wetland tasks such as delineations, function and value assessments utilizing the ORAM, mitigation design, construction monitoring for mitigation, long term mitigation monitoring, and application preparation services for U.S. Army Corps of Engineers §404 Permits and Ohio Environmental Protection Agency §401 Water Quality Certification. Additionally, ecological investigations performed include aquatic investigations, evaluation of stream function utilizing the HHEI and QHEI methodologies, endangered species investigations, and stream mitigation monitoring and design projects.

Ecological Survey and Mitigation Opportunity Assessment, Ohio Department of Transportation, District 9

Team member for an ecological survey of wetland and streams resources along a 16 mile new alignment highway project. Ms. Bazzie assisted in the stream assessment and delineation of wetland resources along the proposed new alignment. She was a team member for the identification and classification of potential stream and wetland mitigation opportunities along the highway project. She assisted in field surveys to identify and document existing wetland and stream resources, potential wetland and stream restoration areas, and potential wetland and stream preservation areas within and adjacent to the project area within the Scioto River watershed.

Wetland Mitigation Construction and Monitoring, Columbus Regional Airport Authority, Applicant Specific Consolidated Wetland Mitigation Design and Monitoring
Team member for an approximately 25 acre wetland mitigation site on former agricultural land managed by the Ohio Division of Wildlife. Ms. Arp-Bazzie assisted in construction lay-out and provided on-site construction inspection and oversight during the build and planting phases of this project. Ms. Arp-Bazzie was involved in the 5-year mitigation monitoring phase of the wetland mitigation area as required by the regulatory agencies.

Waterways Permitting, Kenneth F. Burns Memorial Bridge Replacement, Massachusetts Department of Transportation
Team member to complete applicable permits for the replacement of the existing Kenneth F. Burns Memorial Bridge (Route 9, Belmont Street) as it crosses Lake Quinsigamond connecting the City of Worcester and the Town of Shrewsbury. Ms. Arp-Bazzie was the lead for the completion of the applicable permit applications including a §401 Water Quality Certification, Notice of Intent, and a Chapter 91 waterways permit.

Ecological Review, I-220 Entry Control Facility, Barksdale Air Force Base
Lead team member to complete a Red Flag Summary of ecological resources associated with the proposed location for a new East Entry Control Facility as dictated by Bossier Parish and the State of Louisiana's plans to extend I-220 south into Barksdale AFB boundary. Utilizing secondary resources and field investigation, Ms. Arp-Bazzie identified probable jurisdictional wetland areas, streams, existing terrestrial habitat, and threatened and endangered habitat within the proposed entry road corridor.

Bathymetric Survey, Gudmond "Sonny" Jessen Bridge, Illinois Department of Transportation
Bathymetric profiles were collected at piers within the Illinois River at the I-180 Bridge, structure no. 078-0001, Putnam County, Illinois. Elevations and water depths along transects were interpolated and mapped.

Wetland Delineation and Environmental Permitting, South Carolina Department of Transportation
Team member for field studies to identify Waters of the U.S. and other ecological resources for seven bridge replacement projects and one sidewalk installation project throughout the State of South Carolina. Field services included wetland delineations involving the identification and flagging of upland/wetland boundaries. Performed initial biological assessment for potential state and federally listed threatened and endangered species within

or adjacent to project areas. Prepared and submitted appropriate permit application packets for potential impacts associated with the proposed projects.

Environmental Site Assessment and Permitting, Burlington Northern and Santa Fe Railway Corporation
Team member for a wetland delineation and site assessment to identify wetlands and other ecological resources along a 2.3mile corridor as part of the construction of a new, off-line, single track crossing of the Missouri River adjacent to the existing bridge, within the BNSF Creston Subdivision, between Pacific Junction, Iowa and Oreapolis, Nebraska. Ms. Arp-Bazzie completed the 404/401 permit applications and coordinated the bridge permitting.

Environmental Permitting, Burlington Northern and Santa Fe Railway Corporation
Team member for a wetland delineation and aquatic resources survey to identify wetlands and other ecological resources along a 44 mile corridor as part of the construction of a third mainline track within the BNSF Powder River Division, Orin Subdivision, Wyoming. Ms. Arp-Bazzie was responsible for the preparation of the U.S. Army Corps of Engineers §404 permit application for wetland and stream impacts associated with the railroad add track project.

Stream and Wetland Mitigation, CXS King Yard Rail Yard
Team member for stream and wetland restoration of a wetland and stream mitigation complex project located in Gibson County, Indiana. The project involves the restoration and enhancement of 410 linear feet of stream and the creation of wetland habitat to account for impacts associated with the construction of a rail yard. The stream design was based on natural channel design as determined by regional curve analysis with floodplain expansion.

Ecological Survey &Waterways Permitting, Ohio Department of Transportation, District
Team member to identify wetlands and other ecological resources for a railroad grade separation project on a 2 mile new alignment for US Route 250. Ms. Arp sampled the aquatic fauna and assessed stream habitats, delineated wetland boundaries, assessed the functions and values of wetlands on site, and determined adjacency. In addition, she was a team member for the identification and classification of potential stream and wetland mitigation opportunities. Ms. Arp-Bazzie was also a team member for the completion of the §401 Water Quality Certification and a U.S. Army Corps of Engineers Individual Section §404 Permit application.

Waterway Permitting with Wetland Delineation, Union Pacific Rail Road
Team member for waterway permitting services including wetland delineation for new construction associated with the Union Pacific Rail Road (UPRR) Velasco Yard located in Freeport, Texas. A project report documenting existing conditions was prepared for and verified by the U.S. Army Corps of Engineers.

Endangered Species Surveys, Various Clients
Team member for a variety of projects in order to evaluate or document habitat of threatened and endangered species. Types of projects include identifying and evaluating habitat for the

federally endangered Indiana bat, Karner butterfly, freshwater mussel relocation projects, and federally threatened bald eagle roosting tree surveys.

Beckley, WV
Raleigh County Airport Industrial Park 124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

A SUMMER SURVEY FOR THE FEDERALLY ENDANGERED INDIANA BAT (MYOTIS SODALIS) AND THE PROPOSED LISTED NORTHERN LONG-EARED BAT (MYOTIS SEPTENTRIONALIS) AT A PROPOSED REFUSE FACILITY WILLIAMSON COUNTY, ILLINOIS WILLIAMSON ENERGY, LLC

PERMIT 417
POND CREEK CRDA NO. 3

Prepared for

WILLIAMSON ENERGY, LLC
WILLIAMSON COUNTY, ILLINOIS

ALLIANCE PROJECT NO. B14-445-1413
SEPTEMBER 2014

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

A SUMMER SURVEY FOR THE FEDERALLY ENDANGERED INDIANA BAT (*MYOTIS SODALIS*) AND THE PROPOSED LISTED NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) AT A PROPOSED REFUSE FACILITY WILLIAMSON COUNTY, ILLINOIS WILLIAMSON ENERGY, LLC

1.0 INTRODUCTION

Alliance Consulting, Inc. (Alliance) was contracted by Williamson Energy, LLC (Williamson) to assess the status of the federally endangered species, *Myotis sodalis* (Indiana bat) and the proposed to be listed *Myotis septentrionalis* (Northern long-eared bat) for a proposed refuse facility, located in Williamson County, Illinois. This proposed permit area is shown in Drawing Nos. B14-445-A2, B14-445-A3, and B14-445-A4. This report is hereby submitted on behalf of Williamson to fulfill the requirements set forth by the U.S. Fish and Wildlife Service (USFWS) and Illinois Department of Natural Resources (IDNR).

The Indiana and Northern long-eared bat survey was conducted by Alliance from August 4th through August 8th, 2014. The survey services were completed in accordance with our proposal for professional ecological services and Williamson's subsequent authorization to proceed.

The purpose of the study was to confirm the presence or probable absence of the Indiana and Northern long-eared bats within the project area. The survey was based on Alliance's professional judgment and interpretation of the technical criteria outlined in the USFWS (Region 3) agency draft document entitled "Indiana Bat (*Myotis sodalis*) Revised Recovery Plan", dated March 1999, "Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision" dated April 2007, and "2014 Range-Wide Indiana Bat Summer Survey Guidelines" dated January 2014.

2.0 SITE LOCATION

The project area is located 6 miles east of Johnston City in Section 7, Township 8S, Range 4E of Williamson County, Illinois. The proposed area covers approximately 230 acres and is located in the Pond Creek watershed, which is a tributary of the Big Muddy River. The proposed project area is located on the Pittsburg U.S.G.S. 7.5' quadrangle.

2.1 Geography and Geology

The project area lies within the Southern Till Plain Physiographic Division. The topography of the area is characterized as rolling, gently slopes hills, and wide floodplains. Geologic strata within this area consist of sandstones, limestone, coal and shale (Mohlenbrock 2002).

2.2 Forest Community Composition

The forest in the project area is classified as Upland Flatwoods, where oaks (*Quercus spp.)* dominate, along with hickories (*Carya spp.*) in the uplands, and silver maple (*Acer*

saccharinum), willows (*Salix, spp.*), sycamore (*Platanus occidentalis*) and American elm (*Ulmus americana*) near the flood plains and riparian corridors.

3.0 INDIANA BAT INFORMATION

3.1 Species Status and Conservation

The Indiana bat (*Myotis sodalis*) was one of the first bat species in the United States to be recognized as endangered by the U.S. Fish and Wildlife Service Endangered Species Act (ESPA). It was listed as a federally endangered species on March 11, 1967 under the ESPA. This listing was largely due to declines recorded at winter hibernation sites in caves, which, until very recently, were the only known roosts for this species. It is now known that in summer, Indiana bats roost and rear their young under loose bark or in tree hollows. In order to outline habitat requirements, critical habitat, potential causes for the bats' decline, and recovery objectives, the U.S. Fish and Wildlife Service (USFWS) published a recovery plan in 1983. An agency Draft of a Revised Recovery Plan was distributed by the USFWS in 1999. This document was re-circulated in 2002 for further comments and a first revision was available in 2007. The objectives of the Indiana Bat Recovery Plan include: (1) protect hibernacula, (2) maintain, protect, and restore summer maternity habitat, (3) monitor population trends through winter censusing, (4) educate the public, and (5) continue research. Most recently the USFWS released the "2014 Range-Wide Indiana Bat Summer Survey Guidelines" dated January 2014 that outline the specific efforts that should be undertaken during a survey.

The Indiana bat was listed as endangered by the federal government because of declines in their numbers that were documented at their seven major hibernacula in the Midwest. At the time of the federal listing, about 85% of the entire population hibernated at only seven sites, and nearly half of the entire population hibernated in only two caves. Populations across the species range (as recorded from counts in hibernacula) have declined since the late 1950s. Human disturbance, collapse, and flooding of hibernacula are considered to be major factors in the bats' population decline. Suspected contributing factors include loss of suitable summer habitat and contamination by pesticides (USFWS 1999). Since then, steps have been taken to protect most of the major as well as minor hibernation sites.

3.2 Distribution

The Indiana bat is a migratory species found throughout much of the eastern half of the United States (Figure No. 2). They are found from Oklahoma, Iowa, Wisconsin, east to Vermont, and south to northwestern Florida (Barbour and Davis 1969). As this species is migratory, this range includes both summer and winter habitat. During winter, the Indiana bat primarily hibernates in caves and abandoned mines. Within these hibernacula, Indiana bats congregate in tightly packed clusters and are easily counted. Therefore winter census data is the most reliable method for documenting population trends range-wide. Consequently, winter distribution of the Indiana bat is well documented. During the summer maternity season, the bats are much more scattered and difficult to locate, so there is much less known about summer distribution. Data on summer distribution may reflect lack of search effort in some areas (USFWS 1999). Also, even less is known about the migratory habits of the Indiana bat.

3.2.1 Winter Distribution and Habitat

Indiana bats hibernate from October to April, depending on climactic conditions. Specific roost sites in caves or mines that attain temperatures appropriate for hibernation serve as winter habitat for Indiana bats. The preferred hibernacula have temperatures averaging 37 degrees to 43 degrees Fahrenheit in midwinter, and a relative humidity averaging 87 percent. The 2013 winter census estimate of the population was 534,239 individuals (USFWS 2013). The current population is less than half the estimated population of 1960, even though there were fewer known hibernacula at that time (USFWS 2002).

3.2.2 Summer Distribution and Habitat

Reproductive female Indiana bats typically form maternity colonies in trees during the summer. Although summer records are scarce and critical summer habitat has not been designated at this time, the entire state of Illinois has been determined to be potential summer habitat. Most records of reproductively active females come from the Midwest: southern Iowa, northern Missouri, northern Illinois, northern Indiana, southern Michigan, and western Ohio (Gardner and Cook 2002). This area is considered to be the core summer range for the species.

Typically, Indiana bats use the space under exfoliating bark of trees in riparian, bottomland, and upland forest to day roost in the summer. Maternity colonies of females may congregate under this loose tree bark. Because these bats are roosting mainly under exfoliating tree bark, their summer roosts are short-lived. Maternity colonies appear to have at least one "primary roost" that is used by the majority of the colony. Portions of the colony may use over a dozen different "alternate roosts" intermittently.

3.3 Reproduction

Most bats of the United States, including the Indiana bat, mate in the fall. Between early August and mid-September, Indiana bats arrive near their hibernation caves and engage in swarming and mating activity. Swarming at cave entrances continues into mid- or late October. Limited observations indicate that birth and development occur in very small, widely scattered colonies consisting of 25 or so females and their young. Females give birth to a single young in late May to early July. Young Indiana bats are capable of flight within a month of birth, and may mate their first autumn (USFWS 2002).

3.4 Food Habits

Indiana bats forage in and around the tree canopy of flood plains, riparian areas, and upland forests (USFWS 1999). They eat a variety of soft-bodied, flying insects found along rivers and lakes in these habitats. Consistently, food habit studies conducted throughout the species range reveal that small moths are important prey items. However, components of diet vary depending on habitat, region, season, and sex or age of the bat. Some researchers have labeled the Indiana bat as a "selective opportunist" feeder due to the abundant occurrence in the diet of one

particular insect for brief, unpredictable periods, corresponding with the hatch or mating swarms (Brack and LaVal 1985).

3.5 Reasons for Current Status

Causes for the overall decline of the Indiana bat are not fully understood or have not been determined. Furthermore, the decline of the species at its current rate is unknown. Originally, cave disturbance by humans was thought to be the primary reason for the decline. Therefore, habitat protection for these bats has primarily focused on the caves where they hibernate, such as gating of the opening, fencing of the surrounding land, and generally protecting the hibernacula. However, as evidenced by the still-declining population numbers, these measures have not produced the desired result of recovery of the species (USFWS 1999). Other potential causes for the decline include loss of summer habitat, improper cave gate construction, loss of forest cover, stream channelization, severe weather, and range-wide pesticide poisoning (USFWS 2002). Most recently white-nose syndrome, caused by the fungus *Pseudogymnoascus destructans* (formally known as *Geomyces destructans*) has put bat populations, including the Indiana bat, at risk in some areas of the country (USFWS 2011).

4.0 NORTHERN LONG-EARED BAT INFORMATION

4.1 Species Status and Conservation

The Northern long-eared bat is currently proposed to be listed as federally endangered under the ESPA due to significant population declines throughout the bat's range. A final decision on listing the bat as endangered will be made by the USFWS no later than April 2, 2015.

4.2 Distribution

The Northern long-eared has an extensive range, from Canada down to North Carolina, and from the Atlantic coast to as far west as the Yukon territory in Canada and Montana and Wyoming in the United States (USFWS, 2014).

4.2.1 Winter Habitat

The winter habitat of the Northern long-eared bat is similar to that of the Indiana bat, in that they utilize hibernacula. Typically, these hibernacula are caves and abandoned mines that have constant temperatures and high humidity. During hibernation the bats often tuck themselves into small spaces as opposed to hanging openly on cave ceilings or walls (USFWS, 2014).

4.2.2 Summer Habitat

Summer habitat for the Northern long-eared bat is normally living and dead trees, sometimes in caves and mines, and they are occasionally found in barns or sheds. The bats utilize loose, exfoliating bark on trees to get under when they roost, where they can be found singly or in colonies (USFWS, 2014).

4.3 Reproduction

Female bats give birth to one pup in late May or early June normally after joining a maternity colony within their summer habitat. The bats practice delayed fertilization, meaning that although copulation occurs in late summer or early fall the females do not ovulate again until the spring, storing the sperm during the hibernation period. This allows the bats to give birth in more favorable conditions (USFWS, 2014).

4.4 Food Habits

Feeding occurs in forested areas, typically along ridges and hillsides. The forage for these bats is insects like moths, beetles, and flies that the bat captures mid-flight (USFWS, 2014).

4.5 Reasons for Current Status

The most immediate threat to the Northern long-eared bat is white-nose syndrome. The fungus has spread rapidly throughout the range of the Northern long-eared bat, leading to a dramatic population decline. As with the Indiana bat discussed previously, cave disturbance by humans and loss of summer habitat can impact bat populations. Wind turbine operation also kills bats, although probably to a lesser extent than other causes of mortality. Coupled with white-nose-syndrome, these sources of mortality have led to a very serious decline in population numbers (USFWS, 2014).

5.0 METHODS

5.1 Level of Survey Effort

The level of survey effort for this project was based upon survey guidelines developed by the USFWS in the 2014 Range-Wide Indiana Bat Summer Survey Guidelines (USFWS 2014; Appendix A). The level of effort was also dependent on coordination with the Illinois Department of Natural Resources (IDNR) and the USFWS. Alliance submitted a study plan to the IDNR and USFWS that described the proposed level of survey effort and mist netting protocol. The IDNR issued a scientific collection permit, permit numbers 2013-255 and 2013-105, authorizing Alliance to implement the proposed plan, see Appendix E.

5.2 Site Selection

Using a topographic map, aerial photographs, and field reconnaissance of the proposed project area, Alliance identified areas for possible mist net site placement. Actual mist net sites were selected during field reconnaissance. Refer to Figures section, Drawing No. B14-445-A2. Field reconnaissance was completed in order to establish mist net sites that would maximize the success of the mist net survey. In the field, Indiana and Northern long-eared bat habitat assessment was performed that focused on plant community type and structure, especially focusing on canopy cover and species of trees. Attention was especially paid to large tree species, including snags that could provide roost habitat for Indiana and Northern long-eared bats. Additionally, each net site was assessed individually. Photographs were taken and



sketches were made of each net site to show net placement and surrounding habitat features, and habitat characteristics near each net site were recorded (Appendices B and C).

5.3 Mist Net Survey

Alliance conducted the mist netting survey following the guidelines developed by the USFWS in the 2014 Range-Wide Indiana Bat Summer Survey Guidelines (Appendix A). Mist nets were composed of 2-ply, 50-denier nylon construction with a mesh size of 38 mm. Mist net sizes were 2.6 to 7.8 m high (approximately 9 to 27 feet) in height, and were 2.6, 4, 6, 9, or 12m (approximately 9, 13, 20, or 30, or 40 feet) in width.

Two sites were surveyed for Indiana and Northern long-eared bats by Alliance biologists on August 4th through August 8th, 2014. Three net sets were each operated for three calendar nights at two sites. This resulted in a total of 18 net nights for the entire survey (three nets x three nights x two sites = 18 net nights). A "net night" is defined as the operation of one net set for one night. To the extent possible, nets were placed in a location where they would be bordered on top and sides by vegetation to create a funneling effect to facilitate the capture of bats. Nets were spaced at least 30 meters apart to ensure that nets did not interfere with one another. Mist nets were deployed at dusk (approximately 20:00 hours) and monitored every 10 minutes for at least five hours.

It is not recommended that Indiana and Northern long-eared bat surveys be conducted when temperatures drop below 50 degrees Fahrenheit or during rainy, foggy, or windy conditions (USFWS 1999). To ensure that surveys were not conducted during inclement weather, temperature, wind speed, percent cloud cover, rainfall and moon phase were monitored and recorded.

During the course of the survey, there were two rainouts, where the survey was stopped early due to rain and the night was resurveyed.

Captured bats were carefully removed from the nets and then identified. The age, sex, reproductive condition, weight, forearm length, and any other notable characteristics were then recorded for all bats. After all information had been collected, the bats were released at the site of capture. No bats were injured, killed, or retained during survey efforts.

6.0 RESULTS

6.1 Summer Habitat Survey

From August 4th through August 8th, 2014, Alliance biologists evaluated the project area for potential Indiana and Northern long-eared bat summer habitat. The forested areas are dominated by an overstory of *Quercus spp.*, American sycamore and silver maple. The area is covered with a mixed mesophytic forest of primarily second or third growth timber, as few large snags or potential roost trees were noted and the average dbh was small.

6.2 Mist Net Survey

Mist nets were set primarily along flyways in between forested areas and drinking pools. The flyway setups were used by the bats for traveling and foraging, where the pool setups were used by foraging and drinking bats. Refer to Drawing No. B14-445-A2 entitled, "Mist Net Location Map".

No federally listed endangered bats, or proposed to be federally listed endangered bats, were captured during survey efforts.

A total of 40 bats of two species were captured during the 18 net nights of effort for the proposed project area (Table 1). The red bat (*Lasiurus borealis*) was the species most commonly encountered, making up 95 percent of the total capture. Bat survey forms were completed for each night of the mist netting and contained in Appendix C. Photographs of representative bat species are located in Appendix D.

Weather conditions at the permit area were within the limits, i.e. above 50 degrees Fahrenheit, to conduct an Indiana bat survey (USFWS 1999, USFWS 2014). Nightly temperatures were within seasonal norms during the survey period: low temperatures between 20:30 and 01:30 for the survey ranged from 51 to 72 degrees Fahrenheit, while highs ranged from 59 to 79 degrees Fahrenheit. During the survey, the moon phases cycled from ¾ to full, ending at a half moon.

Table 1. Bats captured from mist net sites in the project area.

SITE	NIGHT	RED BAT	TRI-COLORED BAT
1	1	13	0
	2	14	0
	3	1	1
	4	0	0
	5	1	0
2	1	3	0
	2	3	1
	3	0	0
	4	0	0
	5	3	0
Total		38	2

7.0 DISCUSSION

Weather conditions at the project area were within the limits to conduct an Indiana bat survey. The eastern red bat was the species most commonly captured during survey efforts. Other bats captured included the tri-colored bat. These species of bats are fairly common in this portion of

Illinois and are encountered during most mist net surveys conducted in the region. No federally endangered or proposed federally endangered bats were captured during survey efforts.

Eastern red bats (*Lasiurus borealis*) were the majority of bats captured during the survey. Its distribution includes southern Canada, the eastern United States (except the Florida peninsula), and northeastern Mexico (Harvey et al. 1999). In colder parts of their range, they are known to migrate south in winter or hibernate in hollow trees or leaf litter. The eastern red bat is common throughout most of its range.

Tri-colored bats (*Perimyotis subflavus*) were captured during the survey. Tri-colored bats are one of the most common bats in their range, which includes eastern Canada, most of the eastern United States, and southward through eastern Mexico to Central America (Harvey et al, 1999). Winter roosts include caves, mines, and rock crevices, while summer is spent in trees within the forest (Harvey et al, 1999). Tri-colored bats are among the first bats to emerge at dusk each night and are found at treetop level (BCI, 2007). Mating occurs during the fall, fertilization takes place in the spring, and usually twins are born in late spring and early summer (Harvey et al., 1999).

The mist net surveys that Alliance conducted at the proposed project area provided no evidence of summer Indiana or Northern long-eared bat usage. The surveys were conducted following guidelines set forth by the USFWS and the Indiana Bat Recovery Team. Based on these results, it is not likely that the proposed activities will negatively affect the Indiana or Northern long-eared bat.

In preparing this document, our professional services have been performed with the care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made. We reserve the right to revise or amend our opinion in this report in the event new information, documentation or evidence becomes available.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Dan Richardson
Staff Scientist

Braden A. Hoffman
Senior Project Manager

DR/BAH:dr
File: \\Aci-zeus\projects\Projects\Williamson Energy (1413)\2014\B14-445-1413\bat_report.doc

8.0 LITERATURE CITED

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University Press Kentucky, Lexington. 286 pp.

BCI (Bat Conservation International). 2007. Species profiles. http://batcon.org.

Brack, Virgil Jr., Sparks, Dale W., Whitaker, John O, Jr., Walters, Brianne L., Boyer, Angela. 2010. Bats of Ohio. ISU Center for North American Bat Research and Conservation.

Brack, W., Jr., and R.K. LaVal. 1985. Food habits of the Indiana bat in Missouri. Journal of Mammalogy. 66:308-315.

Gardner and Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Bat Conservation International. Austin, Texas.

Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game & Fish Commission. 64 pp.

Mohlenbrock, Robert H. 2002. Vascular Flora of Illinois. Southern Illinois University Press, Carbondale, Illinois, pp 23-24.

U.S. Fish and Wildlife Service (USFWS). 1999. Agency Draft: Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. Region 3 U.S. Fish and Wildlife Service, Ft. Snelling, Minnesota. March 1999.

U.S. Fish and Wildlife Service (USFWS). 2002. Indiana bat (*Myotis sodalis*) revised recovery plan, Agency Draft. Ft. Snelling, Minnesota. 69 pp.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Region 3 U.S. Fish and Wildlife Service. Fort Snelling, Minnesota. 258 pp.

U.S. Fish and Wildlife Service (USFWS). 2011. Fish and Wildlife Service Unveils National Plan to Combat Deadly White-Nose Syndrome in Bats. http://www.fws.gov/WhiteNoseSyndrome/

U.S. Fish and Wildlife Service (USFWS). 2014. Northern Long-Eared Bat *Myotis septentrionalis*. http://www.fws.gov/midwest/endangered/mammals/nlba/nlbaFactSheet.html accessed July 18, 2014

U.S. Fish and Wildlife Service (USFWS). 2014. 2014 Range-Wide Indiana Bat Summer Survey Guidelines. http://www.fws.gov/northeast/virginiafield/pdf/endspecies/2014_IBat_Summer_Survey_Guidelines.pdf

USGS. 2006. *Indiana bats.* http://biology.usgs.gov/s+t/frame/c164.htm#10816 accessed July 24, 2006.

APPENDIX A

MIST NETTING GUIDELINES RATIONALE

(AS CONTAINED WITHIN APPENDIX B OF 2014 INDIANA BAT SUMMER SURVEY GUIDANCE)

APPENDIX B
PHASE 2 or 3 MIST-NETTING

Mist-netting can be used as a presence/probable absence method (Phase 2 surveys) or it can be conducted for the purpose of attempting to capture Indiana bats after detection during acoustic presence/probable absence surveys (Phase 3 surveys). The same recommendations (e.g., season, personnel, equipment, net placement, checking nets) apply for either use of mist-netting surveys.

SUMMER MIST-NETTING SEASON: May 15[20] – August 15

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to help determine the presence or absence of a maternity colony or large concentrations of bats in the area when only males and/or non-reproductive females are captured.

PERSONNEL

A qualified biologist(s)[21] must (1) select/approve mist-net set-ups in areas that are most suitable for capturing Indiana bats, (2) be physically present at each mist-net site throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage mist-net set-ups in close proximity to one another as long as the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between nets.

COORDINATION WITH USFWS FO(s)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval. Study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, and the proposed number and tentative locations of net sites.

EQUIPMENT

Use the finest, lowest visibility mesh mist-nets commercially available, as practicable. Currently, the finest net on the market is 75 denier, 2 ply, denoted 75/2 (Arndt and Schaetz 2009); however, the 50 denier nets are still acceptable for use at this time. The finest mesh size available is approximately 1½ inches (38 millimeters).

---

[20] Due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies before beginning surveys.

[21] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

APPENDIX B
PHASE 2 or 3 MIST-NETTING

No specific hardware is required. There are many suitable systems of ropes and/or poles to hold nets. The system of Gardner et al. (1989) has been widely used. See NET PLACEMENT for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

MINIMUM PRESENCE/ABSENCE MIST-NETTING LEVEL OF EFFORT (PHASE 2)

Conduct Mist-Netting Surveys following Recovery Unit-based protocols[22]

Northeast and Appalachian Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT):

Linear projects: a minimum of 6 net nights per km (0.6 miles) of suitable summer habitat.

Non-linear projects: a minimum of 42 net nights per 123 acres[23] (0.5 km^2) of suitable summer habitat.

For example:

- 7 sites[24], 2 nets[25]/site for 3 calendar nights = 42 net nights
- 7 sites, 3 nets/site for 2 calendar nights = 42 net nights
- 3 sites, 2 nets/site for 7 calendar nights* = 42 net nights

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are

[22] The Indiana bat populations in the Northeast and Appalachian Recovery Units have been most heavily impacted by white-nose syndrome; therefore, we recommend higher survey effort when compared to the Midwest and Ozark-Central Recovery Units.

[23] We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Detection probabilities and occupancy estimates were derived from past survey efforts that used the same acreage threshold (see Niver et al. 2013).

[24] A site is defined as a geographic area to be sampled. It can include one or more nets that can be managed by one Qualified Biologist.

[25] A net is defined as any combination of individual panels and poles (e.g., single, double, triple high) to fill the area (e.g., corridor) being sampled.

necessary[26].

b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

Midwest and Ozark-Central Recovery Units (AL, AR, GA, IA, IL, IN, KY, MI, MO, MS, OH, OK, and central & western TN):

Linear projects: a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat.

Non-linear projects: a minimum of 9 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

- 3 sites, 1 nets/site for 3 calendar nights = 9 net nights
- 1 sites, 3 nets/site for 3 calendar nights = 9 net nights

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are necessary.
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

MIST-NETTING SURVEYS TO CAPTURE INDIANA BATS AFTER ACOUSTICS WERE USED AS P/A METHOD (PHASE 3)

If netting was not conducted as the P/A method, then netting may be conducted to capture and characterize (e.g., sex, age, reproductive condition) the Indiana bats (documented through the Phase 2 acoustic P/A survey) present in an area and to facilitate Radio-tracking (Phase 4) efforts. We encourage working with the FO(s) to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no Indiana bats are captured, then coordinate with the USFWS FO.
b) If Indiana bats are captured, then proceed to **Phase 4** as previously decided in coordination with the FO(s).

[26] NOTE: For Phase 2 Presence/Absence Surveys, wherever the phrase "no further summer surveys are necessary" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of Indiana bats during the summer.

APPENDIX B
PHASE 2 or 3 MIST-NETTING

NET PLACEMENT

Potential travel corridors (e.g., streams, logging trails) typically are the most effective places to net (although other places may also be productive; see Carroll et al. 2002). Place nets approximately perpendicular across the corridor. Nets should fill the corridor from side to side, extending beyond the corridor boundaries when possible, and from stream (or ground) level up to the overhanging canopy. Nets of varying widths and heights may be used as the situation dictates. A typical set is at least 5 m to 9 m high consisting of two or more nets stacked on top one another and from 6 m to 18 m wide. If netting over water, ensure there is enough space between the net and the water so that captured bats will not get wet.

Occasionally it may be necessary or desirable to net where a suitable corridor is lacking. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the surveyor (see Humphrey et al. 1968). See Kiser and MacGregor (2005) for additional discussion about net placement.

Although no minimum spacing between mist-nets is being specified, surveyors should distribute net set-ups throughout suitable habitat. Net set-ups can be repeatedly sampled throughout the project, but generally no more than 2-3 nights at a single location is recommended. In addition, changing locations within a project area may improve capture success (see Robbins et al. 2008; Winhold and Kurta 2008). Photo-document placement of nets.

SURVEY PERIOD

The survey period for each net shall begin at sunset[27] and continue for at least 5 hours (longer survey periods may also improve success).

CHECKING NETS

Each net set-up should be checked approximately every 10 minutes, never exceeding 15 minutes (Gannon et al. 2007). If surveyors monitor nets continuously, take care to minimize noise, lights and movement near the nets. Monitoring the net set-up continuously with a bat detector (ideally using ear phones to avoid alerting bats) can be beneficial: (a) bats can be detected immediately when they are captured, (b) prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006), and (c) monitoring with a bat detector also allows the biologist to assess the effectiveness of each net placement (i.e., if bats are active near the net set-up but avoiding capture), which may allow for adjustments that will increase netting success on subsequent nights. There should be no other disturbance near the nets, other than to check nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes (CCAC 2003; Kunz et al. 2009).

[27] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php.

APPENDIX B
PHASE 2 or 3 MIST-NETTING

Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Indiana bats should not be held for more than 30 minutes after capture, unless the individual is targeted for radio-tracking. Bats targeted for radio-tracking should be released as quickly as possible, but no longer than 45 minutes after capture, or as allowed in federal and state permits. See Kunz and Kurta (1988) for general recommendations for holding bats.

WEATHER AND LIGHT CONDITIONS

Severe weather adversely affects capture of bats. Some Indiana bats may remain active despite inclement weather and may still be captured while others in the same area become inactive. Therefore, negative surveys combined with any of the following weather conditions throughout all or most of a sampling period are likely to require an additional night of mist-netting: (a) temperatures that fall below 50°F (10°C); (b) precipitation, including rain and/or heavy fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/seconds; 3 on Beaufort scale).

NOTE: Provided that nets are not dripping wet, surveyors can resume netting to meet the minimum 5-hour requirement after short periods of adverse weather. If nets are under good cover, light rain may not alter bat behavior. However, if no bats are being captured during marginal weather, coordinate with the USFWS FO(s).

It is typically best to place net set-ups under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net set-ups illuminated by artificial light sources should also be avoided.

DOCUMENTATION OF *MYOTIS SODALIS* CAPTURES

If an Indiana bat(s) is captured during mist-netting, protocols for radio-tracking and emergence survey requirements, as provided in Appendix D and E, respectively, should be followed. In addition, the appropriate USFWS FO(s) must be notified of the capture within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided.

Several species of bats from the genus *Myotis* share common features which can make identification difficult; Indiana bats and little brown bats (*Myotis lucifugus)* can be particularly difficult to distinguish. Photo-documentation of all bats captured and identified as Indiana bats and the first 10 little brown bats per project are requested to verify the identifications made in the field.

Photo-documentation should include diagnostic characteristics:

- a ¾-view of face showing ear, tragus, and muzzle
- view of calcar showing presence/absence of keel
- a transverse view of toes showing extent of toe hairs

APPENDIX B
PHASE 2 or 3 MIST-NETTING

If a bat from the genus *Myotis* is captured during mist netting that cannot be readily identified to the species level, then species verification may be attempted through fecal DNA analysis. Collect one or more fecal pellets (i.e., guano) from the bat in question by placing it temporarily in a holding bag (15 minutes is usually sufficient, no more than 30 minutes is recommended). The pellet (or pellets) collected should be placed in a small vial (e.g., 1.5 ml) with silica gel desiccant; pellets from each individual bat should be stored in separate vials and out of direct light. Fees charged by independent laboratories for sequencing fecal DNA samples is generally inexpensive (approx. $50 per guano sample), however, it has been challenging to identify labs willing to consistently conduct these analyses. Any additional information and a list of available laboratories will be made available on the Indiana bat webpage on the USFWS's Region 3 website (http://www.fws.gov/midwest/Endangered/mammals/inba/index.html).

SUBMISSION OF MIST-NETTING RESULTS

Provide results of netting surveys to the appropriate USFWS FO(s) in accordance with previously agreed upon[28] timeframes. If Indiana bats are captured, this report should also include the results of subsequent radio-tracking and emergence counts. Reports should include the following:

1. Copy of prior phase reports (if not previously provided).
2. Explanation of any modifications from original survey plan (e.g., altered net locations).[29]
3. Description of net locations (including site diagrams), net set-ups (include net heights), survey dates, duration of surveys, weather conditions, and a summary of findings.
4. Map identifying netting locations and information regarding net set-ups, including lat/long or UTM, individual net placement, and net spacing (i.e., include mist-netting equipment in photographs of net locations).
5. Full names of mist-netting personnel attending each mist-net site during an operation, including the federally-permitted/qualified biologist present at each mist-net site. Indicate on the field data sheet the full name of person who identified bats each night at each site.
6. Legible copies of all original mist-netting datasheets (see example datasheet below) and a summary table with information on all bats captured during the survey including, but not limited to: capture site, date of capture, time of capture, sex, reproductive condition, age, weight, right forearm measurement, band number and type (if applicable), and Reichard's wing damage index score (Reichard and Kunz. 2009).

---

[28] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.

[29] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods

APPENDIX B
PHASE 2 or 3 MIST-NETTING

7. Photographs of all net set-ups, as well as **all** Indiana bats and the first 10 little brown bats captured from each project, so that the placement of netting equipment and identification of species can be verified. Photographs of bats should include all diagnostic characteristics that resulted in the identification of the bat to the species level.
8. Any other information requested by the local USFWS FO(s) related to the project.

REFERENCES

Arndt, R.J. and B.A. Schaetz. 2009. A tale of two deniers: nylon versus polyester mist nets. Bat Research News 50(3):57.

Carroll, S.K., T.C. Carter, and G.A. Feldhamer. 2002. Placement of nets for bats: effects on perceived fauna. Southeastern Naturalist 1:193-198.

Canadian Council on Animal Care (CCAC). 2003. CCAC species-specific recommendations on bats. 9pp. Available at: http://www.ccac.ca/en/CCAC_Programs/Guidelines_Policies/GDLINES/BatsFinal20May03.htm (Accessed October 30, 2008).

Gannon, W.L., R.S. Sikes, and the Animal Care and Use Committee of the American Society of Mammologists. 2007. Guidelines of the American Society of Mammologists for the use of wild mammals in research. Journal of Mammalogy 88:809-823.

Gardner, J. E., J.D. Garner, and J.E. Hofmann. 1989. A portable mist-netting system for capturing bats with emphasis on *Myotis sodalis* (Indiana bat). Bat Research News 30:1-8.

Humphrey, P.S., D. Bridge, and T.E. Lovejoy. 1968. A technique for mist-netting in the forest canopy. Bird-Banding 39(1): 43-50.

Kiser, J.D. and J.R. MacGregor. 2005. Indiana bat (*Myotis sodalis*) mist net surveys for coal mining activities. Pp. 169-172 *in* K.C. Vories and A. Harrington (eds.), The Proceedings of the Indiana bat and coal mining: a technical interactive forum Office of Surface Mining, U.S. Department of the Interior, Alton, IL. Available at: http://www.mcrcc.osmre.gov/MCR/Resources/bats/pdf/Indiana_Bat_and_Coal_Mining.pdf. (Accessed October 06, 2011).

Kunz, T.H. and A. Kurta. 1988. Capture methods and holding devices. Pp. 1-29 *in* T.H. Kunz (ed.), Ecological and behavioral methods for the study of bats. Smithsonian Institution Press, Washington, D.C.

APPENDIX B
PHASE 2 or 3 MIST-NETTING

Kunz, T.H., R. Hodgkison, and C.D. Weise. 2009. Methods of capturing and handling bats. Pp. 3-35 *in* T.H. Kunz and S. Parsons (eds.), Ecological and behavioral methods for the study of bats, second edition. The Johns Hopkins University Press, Baltimore, Maryland.

MacCarthy, K.A., T.C. Carter, B.J. Steffen, and G.A. Feldhamer. 2006. Efficacy of the mist-net protocol for Indiana bats: A video analysis. Northeastern Naturalist 13:25-28.

Reichard, J.D., and T.H. Kunz. 2009. White-nose syndrome inflicts lasting injuries to the wings of little brown myotis (Myotis lucifugus). Acta Chiropterologica 11: 457-464.

Robbins, L.W., K.L. Murray, and P.M. McKenzie. 2008. Evaluating the effectiveness of the standard mist-netting protocol for the endangered Indiana bat (*Myotis sodalis*). Northeastern Naturalist 15:275-282.

Winhold, L. and A. Kurta. 2008. Netting surveys for bats in the Northeast: differences associated with habitat, duration of netting, and use of consecutive nights. Northeastern Naturalist 15:263-274.

APPENDIX B

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA

Project No. B14-445-1413

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA



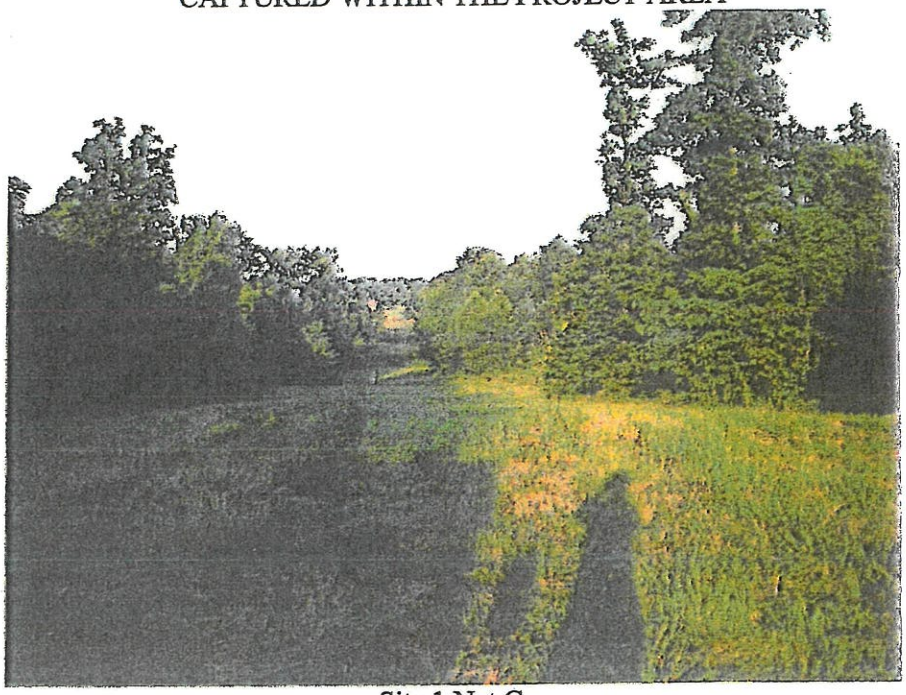
Site 1 Net A



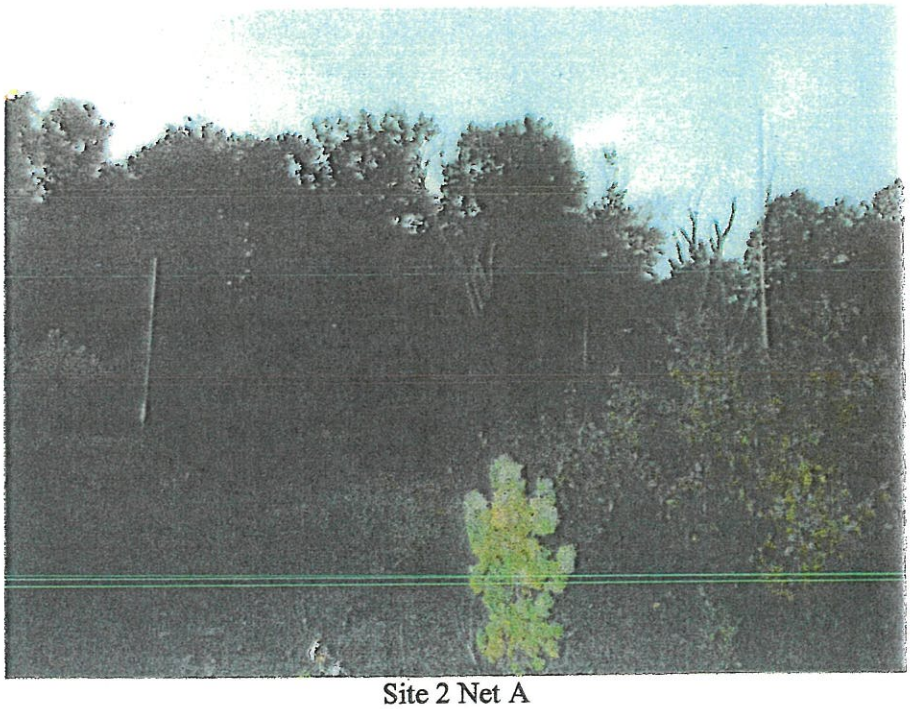
Site 1 Net B

Project No. B14-445-1413

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA



Site 1 Net C



Site 2 Net A

Project No. B14-445-1413

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA



Site 2 Net B

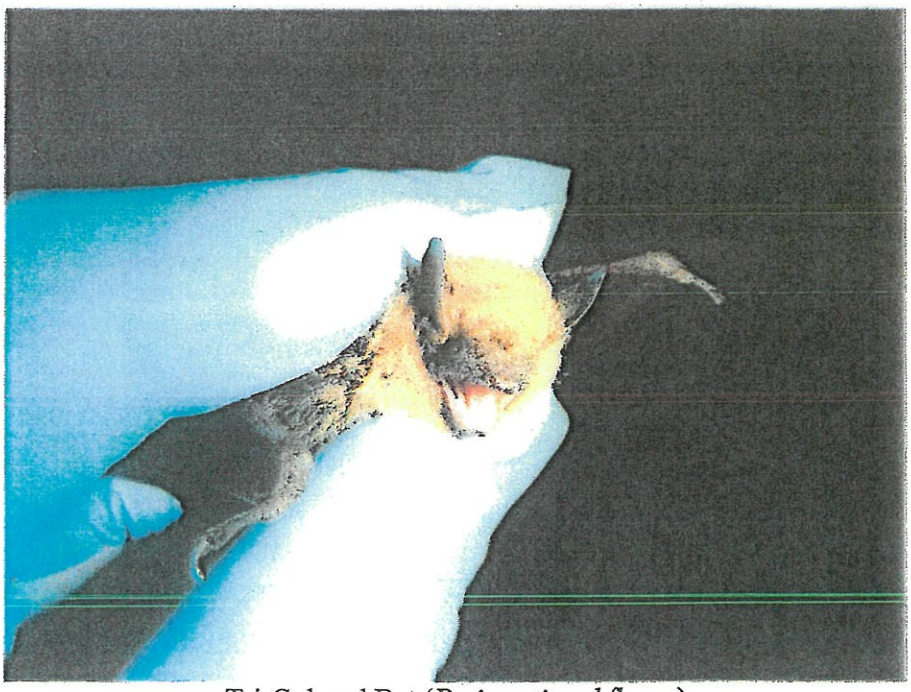


Site 2 Net C

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA



Red Bat (*Lasiurus borealis*)



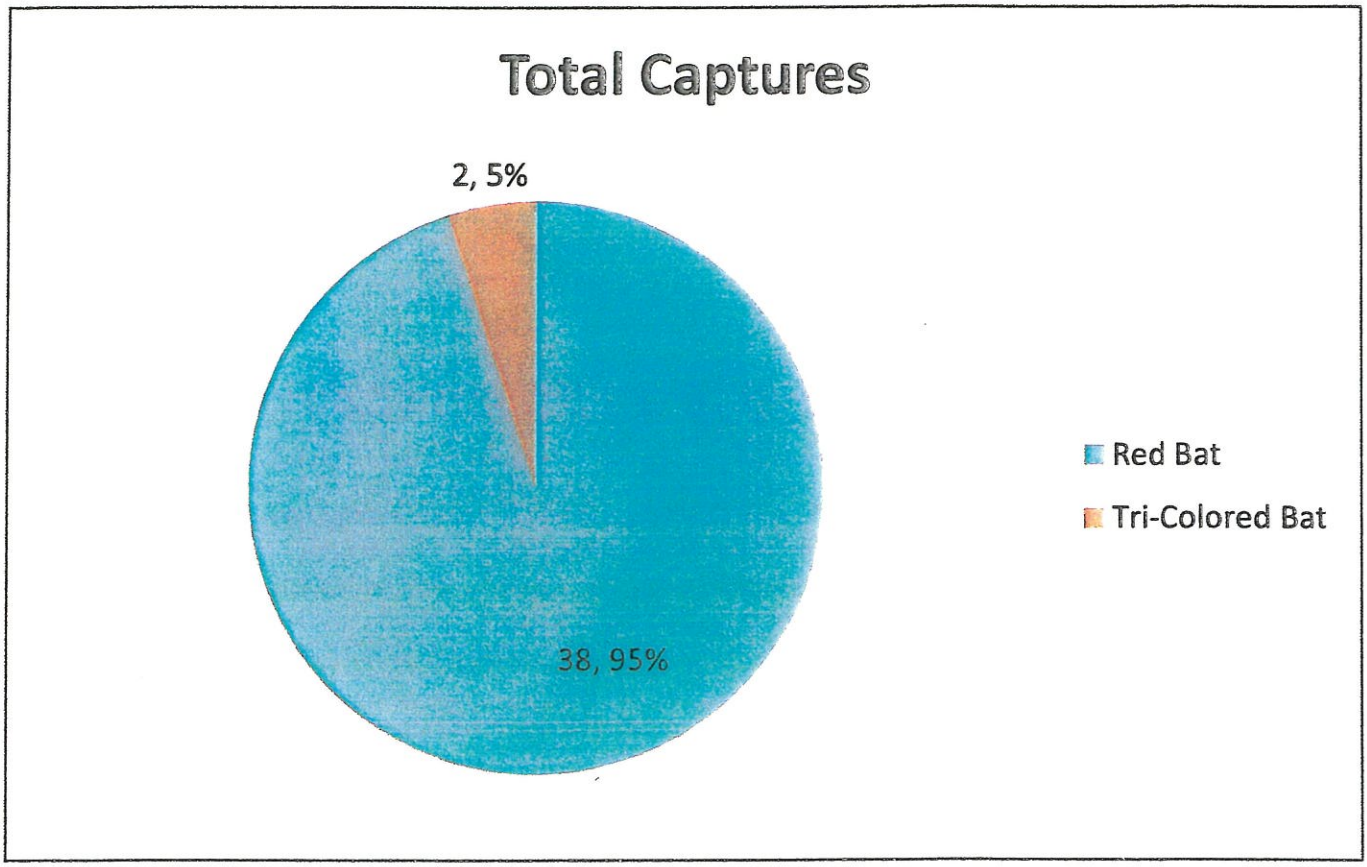
Tri-Colored Bat (*Perimyotis subflavus*)

Project No. B14-445-1413

PHOTOGRAPHS OF MIST NET SITES AND REPRESENTATIVE BAT SPECIES CAPTURED WITHIN THE PROJECT AREA



Tri-Colored Bat (*Perimyotis subflavus*)


Total Captures
2, 5%
38, 95%
Red Bat
Tri-Colored Bat

APPENDIX C

COMPLETED BAT SURVEY DATA FORMS

Alliance Bat Survey Data Form

Project Name: East of Dwina Date: 08/04/2014 Scientists: H Green Page ____ of ____

Township: _____ State: Il County: Williamson USGS Quad: Pitsburg

Start Weather: 18.8 (°C) Warm (feel) Calm (wind) Clear (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: 16.6 (°C) Warm (feel) Calm (wind) 20% (sky) 22:30 (Time) Lat: 37 ° 50 ' 17.40 "

End Weather: 16.1 (°C) Cool (feel) 1-3 mpl (wind) Clear (sky) 01:00 (Time) Long: 88 ° 48 ' 38.80 "

Identification By: B. Hoffman Site Number : 1 Night Number: 1 Moon Phase: Half rise 06:00 set 20:02

Site Description : flyway over gasline

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	flyway
B:	18	X	3	flyway
C:	12	X	3	flyway
D:	-	X	-	

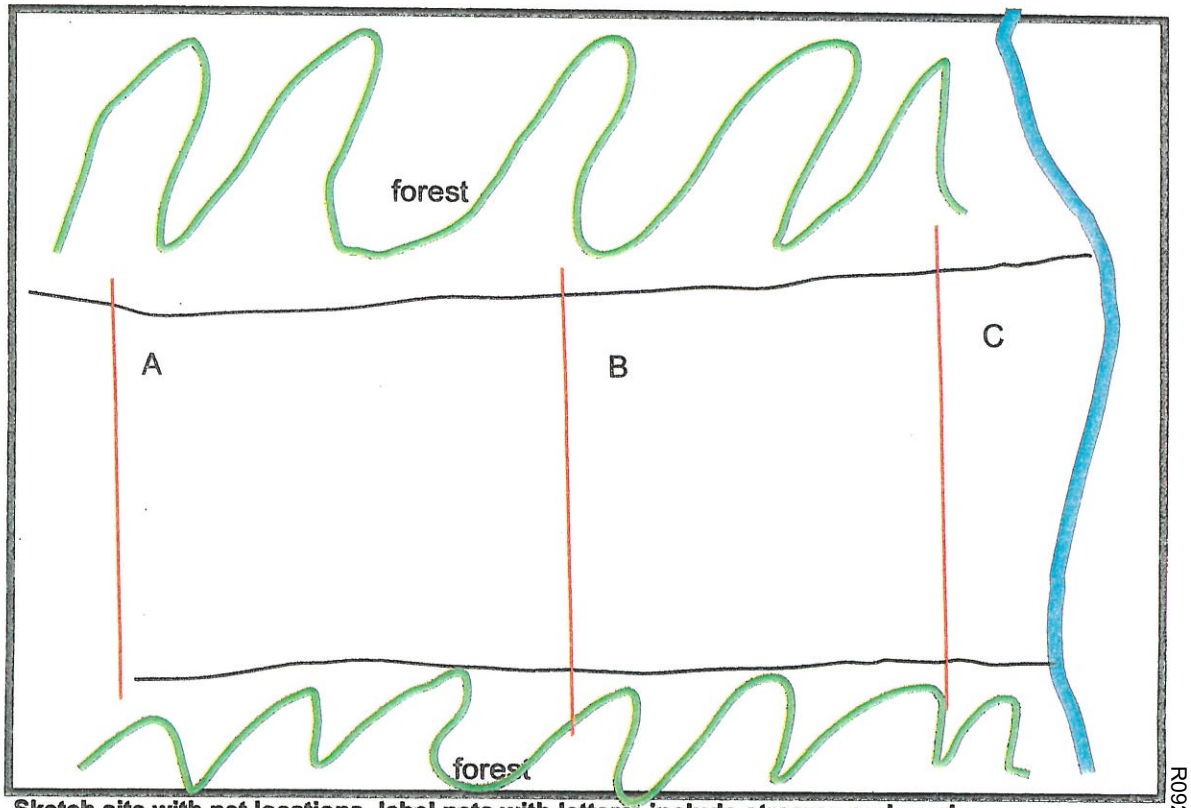
# of Net Sets at Site: 9 Time Started: 20:00 Time Ended: 01:00

Bat Activity (time): 20:05

Other Wildlife Observed: whitetail deer

Notes / Comments: dense forest
on both sides of gas line

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09267

Bat Survey Data Form

Project Name: East of Dwina **Site Number:** 1 **Night Number:** 1 **Date:** 08/04/2014 **Page** ___ **of** ___

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	21:10	J	M	NR	9.5	40.2	8	No	No	B	0 pic 48,49
2	Eastern Red bat	Lasiurus borealis	21:10	A	F	Post Lac	15.0	39.3	14	No	No	C	0
3	Eastern Red bat	Lasiurus borealis	21:10	A	F	Post Lac	16.0	40.7	10	No	No	A	0
4	Eastern Red bat	Lasiurus borealis	21:45	J	M	NR	8.5	38.5	6	No	No	C	0 pic 50
5	Eastern Red bat	Lasiurus borealis	21:45	A	F	NR	11.0	41.4	8	No	No	B	0
6	Eastern Red bat	Lasiurus borealis	21:45	A	F	Post Lac	12.5	38.1	8	No	No	B	0
7	Eastern Red bat	Lasiurus borealis	21:45	J	F	NR	10.5	39.2	6	No	No	B	0
8	Eastern Red bat	Lasiurus borealis	22:20	A	F	Post Lac	13.5	40.2	15	No	No	C	0
9	Eastern Red bat	Lasiurus borealis	22:40	J	F	NR	9.0	40.7	13	No	No	C	0
10	Eastern Red bat	Lasiurus borealis	23:05	J	M	NR	9.5	41.0	10	No	No	C	0
11	Eastern Red bat	Lasiurus borealis	23:05	J	F	NR	10.5	40.6	4	No	No	B	0
12	Eastern Red bat	Lasiurus borealis	23:30	J	M	NR	9.0	39.4	8	No	No	A	0
13	Eastern Red bat	Lasiurus borealis	00:20	A	F	Post Lac	12.0	41.2	19	No	No	A	0
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09268

Alliance Bat Survey Data Form

Project Name: East of Dwina Date: 08/05/2014 Scientists: H Green Page 1 of 2

Township: _____ State: Il County: Williamson USGS Quad: Pitsburg

Start Weather: 22.0 (°C) Humid (feel) Calm (wind) 20% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: 21.0 (°C) Humid (feel) Calm (wind) 20% (sky) 22:30 (Time) Lat: 37 ° 50 ' 17.40 "

End Weather: 19.0 (°C) Warm (feel) Calm (wind) Clear (sky) 01:00 (Time) Long: 88 ° 48 ' 38.80 "

Identification By: B. Hoffman Site Number : 1 Night Number: 2 Moon Phase: Half rise 06:00 set 20:02

Site Description : flyway over gasline

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	flyway
B:	18	X	3	flyway
C:	12	X	3	flyway
D:	-	X	-	

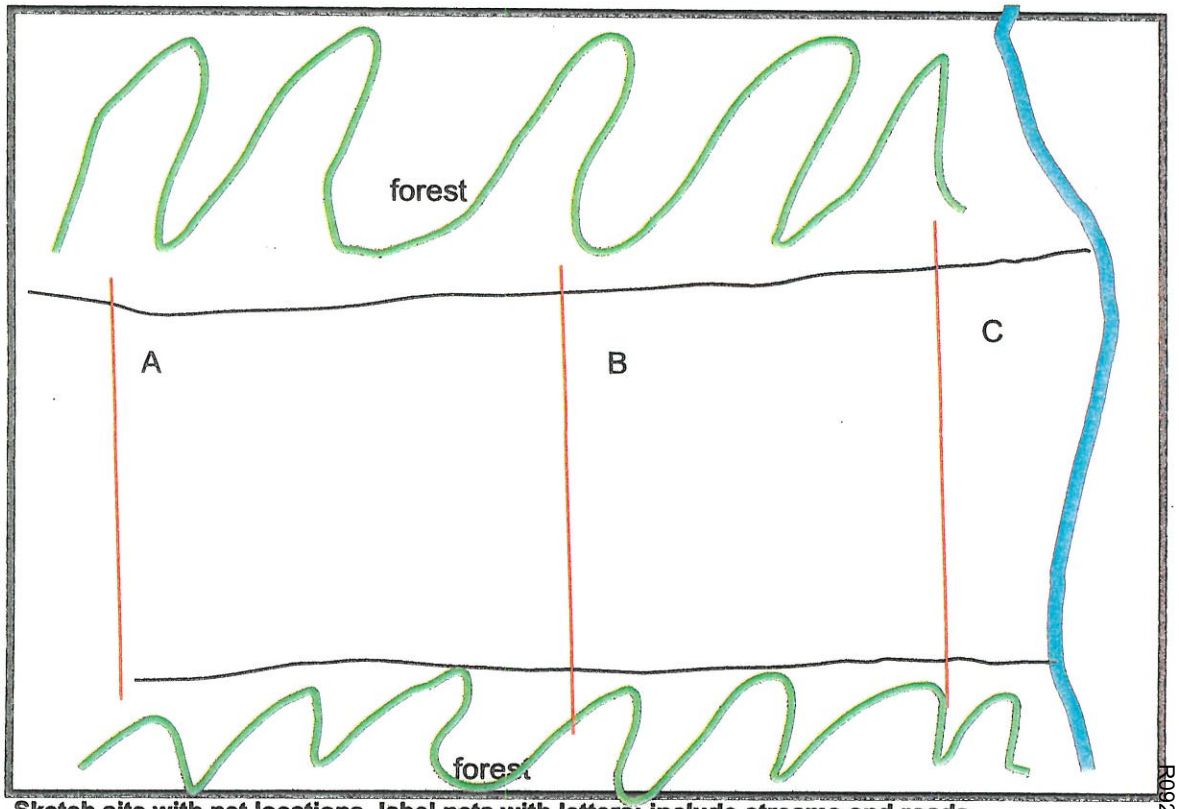
# of Net Sets at Site: 9 Time Started: 20:00 Time Ended: 01:00

Bat Activity (time): 20:05

Other Wildlife Observed: whitetail deer

Notes / Comments: dense forest
on both sides of gas line

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09269

Bat Survey Data Form

Project Name: East of Dwina **Site Number:** 1 **Night Number:** 2 **Date:** 08/05/2014 **Page** ___ **of** ___

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	21:10	J	F	NR	8.5	38.5	12	No	No	A	0
2	Eastern Red bat	Lasiurus borealis	21:25	J	M	NR	10.0	39.5	6	No	No	C	0
3	Eastern Red bat	Lasiurus borealis	21:25	A	M	NR	9.5	38.2	6	No	No	C	0
4	Eastern Red bat	Lasiurus borealis	22:00	A	M	SCR	8.5	37.0	9	No	No	C	0
5	Eastern Red bat	Lasiurus borealis	22:00	A	F	NR	12.0	40.6	12	No	No	B	0
6	Eastern Red bat	Lasiurus borealis	22:20	A	F	NR	12.0	42.7	15	No	No	B	0
7	Eastern Red bat	Lasiurus borealis	22:40	J	M	NR	8.5	37.5	13	No	No	A	0
8	Eastern Red bat	Lasiurus borealis	23:20	A	F	NR	11.0	43.0	11	No	No	C	0
9	Eastern Red bat	Lasiurus borealis	23:20	-	-	-				No	No	C	Escaped from net
10	Eastern Red bat	Lasiurus borealis	23:30	-	-	-				No	No	C	Escaped from net
11	Eastern Red bat	Lasiurus borealis	23:45	A	M	SCR	10.0	38.6	1	No	No	C	0
12	Eastern Red bat	Lasiurus borealis	00:30	J	F	NR	10.0	41.4	1	No	No	A	0
13	Eastern Red bat	Lasiurus borealis	00:30	J	M	NR	8.5	37.3	3	No	No	A	0
14	Eastern Red bat	Lasiurus borealis	00:30	A	M	SCR	9.5	39.6	9	No	No	C	
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09270

Alliance Bat Survey Data Form

Project Name: East of Dwina Date: 08/06/2014 Scientists: H Green Page 1 of 2

Township: _____ State: Il County: Williamson USGS Quad: Pitsburg

Start Weather: 22.0 (°C) Humid (feel) Calm (wind) 40% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: _____ (°C) - (feel) - (wind) - (sky) _____ (Time) Lat: 37 ° 50 ' 17.40 "

End Weather: _____ (°C) - (feel) - (wind) - (sky) _____ (Time) Long: 88 ° 48 ' 38.80 "

Identification By: B. Hoffman Site Number : 1 Night Number: 3 Moon Phase: Half rise 06:02 set 20:00

Site Description : flyway over gasline

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	flyway
B:	18	X	3	flyway
C:	12	X	3	flyway
D:	-	X	-	

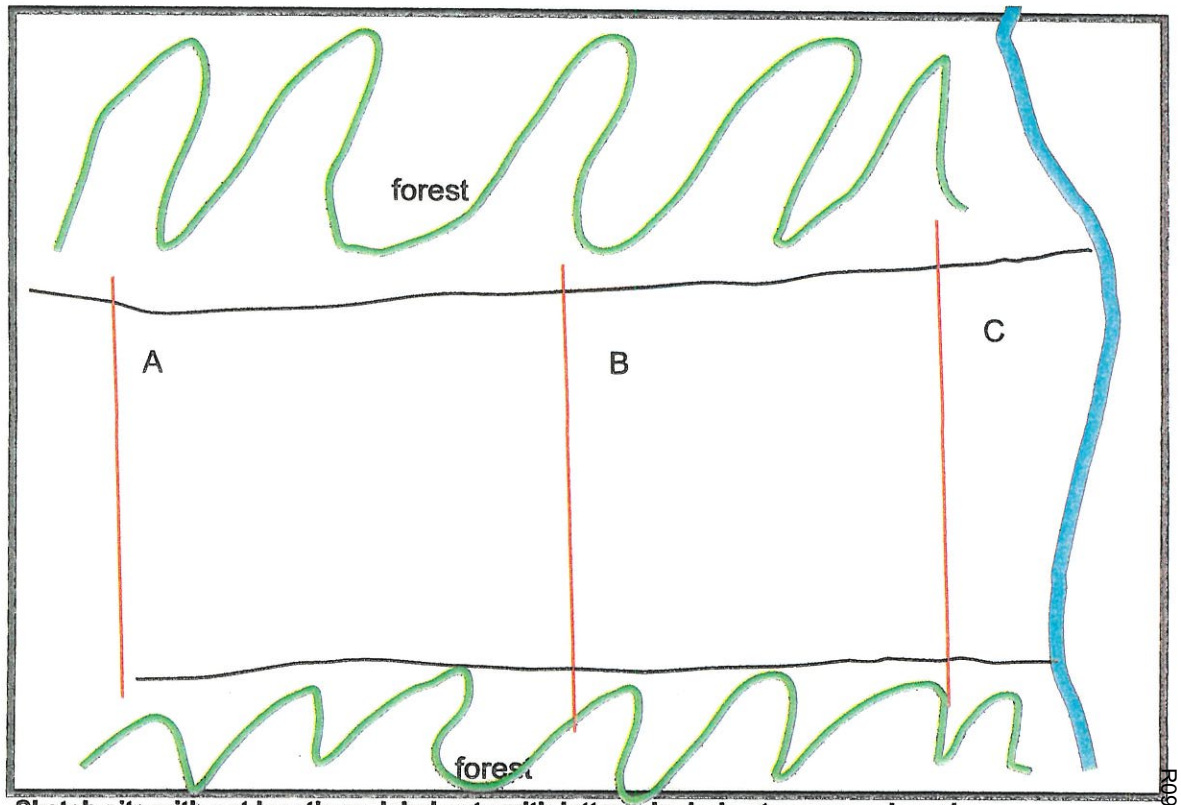
# of Net Sets at Site: 9 Time Started: 20:00 Time Ended: 01:00

Bat Activity (time): 20:05

Other Wildlife Observed: whitetail deer

Notes / Comments: dense forest
on both sides of gas line
rain out 22:00

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09271

Bat Survey Data Form

Project Name: East of Dwina **Site Number:** 1 **Night Number:** 3 **Date:** 08/06/2014 **Page** ___ **of**

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	21:00	A	M	SCR	9.5	39.0	9	No	No	A	0
2	Tri-colored bat	Perimyotis subflavus	21:00	J	M	NR	6.0	32.4	10	No	No	A	0
3	-			-	-	-				-	-		
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09272

Alliance Bat Survey Data Form

Project Name: East of Dwina Date: 08/07/2014 Scientists: H Green Page 1 of 2

Township: _____ State: Il County: Williamson USGS Quad: Pitsburg

Start Weather: 20.0 (°C) Cool (feel) 3-5 mpl (wind) 90% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: _____ (°C) - (feel) - (wind) - (sky) _____ (Time) Lat: 37 ° 50 ' 17.40 "

End Weather: _____ (°C) - (feel) - (wind) - (sky) _____ (Time) Long: 88 ° 48 ' 38.80 "

Identification By: B. Hoffman Site Number : 1 Night Number: 4 Moon Phase: Half rise 06:02 set 20:00

Site Description : flyway over gasline

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	flyway
B:	18	X	3	flyway
C:	12	X	3	flyway
D:	-	X	-	

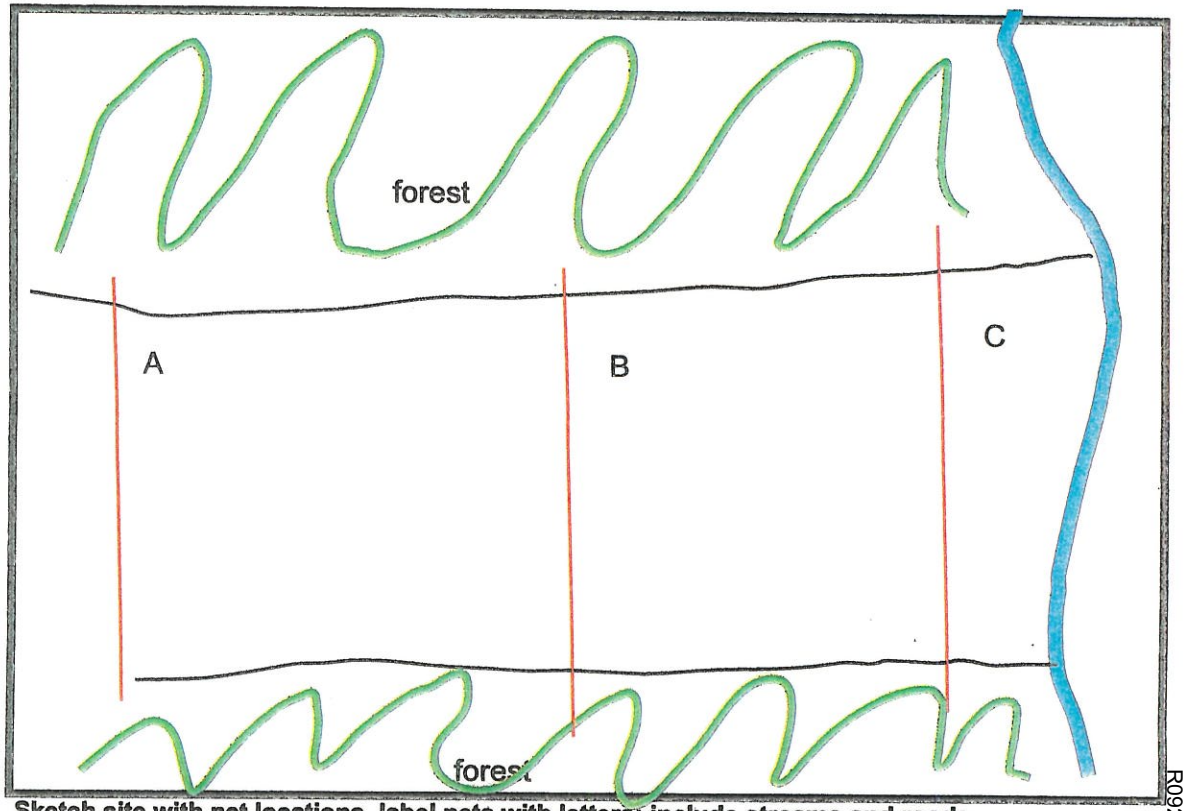
# of Net Sets at Site: 9 Time Started: 20:00 Time Ended: 22:00

Bat Activity (time): 20:05

Other Wildlife Observed: whitetail deer

Notes / Comments: dense forest
on both sides of gas line
Rain out 22:00, no bats

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09273

Bat Survey Data Form

Project Name: East of Dwina **Site Number:** 1 **Night Number:** 4 **Date:** 08/07/2014 **Page** ___ **of** ___

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	-			-	-	-				-	-		
2	-			-	-	-				-	-		
3	-			-	-	-				-	-		
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09274

Alliance Bat Survey Data Form

Project Name: East of Dwina Date: 08/08/2014 Scientists: J Varner Page 1 of 2

Township: _____ State: Il County: Williamson USGS Quad: Pitsburg

Start Weather: 22.0 (°C) Cool (feel) 1-3 mpl (wind) 30% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: 21.0 (°C) Humid (feel) +7 mph (wind) 70% (sky) 22:00 (Time) Lat: 37 ° 50 ' 17.40 "

End Weather: 21.0 (°C) Cool (feel) 5-7 mpl (wind) 100% (sky) 01:00 (Time) Long: 88 ° 48 ' 38.80 "

Identification By: B. Hoffman Site Number : 1 Night Number: 5 Moon Phase: 3/4 rise 06:03 set 19:53

Site Description : flyway over gasline

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	flyway
B:	18	X	3	flyway
C:	12	X	3	flyway
D:	-	X	-	

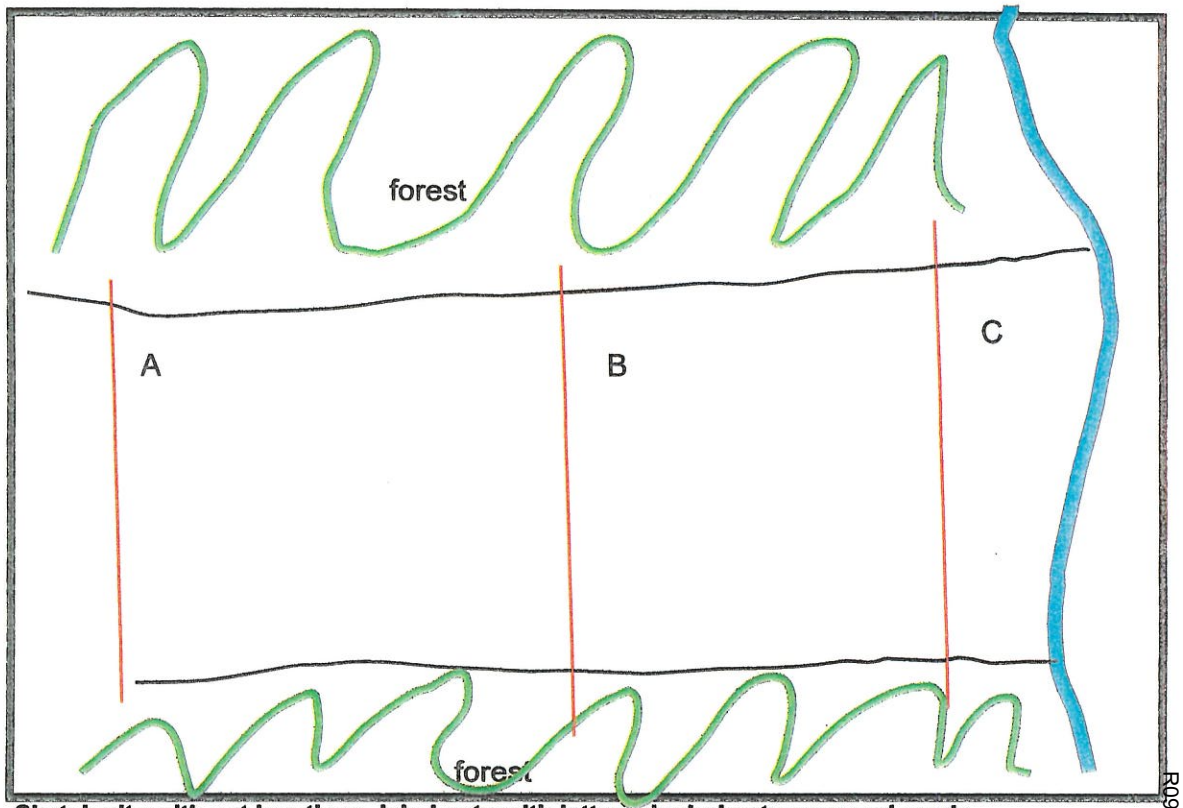
# of Net Sets at Site: 9 Time Started: 20:00 Time Ended: 01:00

Bat Activity (time): 20:00

Other Wildlife Observed: whitetail deer

Notes / Comments: _____

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09275

Bat Survey Data Form

Project Name: East of Dwina **Site Number:** 1 **Night Number:** 5 **Date:** 08/08/2014 **Page** 2 **of** 2

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height In Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	00:30	A	M	SCR	10.0	42.9	15	No	No	C	0
2	-			-	-	-				-	-		
3	-			-	-	-				-	-		
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09276

Alliance Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE Date: 08/04/2014 Scientists: DAN RICHARDSON Page 1 of 10

Township: -- State: IL County: WILLIAMSON USGS Quad: PITTSBURG

Start Weather: 70.0 (°C) Warm (feel) Calm (wind) Clear (sky) 20:05 (Time) Datum: NAD 27

Mid Weather: 66.0 (°C) Warm (feel) Calm (wind) 30% (sky) 22:35 (Time) Lat: 37 ° 50 ' 37.82 "

End Weather: 61.0 (°C) Warm (feel) Calm (wind) Clear (sky) 01:05 (Time) Long: 88 ° 48 ' 51.15 "

Identification By: S. Settle Site Number : 2 Night Number: 1 Moon Phase: Half rise 06:29 set 20:05

Site Description : POND AND FIELD SURROUNDED BY SCRUB SHRUB HABITAT

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	GAP BETWEEN PONDS
B:	12	X	3	POND EDGE
C:	12	X	3	FIELD EDGE
D:	-	X	-	

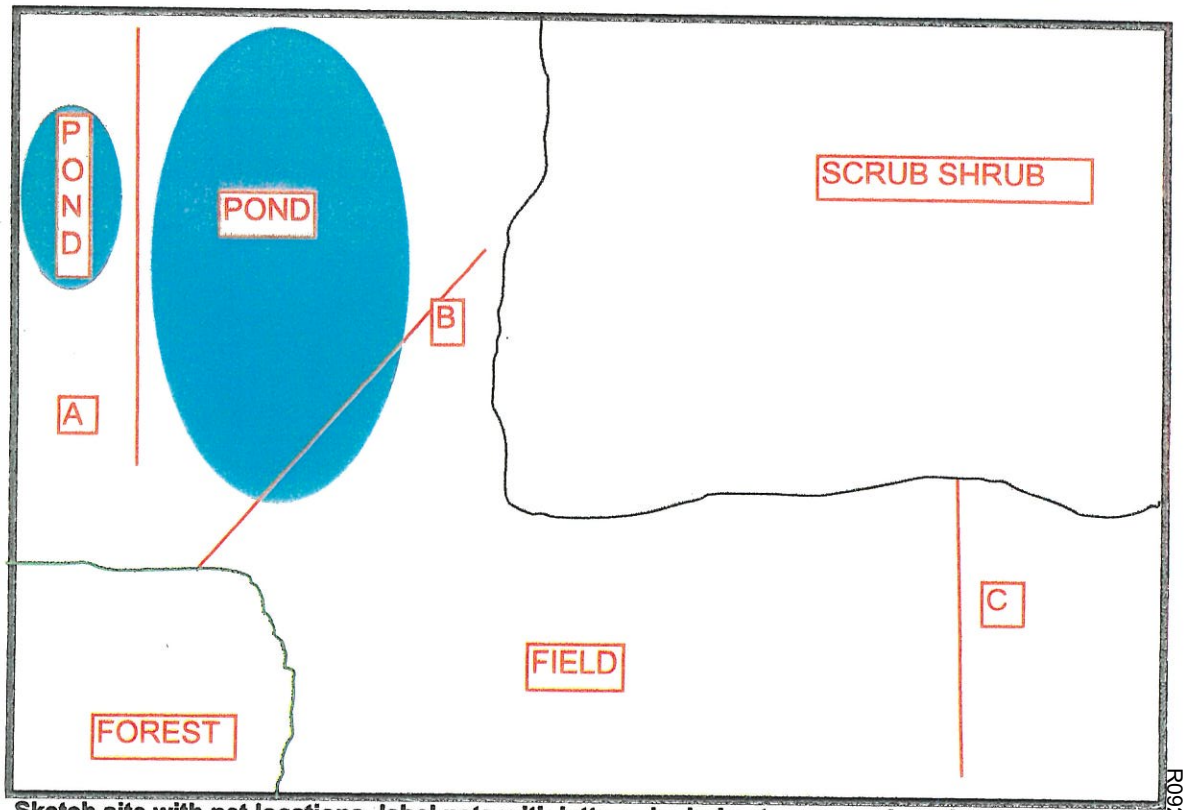
# of Net Sets at Site: 3 Time Started: 20:05 Time Ended: 01:05

Bat Activity (time): 21:05

Other Wildlife Observed:

Notes / Comments:

Date Entered into Database:



Sketch site with net locations, label nets with letters; include streams and roads.

R09277

Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE **Site Number:** 2 **Night Number:** 1 **Date:** 08/04/2014

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	21:05	J	M	NR	7.0	36.0	8	No	No	A	183-184
2	Eastern Red bat	Lasiurus borealis	21:55	A	F	Lac	16.0	41.3	8	No	No	A	185
3	Eastern Red bat	Lasiurus borealis	22:35	J	F	NR	10.0	35.1	8	No	No	B	186
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09278

Alliance Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE Date: 08/05/2014 Scientists: DAN RICHARDSON Page 3 of 10

Township: -- State: IL County: WILLIAMSON USGS Quad: PITTSBURG

Start Weather: 81.0 (°C) Humid (feel) Calm (wind) 60% (sky) 20:05 (Time) Datum: NAD 27

Mid Weather: 72.0 (°C) Humid (feel) Calm (wind) 20% (sky) 22:35 (Time) Lat: 37 ° 50 ' 37.82 "

End Weather: 70.0 (°C) Humid (feel) Calm (wind) Clear (sky) 01:05 (Time) Long: 88 ° 48 ' 51.15 "

Identification By: S. Settle Site Number : 2 Night Number: 2 Moon Phase: Half rise 06:29 set 20:05

Site Description : POND AND FIELD SURROUNDED BY SCRUB SHRUB HABITAT

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	GAP BETWEEN PONDS
B:	12	X	3	POND EDGE
C:	12	X	3	FIELD EDGE
D:	-	X	-	

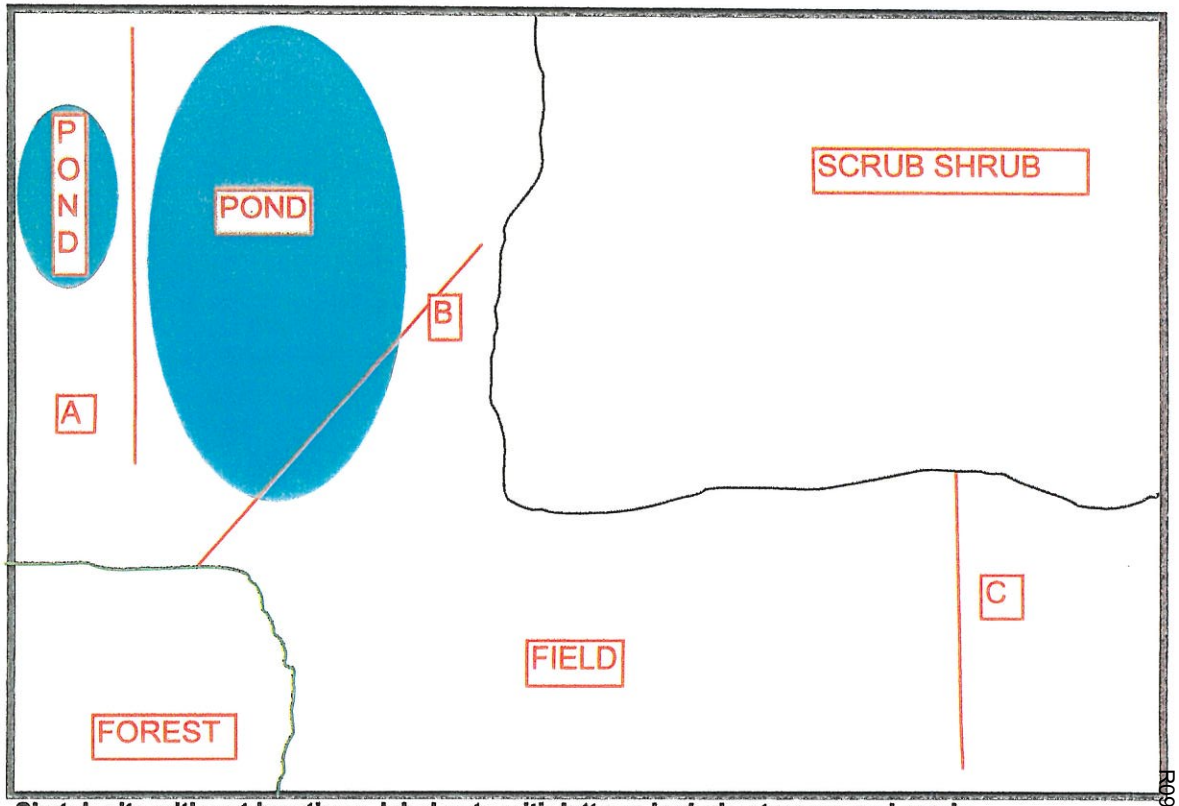
# of Net Sets at Site: 3 Time Started: 20:05 Time Ended: 01:05

Bat Activity (time): 21:05

Other Wildlife Observed:

Notes / Comments:

Date Entered into Database:



Sketch site with net locations, label nets with letters; include streams and roads.

R09279

Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE **Site Number:** 2 **Night Number:** 2 **Date:** 08/05/2014

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	21:00	A	M	SCR	11.0	39.5	7	No	No	C	193
2	Eastern Red bat	Lasiurus borealis	21:00	A	F	Lac	14.0	41.5	7	No	No	C	194
3	Eastern Red bat	Lasiurus borealis	21:00	A	F	Lac	16.0	41.3	7	No	No	C	195
4	Tri-colored bat	Perimyotis subflavus	01:05	J	M	NR	6.0	32.6	10	No	No	B	196
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09280

Alliance Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE Date: 08/06/2014 Scientists: DAN RICHARDSON Page 5 of 10

Township: -- State: IL County: WILLIAMSON USGS Quad: PITTSBURG

Start Weather: 81.0 (°C) Humid (feel) Calm (wind) 80% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: _____(°C) - (feel) - (wind) - (sky) _____(Time) Lat: 37 ° 50 ' 37.82 "

End Weather: _____(°C) - (feel) - (wind) - (sky) _____(Time) Long: 88 ° 48 ' 51.15 "

Identification By: S. Settle Site Number : 2 Night Number: 3 Moon Phase: 3/4 rise 06:29 set 20:00

Site Description : POND AND FIELD SURROUNDED BY SCRUB SHRUB HABITAT

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	GAP BETWEEN PONDS
B:	12	X	3	POND EDGE
C:	12	X	3	FIELD EDGE
D:	-	X	-	

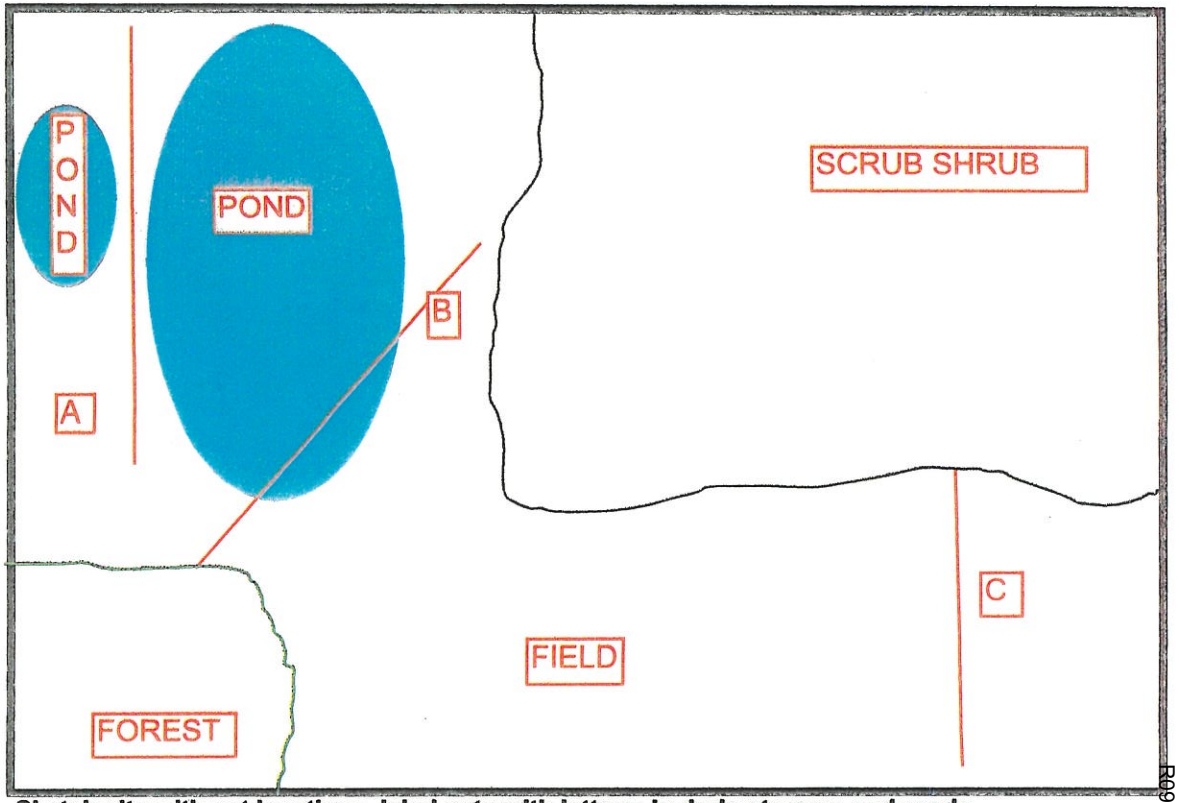
# of Net Sets at Site: 3 Time Started: 20:05 Time Ended: 01:05

Bat Activity (time): _____

Other Wildlife Observed: _____

Notes / Comments: RAINED OUT

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09281

Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE **Site Number:** 2 **Night Number:** 3 **Date:** 08/06/2014

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	-			-	-	-				-	-		RAINED OUT
2	-			-	-	-				-	-		
3	-			-	-	-				-	-		
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09282

Alliance Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE Date: 08/07/2014 Scientists: DAN RICHARDSON Page 7 of 10

Township: -- State: IL County: WILLIAMSON USGS Quad: PITTSBURG

Start Weather: 72.0 (°C) Humid (feel) 1-3 mpl (wind) 100% (sky) 19:49 (Time) Datum: NAD 27

Mid Weather: _____(°C) - (feel) - (wind) - (sky) _____(Time) Lat: 37 ° 50 ' 37.82 "

End Weather: _____(°C) - (feel) - (wind) - (sky) _____(Time) Long: 88 ° 48 ' 51.15 "

Identification By: S. Settle Site Number : 2 Night Number: 4 Moon Phase: 3/4 rise 06:29 set 19:49

Site Description : POND AND FIELD SURROUNDED BY SCRUB SHRUB HABITAT

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	GAP BETWEEN PONDS
B:	12	X	3	POND EDGE
C:	12	X	3	FIELD EDGE
D:	-	X	-	

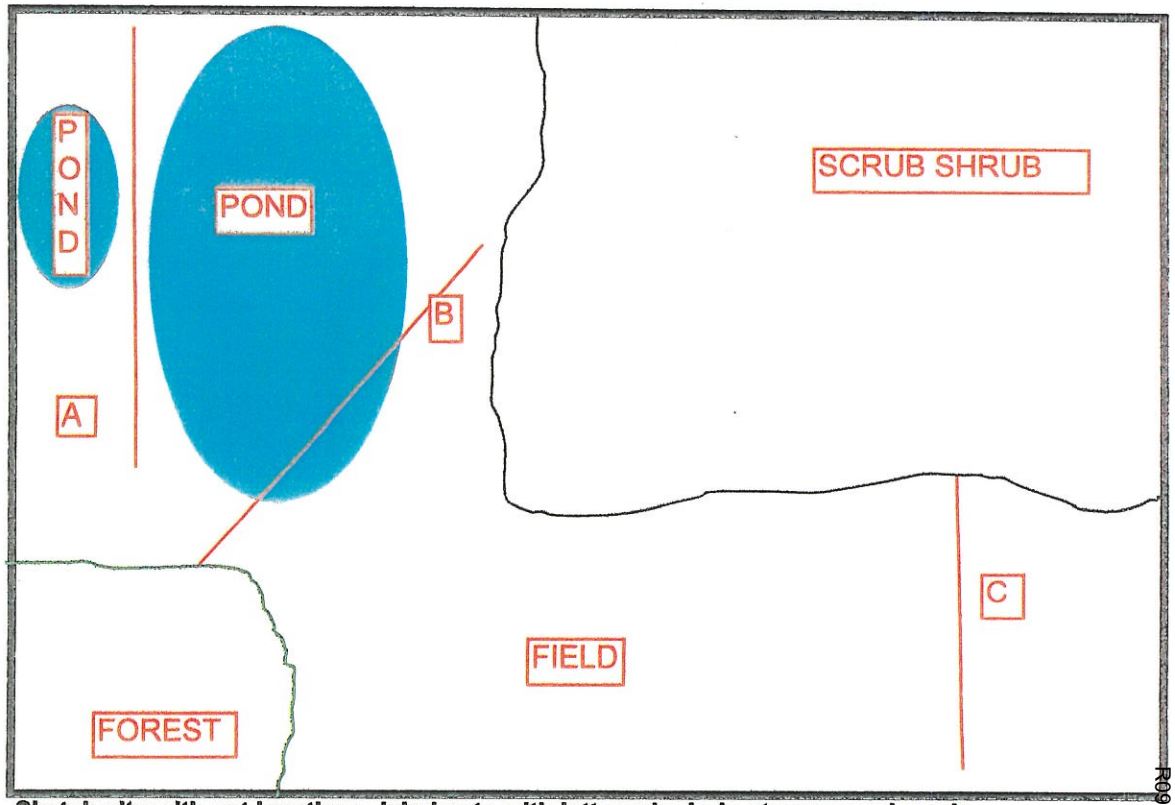
# of Net Sets at Site: 3 Time Started: 20:05 Time Ended: 21:10

Bat Activity (time): 07:49

Other Wildlife Observed: _____

Notes / Comments: RAINED OUT

Date Entered into Database: _____



Sketch site with net locations, label nets with letters; include streams and roads.

R09283

Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE **Site Number:** 2 **Night Number:** 4 **Date:** 08/07/2014

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	-			-	-	-				-	-		RAINED OUT
2	-			-	-	-				-	-		
3	-			-	-	-				-	-		
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09284

Alliance Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE Date: 08/08/2014 Scientists: DAN RICHARDSON Page 9 of 10

Township: -- State: IL County: WILLIAMSON USGS Quad: PITTSBURG

Start Weather: 74.0 (°C) Humid (feel) Calm (wind) 50% (sky) 20:00 (Time) Datum: NAD 27

Mid Weather: 72.0 (°C) Humid (feel) 1-3 mpl (wind) 100% (sky) 22:30 (Time) Lat: 37 ° 50 ' 37.82 "

End Weather: 72.0 (°C) Humid (feel) Calm (wind) 100% (sky) 01:00 (Time) Long: 88 ° 48 ' 51.15 "

Identification By: S. Settle Site Number : 2 Night Number: 5 Moon Phase: 3/4 rise 06:29 set 20:00

Site Description : POND AND FIELD SURROUNDED BY SCRUB SHRUB HABITAT

Net	Length (m)	X	Height (nets)	Habitat
A:	18	X	3	GAP BETWEEN PONDS
B:	12	X	3	POND EDGE
C:	12	X	3	FIELD EDGE
D:	-	X	-	

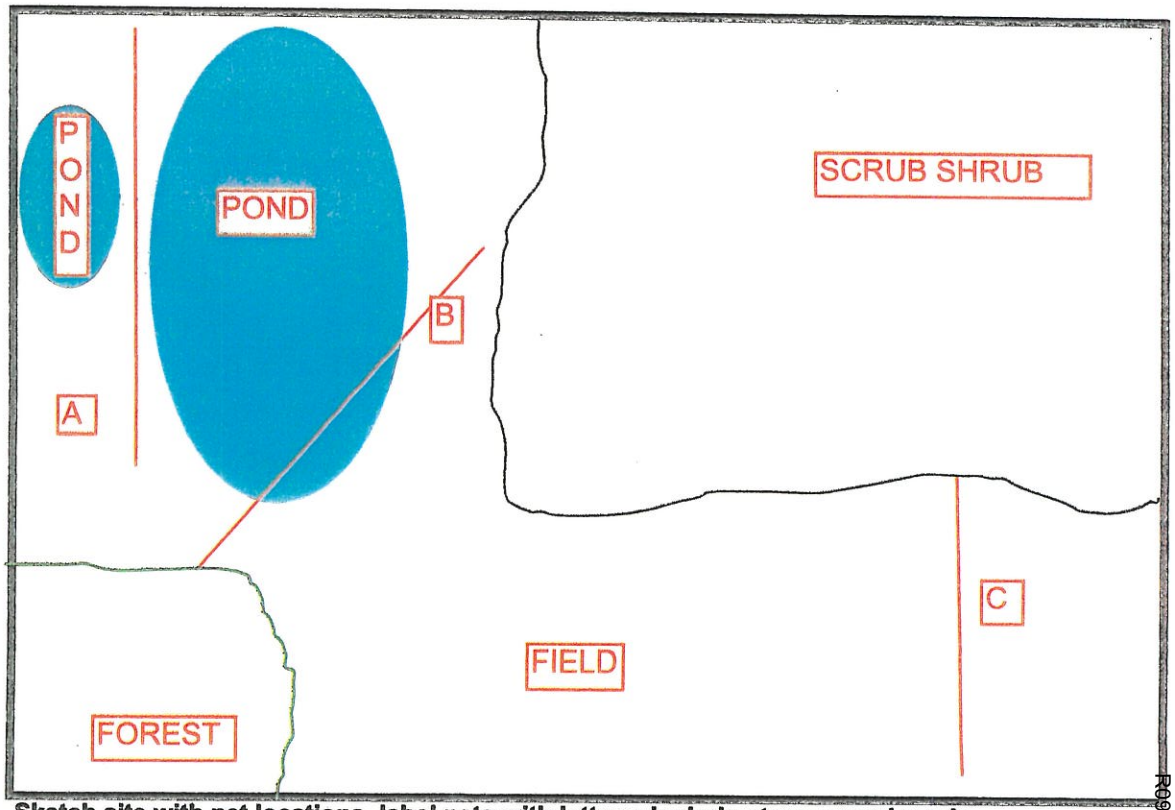
# of Net Sets at Site: 3 Time Started: 20:00 Time Ended: 01:00

Bat Activity (time): 20:50

Other Wildlife Observed:

Notes / Comments: RAINED OUT

Date Entered into Database:



Sketch site with net locations, label nets with letters; include streams and roads.

R09285

Bat Survey Data Form

Project Name: EAST OF DWINA REFUSE **Site Number:** 2 **Night Number:** 5 **Date:** 08/08/2014

	Common Name	Scientific Name	Time	Age	Sex	Reprod Condition	Weight (g)	Forearm Length (mm)	Height in Net (ft)	Band	Parasite	Net	Comments / WNS Score
1	Eastern Red bat	Lasiurus borealis	20:55	A	F	NR	11.0	39.0	15	No	No	A	197
2	Eastern Red bat	Lasiurus borealis	21:55	A	M	SCR	9.0	38.0	6	No	No	A	198
3	Eastern Red bat	Lasiurus borealis	00:30	A	M	SCR	10.0	38.1	6	No	No	A	199
4	-			-	-	-				-	-		
5	-			-	-	-				-	-		
6	-			-	-	-				-	-		
7	-			-	-	-				-	-		
8	-			-	-	-				-	-		
9	-			-	-	-				-	-		
10	-			-	-	-				-	-		
11	-			-	-	-				-	-		
12	-			-	-	-				-	-		
13	-			-	-	-				-	-		
14	-			-	-	-				-	-		
15	-			-	-	-				-	-		
16	-			-	-	-				-	-		
17	-			-	-	-				-	-		
18	-			-	-	-				-	-		
19	-			-	-	-				-	-		
20	-			-	-	-				-	-		
21	-			-	-	-				-	-		
22	-			-	-	-				-	-		
23	-			-	-	-				-	-		
24	-			-	-	-				-	-		
25	-			-	-	-				-	-		
26	-			-	-	-				-	-		
27	-			-	-	-				-	-		
28	-			-	-	-				-	-		
29	-			-	-	-				-	-		
30	-			-	-	-				-	-		

Submit

R09286

APPENDIX D

REQUIRED PERMITS

R09288

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

Alliance Consulting Inc Study Plan and request for permit amendment

Lundh, Kristen <kristen_lundh@fws.gov> Fri, Aug 1, 2014 at 1:59 PM
To: Braden Hoffman <bhoffman@aci-wv.com>
Cc: Matt Mangan <matthew_mangan@fws.gov>

Braden,

Dallas Scott Settle and Braden A. Hoffman are authorized to conduct the mist netting survey and associated tagging and tracking of Indiana bats for the Pond Creek Coal Refuse Disposal Area as outlined in your SOW and per the conditions of the U.S. Fish and Wildlife Service permits TE98295A-0 and TE98296A-0. This authorization should be carried by the permit holders to fulfill Condition G of the permits.

Please contact our office if listed species are found during the survey and provide us with a complete report of your survey efforts.

Kristen Lundh
U.S. Fish & Wildlife Service
Rock Island Ecological Services Field Office
1511 47th Ave
Moline, IL 61265
ph: 309-757-5800 x 215
fax: 309-757-5807
kristen_lundh@fws.gov

Kristen Lundh
U.S. Fish & Wildlife Service
Rock Island Ecological Services Field Office
1511 47th Ave
Moline, IL 61265
ph: 309-757-5800 x 215
fax: 309-757-5807
kristen_lundh@fws.gov

On Fri, Aug 1, 2014 at 12:28 PM, Braden Hoffman <bhoffman@aci-wv.com> wrote:
[Quoted text hidden]

Illinois
Department of
Natural Resources
One Natural Resources Way • Springfield, Illinois 62702-1271
http://dnr.state.il.us

PERMIT FOR POSSESSION OF ENDANGERED OR THREATENED SPECIES

PERMIT NO. 13-10S is issued to: Dallas Scott Settle, Alliance Consulting, Inc.,

124 Philpott Lane, Beaver, West Virginia 25813.

to allow Live capture, handling, data collection, banding/tagging, radio-telemetry, and safe release at or near capture location only of all State Listed bats of the following animals or animal products of endangered or threatened species or federal endangered plants:

	SPECIES	ITEM	QUANTITY
1.	All State Listed Bat Species	Live Animals - Capture/Release	As encountered
2.	Marsh Rice Rat	Live Animals - Capture/Release	As encountered

THIS PERMIT IS VOID IF IT CONTAINS ANY STRIKE-OUTS, OVERWRITES OR OTHER ALTERATIONS AND IS NON-TRANSFERABLE

ITEMS LISTED ON THIS PERMIT MAY BE SOLD, GIVEN AWAY OR OTHERWISE DISPOSED OF ONLY WITH PERMISSION OF THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Signed: _____
Dr. Jim Herkert
Office Director
IDNR Office of Resource Conservation

Date issued: March 4, 2013

Expiration Date: December 31, 2016

Special Conditions: A final report documenting all bats and Marsh Rice Rats captured during this survey shall be sent to the IDNR - Attn: Joseph Kath, within 60 days of survey completion. *Please note that this permit is not valid unless accompanied by any and all applicable Federal - USFWS permits and/or provisions.

***This permit is issued pursuant to the Illinois Endangered Species Protection Act and authorizes only those activities listed above. This permit does NOT exempt the permittee from compliance with any other federal, state, or local law, statute, ordinance, or regulation. As a permit holder, the individual/agency acknowledges that all collections of Federal and State listed species be reported to the Endangered Species Program Manager (IL. DNR-Division of Natural Heritage) within 10 days of collection.**

Permit Type: Original X Renewal _____ Amended _____

Printed on recycled and recyclable stock

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

1. PERMITTEE

DALLAS SCOTT SETTLE
dba ALLIANCE CONSULTING INC
70 ABIGAIL LANE
FAYETTEVILLE, WV 25840
U.S.A.

3. NUMBER
TE98295A-0

4. RENEWABLE
YES
NO

5. MAY COPY
YES
NO

6. EFFECTIVE
07/09/2013

7. EXPIRES
12/31/2015

8. NAME AND TITLE OF PRINCIPAL OFFICER (if not a person)

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION. SUBMITTED CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE:

C.1. VALID FOR USE BY PERMITTEE NAMED ABOVE. UNNAMED ASSISTANTS MAY WORK UNDER THE DIRECT AND ON-SITE SUPERVISION OF SCOTT SETTLE. SCOTT SETTLE MUST REMAIN PRESENT AT MIST-NET SITE(S) WHILE THEY ARE BEING OPERATED.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

E. Permittee is authorized to take (capture, handle, radio-tag, and release) the Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) for scientific research aimed at recovery of the species: presence/absence surveys, studies to document habitat use, population monitoring, and to evaluate potential impacts. This permit does not authorize the collection of voucher specimens

F. Activities are authorized within the States of Illinois and West Virginia, upon written concurrence from the USFWS Field Supervisor, as outlined in Condition G.

G. Permittee shall notify the USFWS Field Supervisor for the state in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is Condition M., below. Your request for this site-specific approval must be in writing and must indicate:

G.1. Location of proposed activities, including project site, county, and state.

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
ANNUAL REPORT DUE: 01/31

ISSUED BY

TITLE
ACTING CHIEF - ENDANGERED SPECIES

DATE
07/09/2013

G.2. A description of the activities (i.e., surveys, radio-telemetry studies, etc.)

G.3. Dates when the project is proposed to take place

G.4. Evidence that Permittee has received any required contracts to complete the activities.

G.5. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

H. Permittee shall adhere to the following conditions involving capture and handling of bats:

H.1. Bats may be captured with mist nets following the protocol included in the 2013 Range-wide Indiana Bat Summer Survey Guidelines (USFWS May 2013). Guidelines are available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. The monitoring interval for mist nets is +/- 10 minutes and may not exceed 15 minutes. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.

H.2. Bats may be captured with harp traps with written concurrence from the Field Supervisor in the state in which trapping is proposed. Harp traps must be continually monitored. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.

H.3. Permittees may carry out non-intrusive measurements on captured bats. Lipped metal bands having a unique identifier may be applied to the forearm of captured bats prior to release. No more than one band per bat may be used.

H.4. Radio transmitters may be applied during summer roosting period via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least three days, or until the transmitter falls off, whichever occurs first

H.5. No trapping activities shall occur within 20 meters of a known Indiana bat maternity roost site, either natural or artificial roosts, unless Permittee receives prior written approval from the U.S. Fish and Wildlife Service Field Supervisor for the state in which the activities are proposed to occur.

H.6. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at: http://whitenosesyndrome.org/

I. Upon determination that endangered bats are present at previously undocumented sites, Permittee shall notify the following offices within 48 hours: the U.S. Fish and Wildlife Service Region 3 Office (Condition L.1.), and the U.S. Fish and Wildlife Service Field Office within the geographic location of study areas (Condition L.).

J. Accidental mortality may not exceed two specimens. In the event that this number is met, all activities must cease. Any bat mortality or serious injury must be reported within 5 calendar days to the applicable office listed in Condition L. and to the nearest U.S. Fish and Wildlife Service Office of Law Enforcement Office (http://www.fws.gov/offices). Dead or moribund bats may be retained for further study only with the written permission of the U.S. Fish and Wildlife Service. Any bats that are not authorized for retention are to be chilled and promptly transferred to the U.S. Fish and Wildlife Service for potential necropsy and/or contaminants analysis (Condition L.3.).

K. Reports are due on January 31 following each year this permit is in effect. At a minimum, your report shall include:

K.1. The date, time, geographic locations (including datum and projection information), age, sex, and weight of all bats encountered.

K.2. Locations surveyed where no bats were encountered.

K.3. Band numbers of all bats banded.

K.4. Information on any injuries and/or mortalities and disposition of specimens.

K 5. Location and characteristics of roost trees and bat colonies.

K.6. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.

K 7. A completed INDIANA BAT SURVEY AND BANDING DATA form or the data collection form found in the 2013 Summer Survey Guidelines cited in Condition H.1.

K.8. Copies of all site specific authorization letters required under Condition G

L. Copies of your reports shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

L.1. Lisa Mandell
Regional Recovery Permits Coordinator
U S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458
(612/713-5343, fax 612/713-5292)
permitsR3ES@fws.gov

L.2. Deb Carter
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Northeast Region (Region 5)
Endangered Species Division
300 Westgate Center Drive
Hadley, Massachusetts 01035-9589
(703/358-2402, fax 413/253-8482)
permitsR5ES@fws gov

L.3. Lori Pruitt
Endangered Species Coordinator for Indiana
U.S. Fish and Wildlife Service
Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

For activities in Illinois:

L 4 a. Kristen Lundh
Endangered Species Coordinator for Illinois/Iowa
U.S. Fish and Wildlife Service
Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

L.4.b. Joe Kath
Endangered Species Coordinator
Illinois Department of Natural Resources
Division of Natural Heritage
One Natural Resource Way
Springfield, Illinois 62702-1271
(217/785-8764; fax 217/785-2438)

For activities in West Virginia,

5. Field Supervisor
West Virginia Field Office
Route 250 South, Elkins Shopping Plaza
694 Beverly Pike
Elkins, WV 26241
(304) 636-6586

cc: FWS/Region 5
FWS/ESFO - Rock Island, IL (Attn: TE Coordinator)
IL DNR (Attn: TE Coordinator)

END

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

R09294

Authorization is hereby granted, under Section 5/3.22, Chapter 520 and Section 5/20-100, Chapter 515 of the Illinois compiled Statues to:

Last Name: Settle First Name: Dallas Scott Permit Number: NH13.5680

Issued: 2/13/2013 Expires: 12/31/2013

Business Name: Alliance Consulting, Inc.

Street Address: 124 Philpott Lane

City: Beaver State: WV Zip Code: 25813

for strictly scientific, educational or zoological purposes, to take the Illinois fauna identified below subject to the following provisions:

Applicant and all research associates may: conduct live trap and release surveys all listed and non-listed bat species throughout southern Illinois, specifically Franklin and Hamilton Counties. All special provisions listed below must be followed at all times [As listed on the accompanying Illinois Department of Natural Resources (IDNR) scientific permit application/project proposal (on file in Springfield, IL.)] strictly for scientific, educational, and/or zoological purposes]. Permission to collect in State-owned properties must be obtained and approved prior to activities at such facilities. A federal permit is required for all projects involving federally regulated species, including migratory birds. If Endangered and Threatened Species are to be captured, handled, and/or collected, the IDNR Division of Natural Heritage, Endangered Species Coordinator must first be notified and must approve in writing all project related activities of the permit applicant and a separate Endangered Species Permit must be issued covering such activities

1. All individuals working under the direction of this scientific permit (and/or working under the direction of the permit applicant) shall be able to accurately field identify all 12 species of bats endemic to Illinois, including but not limited to: the Federally endangered Indiana bat (Myotis sodalis), the gray bat (Myotis grisescens), the southeastern myotis (Myotis austroriparius), and the Rafinesque's big-eared bat (Corynorhinus rafinesquii).
2. All chiropteran species are to be released immediately, unharmed after data is collected, including any genetic samples (wing punch, hair clip, swab samples, etc.) - animals may be banded and/or affixed with radio-transmitters is appropriate to the specific project. This includes all sampling activities associated with WNS sampling and monitoring throughout the entire State of Illinois. All specimens and samples collected shall be brought to a Bio-safety Level 2 Facility at the University of Illinois (U-C).
3. Under the direction of this scientific permit, bats are to be collected only by hand (gloved/protected only) and/or butterfly nets and/or mist-nets and/or harp traps designed for such purposes.
4. An annual report documenting all captures, including GPS coordinates, must be submitted to the IDNR (Attn: Joseph Kath) each year after the field season is complete. Failure to submit such a report may result in revocation of this Illinois Scientific permit and your Endangered Species Permit as well.
5. Please note that this permit as well as your Illinois Endangered Species Permit is not valid unless accompanied by any and all applicable Federal (USFWS) permits and/or provisions.
6. All Federal guidelines regarding White Nose Syndrome (WNS) in bats and the proper decontamination procedures developed by the USFWS must be followed at all times within the State of Illinois when conducting ANY and ALL bat research. Failure to strictly comply with these Federal decontamination guidelines may result in the immediate revocation of any and State of Illinois issued permits. For proper WNS decontamination procedures please go to: http://www.fws.gov/northeast/wnscavers.html

I agree to the following provisions and terms of this Scientific Permit.

Permittee's Signature: _____ Approved By: _____ Date: 2/13/13

(Permit not valid unless signed)

Office of Resource Conservation

TERMS FOR SCIENTIFIC PERMIT

1. Under no circumstances shall a scientific permit be used in lieu of sport or commercial licenses.
2. All taking shall be performed by or under the direct supervision of the permittee. Permitte must be present with persons involved in actual taking.
3. All gear left unattended must be tagged bearing name and scientific permit number of permittee.
4. Permittee must be at least eighteen (18) years of age.
5. Permits are not transferable and PERMITTE SHALL CARRY PERMIT AT ALL TIMES WHEN TAKING FAUNA.
6. Agency, company or institution listed on the application is responsible for the taking activities and reports of the individual issued this permit
7. Scientific permits will not be valid for taking any species appearing on official State List of Endangered and Threatened Vertebrate Species of Illinois (see attached Administrative Rule, Part 1010) without specific written approval from the Department of Natural Resources.
8. A federal Permit is required for the taking of species protected by the Federal Government in addition to the State Scientific Permit.
9. The Division of Wildlife Resources may require special conditions or provisions on any Scientific Permit.
10. Use of rotenone or any other toxic materials for taking must have special written approval from the Department of Natural Resources and may need a variance from the Illinois Environmental Protection Agency.
11. By january 31 of next year, an annual report of the permittee's activies must be submitted to the Division of Wildlife Resources. In addition, the permittee shall submit a copy of all written reports, etc. that result from the permitted activity. Permits will be renewed after these annual reports and appropriate publications have been received.
12. Any permit may be revoked or suspended at any time by the Department of Natural Resources.
13. Permits expire December 31 each calendar year unless otherwise specified.

Illinois
Department of
Natural Resources
One Natural Resources Way · Springfield, Illinois 62702-1271
www.dnr.illinois.gov

PERMIT FOR POSSESSION OF ENDANGERED OR THREATENED SPECIES

Permit type: S Permit No. 13-25S is issued to: Braden Hoffman (Alliance Consulting, Inc.), 124 Philpott Lane, Beaver, West Virginia 25813 and the following associates: Dan Richardson, Thaddeus Schau, Hillary Green, Jared Varner, Robbie Ferrell, Jennifer Bazzie, Neil Bossart, Brian Cooper, and Jennifer Drebelbis to allow **live capture, handling, data collection, banding/tagging, radio-telemetry, and safe release at or near the capture location only** of the following animals or animal products of endangered or threatened species or federal endangered plants:

SPECIES	ITEM	QUANTITY
1. All State Listed Bat Species	Live Animal	As Encountered

Permit version: Original __ Renewal X Amended ___

Special conditions: None.

Standard conditions:

— **Reporting**- Annual reports must be submitted by January 31 of each year. Changes in inventory of specimens must be reported within 5 days. Changes in personal information or affiliation must be reported within 10 days.

— **Propagation**- Propagation requires a permit for such a purpose, only available under Scientific and Zoological/Botanical permits.

— **Disposal or Transfer**- Applicants must obtain a permit prior to transfer or disposal of specimens.

- **Facilities:** Holding facilities must meet the standards set forth by the Federal Animal Welfare Act.

- **Temporary holding:** Specimens allowed under limited permits may be held temporarily (up to 90 days) by other persons only after written consent of the director.

- **Revocation:** Permits may be revoked if false information was used to obtained permit, reports were not submitted, facility standards were not met, or applicant violates state or federal laws.

THIS PERMIT IF VOID IF IT CONTAINS ANY STRIKE-OUTS, OVERWRITES OR OTHER ALTERATIONS AND IS NON-TRANSFERABLE

ITEMS LISTED ON THIS PERMIT MAY BE SOLD, GIVEN AWAY OR OTHERWISE DISPOSED OF ONLY WITH PERMISSION OF THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Signed: _____
Dr. Jim Herkert
Office Director
IDNR Office of Resource Conservation

Date issued: 5/21/14

Expiration Date: December 31, 2014

*This permit is issued pursuant to the Illinois Endangered Species Protection Act and authorizes only those activities listed above. This permit does NOT exempt the permittee from compliance with any other federal, state, or local law, statute, ordinance, or regulation. As a permit holder, the individual/agency acknowledges that all collections of Federal and State listed species be reported to the Endangered Species Program Manager (IL. DNR-Division of Natural Heritage) within 10 days of collection.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

1. PERMITTEE

BRADEN A HOFFMAN
dba ALLIANCE CONSULTING INC
167 OLD ANTLER WAY
DANIELS, WV 25832
U.S.A.

3. NUMBER
TE98296A-1
AMENDMENT

4. RENEWABLE
☒ YES
☐ NO

5. MAY COPY
☒ YES
☐ NO

6. EFFECTIVE
05/15/2014

7. EXPIRES
12/31/2016

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If it is a business)*

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSE DESCRIBED IN THE APPLICATION SUBMITTED, CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

C.1. The named permittee must remain present at each mist-net site while it is being operated.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

E. Permittee is authorized to take (capture, handle, radio-tag, and release) the Indiana bat (*Myotis sodalis*), and gray bat (*Myotis grisescens*) for scientific research aimed at recovery of the species: presence/absence surveys, studies to document habitat use, population monitoring, and to evaluate potential impacts. This permit does not authorize the collection of voucher specimens.

F. Activities are authorized at the following locations:

F.1. Locations within Oklahoma (Region 2) upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

F.2. Locations within Region 3 of the USFWS: Illinois, Indiana, Iowa, Michigan, Missouri, and Ohio upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
ANNUAL REPORT DUE: 01/31

ISSUED BY

TITLE
CHIEF - ENDANGERED SPECIES

DATE
05/15/2014

F.3. Locations within Region 4 of the USFWS: Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, North Carolina, and Tennessee, upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

F.4. Locations within Region 5 of the USFWS: Connecticut, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Vermont, Virginia and West Virginia, upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

F.5. Locations within Kansas (Region 6) upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

G. Permittee shall notify the USFWS Field Supervisor for the state in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is Condition M., below. Your request for this site-specific approval must be in writing and must indicate:

G.1. Location of proposed activities, including project site, county, and state.

G.2. A description of the activities (i.e., surveys, radio-telemetry studies, etc.).

G.3. Dates when the project is proposed to take place.

G.4. Evidence that Permittee has received any required contracts to complete the activities.

G.5. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

H. Permittee shall adhere to the following conditions involving capture and handling of bats:

H.1. Bats may be captured with mist nets following the protocol included in the 2014 Range-wide Indiana Bat Summer Survey Guidelines (USFWS January 2014). Guidelines are available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. The monitoring interval for mist nets is +/- 10 minutes and may not exceed 15 minutes. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.

H.2. Bats may be captured with harp traps with written concurrence from the Field Supervisor in the state in which trapping is proposed. Harp traps must be continually monitored. Captured bats may be held for a maximum of 30 minutes, unless injured. In extenuating circumstances, bats shall be held for no longer than 45 minutes.

H.3. Permittees may carry out non-intrusive measurements on captured bats. Lipped metal bands having a unique identifier may be applied to the forearm of captured bats prior to release. No more than one band per bat may be used.

H.4. Radio transmitters may be applied during summer roosting period via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 8% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least three days, or until the transmitter falls off, whichever occurs first.

H.5. No trapping activities shall occur within 20 meters of a known Indiana bat maternity roost site, either natural or artificial roosts, unless Permittee receives prior written approval from the U.S. Fish and Wildlife Service Field Supervisor for the state in which the activities are proposed to occur.

H.6. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at: http://whitenosesyndrome.org/

I. Upon determination that endangered bats are present at previously undocumented sites, Permittee shall notify the following offices within 48 hours: the U.S. Fish and Wildlife Service Region 3 Office (Condition L.), and the U.S. Fish and Wildlife Service Field Office within the geographic location of study areas (Condition M.).

J. Accidental mortality may not exceed two specimens. In the event that this number is met, all activities must cease. Any bat mortality or serious injury must be reported within 5 calendar days to the applicable office listed in condition M. and to

the nearest U.S. Fish and Wildlife Service Law Enforcement Office (http://www.fws.gov/offices). Dead or moribund bats may be retained for further study only with the written permission of the U.S. Fish and Wildlife Service. Any bats that are not authorized for retention are to be chilled and promptly transferred to the U.S. Fish and Wildlife Service for potential necropsy and/or contaminants analysis (Condition L.6.).

K. Reports are due on January 31 following each year this permit is in effect. At a minimum, your report shall include:

K.1. The date, time, geographic locations (including datum and projection information), age, sex, and weight of all bats encountered.

K.2. Locations surveyed where no bats were encountered.

K.3. Band numbers of all bats banded.

K.4. Information on any injuries and/or mortalities and disposition of specimens.

K.5. Location and characteristics of roost trees and bat colonies.

K.6. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.

K.7. A completed INDIANA BAT SURVEY AND BANDING DATA form or the data collection form found in the 2013 Summer Survey Guidelines cited in Condition H.1.

K.8. Copies of all site specific authorization letters required under Condition G.

L. Copies of your reports shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

L.1. Kari Tinsley
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458
(612/713-5343; fax 612/713-5292)
permitsR3ES@fws.gov

L.2. Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Southeast Region (Region 4)
1875 Century Boulevard, Suite 200
Atlanta, Georgia 30345-3301
(404/679-7313; fax 404/679-7081)
permitsR4ES@fws.gov

L.3. Deb Carter
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Northeast Region (Region 5)
Endangered Species Division
300 Westgate Center Drive
Hadley, Massachusetts 01035-9589
(703/358-2402; fax 413/253-8482)
permitsR5ES@fws.gov

L.4. Marty Tuegel
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Southwest Region (Region 2)
P.O. Box 1306
Albuquerque, New Mexico 87103-1306
(505/248-6651; fax 505/248-6788)
permitsR2ES@fws.gov

L.5. Kathy Konishi
ESA Assistant Recovery Coordinator & Permit Coordinator
U.S. Fish and Wildlife Service - Mountain-Prairie Region (Region 6)
Endangered Species Permits Office
Denver Federal Center, P.O. Box 25486
Denver, Colorado 80225-0489
(303/236-4212; fax 303/236-0027)
permitsR6ES@fws.gov

L.6. Lori Pruitt
Endangered Species Coordinator for Indiana
U.S. Fish and Wildlife Service
Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

M. Additionally, based on geographic area, reports and publications shall be submitted to the following:

M.1. For studies conducted in Illinois:

M.1.a. Kristen Lundh
Endangered Species Coordinator for Illinois/Iowa
U.S. Fish and Wildlife Service
Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

M.1.b. Joe Kath
Endangered Species Coordinator
Illinois Department of Natural Resources
Division of Natural Heritage
One Natural Resource Way
Springfield, Illinois 62702-1271
(217/785-8764; fax 217/785-2438)

M.2. For studies conducted in Indiana:

Katie Gremillion-Smith
Endangered Species Coordinator
Indiana Department of Natural Resources
Division of Fish and Wildlife
Room W273, 402 W. Washington St.
Indianapolis, Indiana 46204-2267
(317/232-8160; fax 317/232-8150)

M.3. For studies conducted in Iowa:

M.3.a. Kristen Lundh
Endangered Species Coordinator for Illinois/Iowa
U.S. Fish and Wildlife Service
Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

M.3.b. Daryl Howell
Endangered Species Coordinator
Iowa Department of Natural Resources
Parks, Recreation, and Preserves
Wallace State Office Building
East 9th and Grand Avenue
Des Moines, Iowa 50319-0034
(515/281-8524)

M.4. For studies conducted in Michigan:

M.4.a. Barbara Hosler
Endangered Species Coordinator for Michigan
U.S. Fish and Wildlife Service
2651 Coolidge Road
East Lansing, Michigan 48823
(517/351-6326; fax 517/351-1443)

M.4.b. Dan Kennedy
Endangered Species Coordinator
Michigan Department of Natural Resources
Wildlife Division
P.O. Box 30444
Lansing, Michigan 48909-7444
(517/241-3944; fax 517/373-6705)

M.5. For studies conducted in Missouri:

M.5.a. Amy Salveter
Field Supervisor
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-2132
(573/234-2132; fax 573/234-2181)

M.5.b. Stephanie Liebl
Scientific Collecting Permit Coordinator
Missouri Department of Conservation
Endangered Species and Natural History Division
2901 W. Truman Blvd., P.O. Box 180
Jefferson City, Missouri 65102-0180
(573/751-4115 ext. 3322; fax 573/526-5582)

M.6. For studies conducted in Ohio:

M.6.a. Angela Boyer
Endangered Species Coordinator for Ohio
U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614/416-8993, x22; fax 614/416-8994)

M.6.b. Carolyn Caldwell
Endangered Species Coordinator
Ohio Department of Natural Resources
Division of Wildlife
2045 Morse Road, Building G
Columbus, Ohio 43229-6693
(614-265-6329; fax 614/262-1143)

M.7. For studies conducted in Alabama:

Daphne Field Office
Bill Pearson, Field Supervisor
1208-B Main Street
Daphne, Alabama 36526-4419
(251) 441-5181

M.8. For studies conducted in Arkansas:

Arkansas Field Office
Jim Boggs, Field Supervisor
110 South Amity Road
Suite 300
Conway, Arkansas 72032-8975
(501) 513-4470

M.9. For studies conducted in Massachusetts and Vermont:

New England Field Office
Tom Chapman, Field Supervisor
70 Commercial Street, Suite 300
Concord, NH 03301
(603) 223-2541

M.10. For studies conducted in Maryland:

Chesapeake Bay Field Office
Genevieve LaRouche, Field Supervisor
177 Admiral Cochrane Drive
Annapolis, MD 21401
(410) 573-4573

M.11. For studies conducted in Florida:

North Florida Ecological Services Office
Dave Hankla, Field Supervisor
7915 Baymeadows Way
Suite 200
Jacksonville, FL 32256-7517
(904) 731-3336

M.12. For studies conducted in Georgia:

Georgia Field Office
Sandy Tucker, Field Supervisor
105 Westpark Drive, Suite D
Athens, GA 30606-3175
(706) 613-9493; fax 706/613-6059

M.13. For studies conducted in Kansas:

Kansas Field Office
Heather Whitlaw, Field Supervisor
2609 Anderson Avenue
Manhattan, Kansas 66502
785/539-3474; fax 785/539-8567

M.14. For studies conducted in Kentucky:

Frankfort Field Office
Lee Andrews, Field Supervisor
J C Watts Federal Bldg., Rm 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0468

M.15. For studies conducted in Mississippi:

Mississippi Field Office
Steve Ricks, Field Supervisor
6578 Dogwood View Pkwy, Ste A
Jackson, MS 39213-7858
(601) 321-1122

M.16. For studies conducted in New Jersey:

New Jersey Field Office
Eric Davis, Field Supervisor
927 N. Main Street, Building D
Pleasantville, NJ 08232-1454
(609) 646-9310

M.17. For studies conducted in New York:

New York Field Office
David Stilwell, Field Supervisor
3817 Luker Road
Cortland, NY 13045
(607) 753-9334

M.18. For studies conducted in North Carolina:

Asheville Field Office
Janet Mizzi, Field Supervisor
160 Zillicoa Street
Asheville, NC 28801-1082
(828) 258-3939

M.19. For studies conducted in Oklahoma:

Oklahoma Field Office
Dixie Porter, Field Supervisor
U.S. Fish and Wildlife Service
9014 E. 21st St.
Tulsa, Oklahoma 74129-1428
(918) 382-4501

M.20. For studies conducted in Pennsylvania:

Pennsylvania Field Office
Lora Zimmerman, Field Supervisor
315 So. Allen Street, Suite 322
State College, PA 16801-4850
(814) 234-4090

M.21. For studies conducted in Tennessee:

Cookeville Field Office
Mary Jennings, Field Supervisor
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

M.22. For studies conducted in Virginia:

Virginia Field Office
Cindy Schulz, Field Supervisor
6669 Short Lane
Gloucester, VA 23061
(804) 693-6694

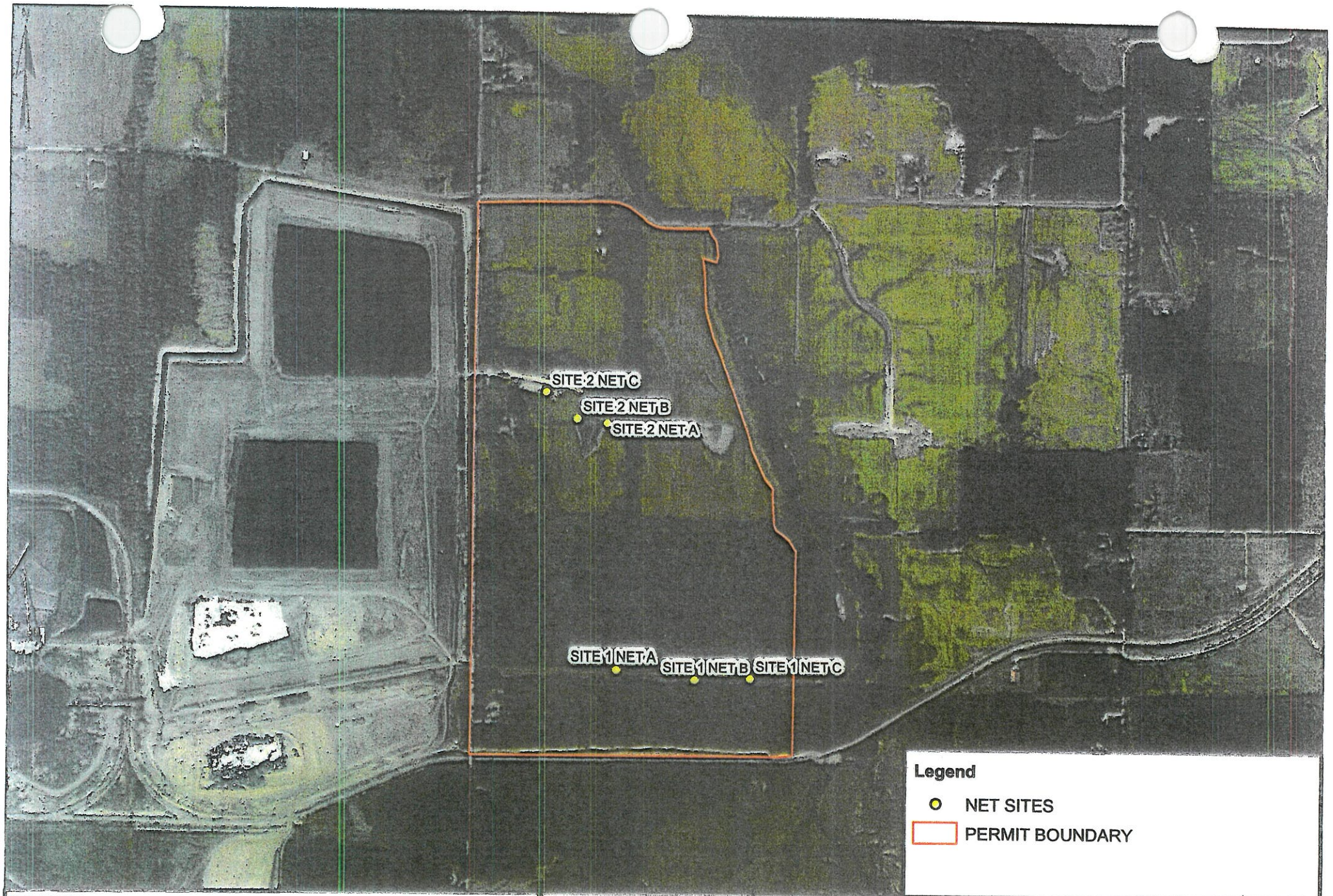
M.23. For studies conducted in West Virginia:

West Virginia Field Office
Field Supervisor
Route 250 South, Elkins Shopping Plaza
694 Beverly Pike
Elkins, WV 26241
(304) 636-6586

cc: FWS/Region 2, 4, 5, and 6
FWS, TE Coordinators for Illinois, Indiana, Iowa, Michigan, Missouri, and Ohio
DNR/DOC, TE Coordinators for Illinois, Indiana, Iowa, Michigan, Missouri, and Ohio

END

FIGURES



REFERENCE:

ArcGIS map service aerial imagery, retrieved 3/18/14
Available at: http://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

1 inch = 1,000 feet

0 500 1,000 2,000 3,000 Feet

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

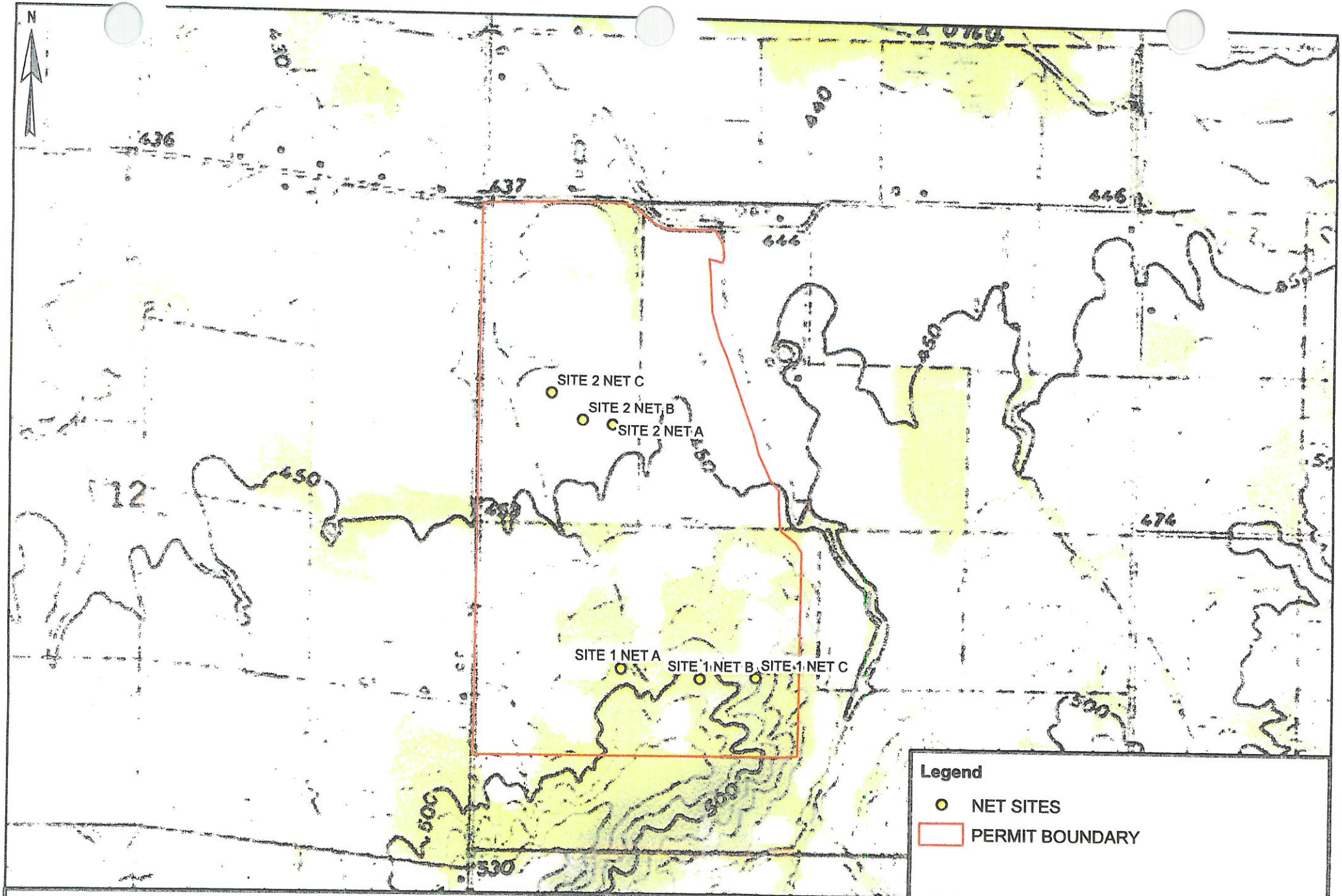
MIST NET LOCATION MAP
EAST OF DWINA
BAT SURVEY

PREPARED FOR
SUGAR CAMP ENERGY, LLC
P.O. BOX 357

DRAWN BY	HD	8/12/14
CHECKED BY	BAH	8/12/14
APPROVED BY		

DRAWING NUMBER
B14-445-A2

R093DB



REFERENCE:

ArcGIS map service, USA topo maps (USGS topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

1 inch = 1,000 feet

0 500 1,000 2,000 3,000 Feet

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

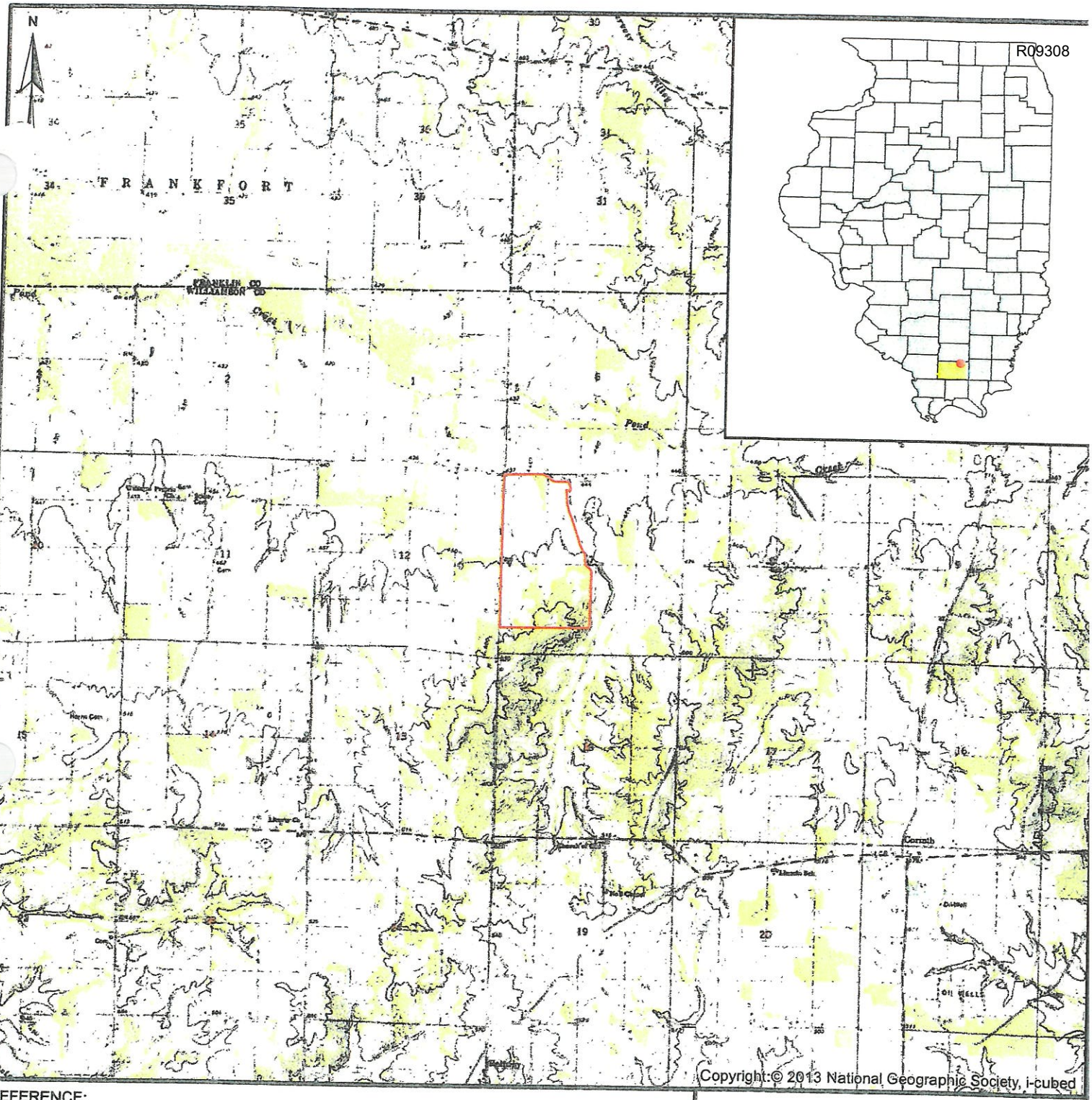
PROJECT TOPOGRAPHIC MAP

EAST OF DWINA
BAT SURVEY
PREPARED FOR
SUGAR CAMP ENERGY, LLC
P.O. BOX 357

DRAWN BY	HD	8/12/14
CHECKED BY	BAH	8/12/14
APPROVED BY		

DRAWING NUMBER
R14-445-A2

R093



REFERENCE:

ArcGIS map service, USA topo maps (USGS topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

0 2,000 4,000 8,000 Feet

Legend

PERMIT BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

PROJECT LOCATION MAP

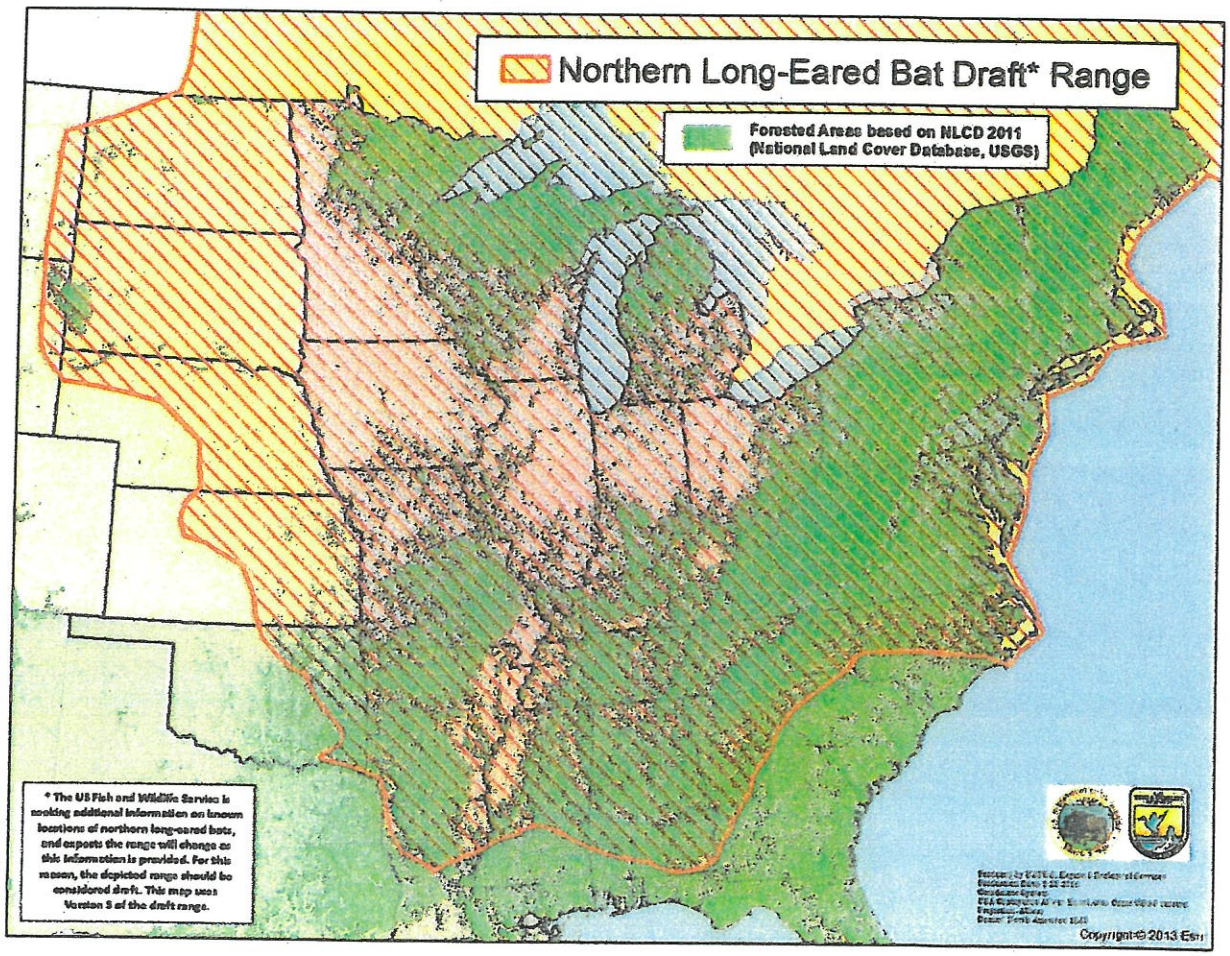
EAST OF DWINA
REFUSE AREA

PREPARED FOR
WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

DRAWN BY	DR	8/21/14
CHECKED BY	BH	8/21/14
APPROVED BY		
DRAWING NUMBER		
B14-445-A4		

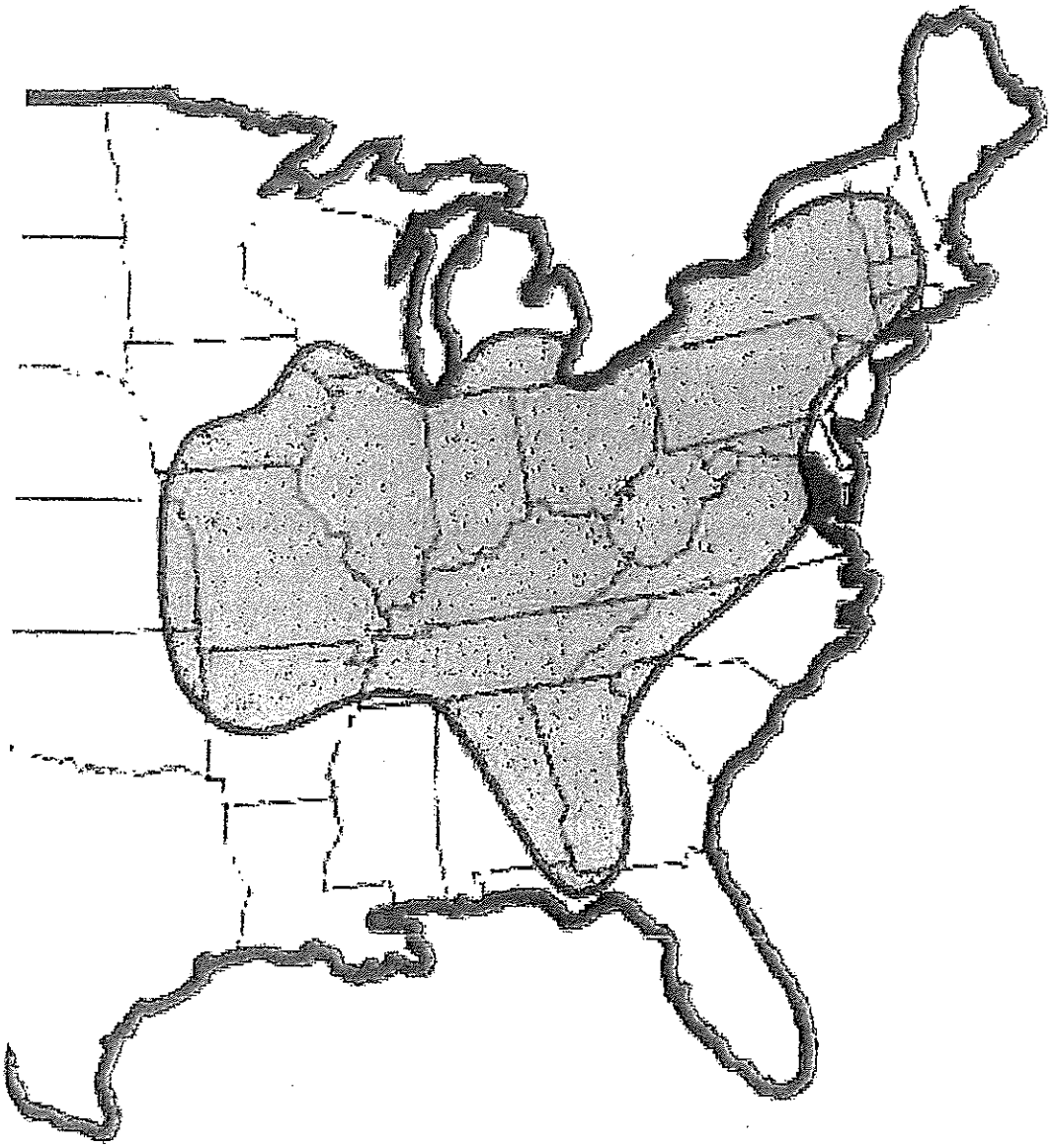
Range for the Northern Long-Eared Bat (*Myotis leibii*)

USFWS 2014.



Range for the Indiana bat (*Myotis sodalis*).

USFWS 2006.



PART II ATTACHMENT II.9
WETLAND ASSESSMENT REPORT

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

3001-15
part 5

REQUEST FOR JURISDICTIONAL DETERMINATION –UNNAMED TRIBUTARIES OF POND CREEK

POND CREEK MINE NO. 1 AND COAL REFUSE DISPOSAL FACILITY NO. 3 PERMIT AREA PERMIT NO. 417 NEAR JOHNSTON CITY, WILLIAMSON COUNTY, ILLINOIS

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
DECEMBER 2010

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
151 East Pike Street
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

REQUEST FOR JURISDICTIONAL DETERMINATION –UNNAMED TRIBUTARIES OF POND CREEK

POND CREEK MINE NO. 1 AND COAL REFUSE DISPOSAL FACILITY NO. 3 PERMIT AREA PERMIT NO. 417 NEAR JOHNSTON CITY, WILLIAMSON COUNTY, ILLINOIS

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
JANUARY 2011

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

January 24, 2011

Project No.: B08-467-1413

Mr. Keith McMullen
U. S. ARMY CORPS OF ENGINEERS
St. Louis District
1222 Spruce Street
St. Louis, MO 63103-2833

Letter Report
Request for Jurisdictional Determination
Two Unnamed Tributaries of Pond Creek
Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area
Permit No. 417
Near Johnston City, Williamson County, Illinois
Williamson Energy, LLC
P.O. Box 99, Johnston City, Illinois 62951

Dear Mr. McMullen:

Alliance Consulting, Inc. (Alliance) is pleased to submit this letter report on behalf of our client, Williamson Energy, LLC (Williamson), as a request for jurisdictional determination. This drainage pattern and wetland determination work was completed at Williamson's request to be utilized in the Section 404 permit process. Alliance Consulting Inc. has prepared the following sections in general accordance with the Corps of Engineers Guidance for Drainage pattern and Wetland Delineations.

This report has been prepared in response to our April 27th 2010 field verification of the project area. At your request wetlands within the project boundary have been added to the jurisdictional determination request. This document supersedes the submittal previously received by your office.

1.0 PURPOSE

The purpose of this work was to delineate jurisdictional waters that may potentially be impacted by the construction of the proposed coal refuse disposal facility.

2.0 INTRODUCTION

The proposed site is located northwest of Johnston City in Williamson County, Illinois and has its approximate center at Latitude 37° 50' 35" and Longitude 88° 48' 45". Drawing No. B08-467-A2, entitled "Aerial Location Map" documents the boundaries of the permit area for the proposed coal refuse disposal facility. The proposed project area will include property to be utilized for the disposal of coal refuse from the preparation plant. The project area is currently bonded under Surface Coal Mining and Reclamation Operation Permit No. 375.

Two unnamed isolated ephemeral tributaries of Pond Creek will be impacted by the proposed project. All affected tributaries flow in a northerly to northwesterly direction to the confluence with Pond Creek of the Big Muddy River of the Mississippi River.

The Applicant contact information is as follows:

Jim Slapak
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

The following sections compile the procedures and the findings of the work completed by Alliance: Drainage pattern measurement data sheets and site overview photographs are presented in Appendix A. Wetland data sheets and site overview photographs are contained in Appendix B. Driving directions to the site are located in Appendix C. The U.S. Army Corps of Engineers approved Jurisdictional Determination forms are located on a CD in the front cover of this report and in Appendix D.

3.0 DRAINAGE PATTERN MEASUREMENTS

Alliance conducted intermittent/ephemeral drainage pattern determinations, and recorded drainage patter measurements every 100 feet. Photographs were also taken every 100 feet of drainage pattern length to aid the U. S. Army Corps of Engineers in conducting a jurisdictional determination for the project area.

Drainage pattern measurements were conducted by Alliance personnel on September 30, 2009 in order to determine the total acreage of drainage pattern proposed to be impacted within the project area. The total acreage was calculated by multiplying the pattern width by the length of drainage pattern at 100-foot intervals. The uppermost drainage pattern measurement corresponds to the location of the end of a defined pattern within the project area. Drainage pattern pattern locations are shown on Drawing No. B08-467-E18, entitled "Wetland Delineation Map", and are described below.

The patterns delineated within the project boundary all appeared to be isolated ephemeral swales in nature. In general, the drainage pattern patterns were filled with debris (i.e. leaves, sticks, etc.) and in many places vegetation was found growing completely across the patterns. The patterns lacked a clear bed and bank definition throughout the majority of the measured reaches. Therefore it is our opinion that while small segments of the patterns could be defined as jurisdictional channel that the long segments where the pattern is completely undefined indicate that the patterns are isolated in nature due to the lack of a nexus to downdrainage pattern waters.

All drainage pattern measurement locations are shown on Drawing No. B08-467-E18 "Wetland Delineation Map", found in the Figures section of this letter report. Drainage pattern measurement data sheets and site overview photographs are presented in Appendix A of this Request for Jurisdictional Determination.

The proposed operation will result in the filling of approximately 978 linear feet of isolated drainage patterns. The following table summarized drainage pattern impacts for each individual wetland drainage patterns.

DRAINAGE PATTERN ID	LENGTH BY PROPOSED OPERATION (LINEAR FEET)
A	500
B	478
TOTALS	978

3.1 DRAINAGE PATTERN DELINEATION METHODS

All pattern stations and photo locations identified with the proposed project were located using a TRIBMLE GEO XT, (submeter accuracy) GPS unit. The total acreage for each pattern segment was calculated by multiplying the pattern width (bank to bank at the high water mark) by the length of drainage pattern at 100-foot intervals.

4.0 WETLAND MEASUREMENTS

Wetland measurements were conducted by Alliance personnel in Spring and Fall 2010, in order to determine if any wetlands would be impacted within the project area. The Midwest Regional Supplement was used as guidance in determining the wetland boundaries. The National Wetland Inventory (NWI) was also consulted, see Drawing No. B08-467-A3 entitled "National Wetland Inventory Map". Two wetlands were found in the project area (See Appendix B) for wetland data forms and wetland photographs. Wetland locations within the project area are shown on Drawing No. B08-467-E18 and are described below.

The following wetlands were identified based upon Alliance field visits:

Wetland ID	Acreage
Wetland A	32.72
Wetland B	1.25
Total	**33.98**

4.1 NATIONAL WETLAND INVENTORY

Alliance consulted the NWI for the project area. The NWI database documented no wetlands within the project area, see Drawing No. B08-467-A3 entitled "National Wetland Inventory Map" illustrates the boundaries of the study area.

4.2 SOIL SURVEY MAPPING

Soil survey mapping for the proposed project area documents the main soil types found at or near the project area, Drawing No. B08-467-A4 entitled "Soils Map". The following types of soils are located within the proposed project area.

SOIL ID NAME	Map Unit Symbol	CHARACTERISTICS
Bluford	13A	0-2% Slope
Bluford	13B2	2-5% Slopes, Eroded
Ava	14B	2-5% Slopes
Ava	14C2	5-10% Slopes, Eroded
Sharon	3072A	0-2% Slope, Frequently Flooded
Belknap	3382A	0-2% Slope, Frequently Flooded
Rend	518C3	5-10% Slopes, Severely Eroded
Bluford	640A	Bench, 0-2% Slope
Bluford	640B2	Bench, 2-5% Slopes Eroded
Hickory-Kell	908D3	10-18% Slopes, Severely Eroded

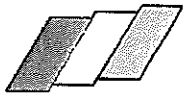
5.0 OPEN WATER

During the Alliance site visits, no areas of open water were identified within the proposed project area.

For this project, open water was considered to be "an area that, during a year with normal patterns of precipitation, has standing or flowing water for sufficient duration to establish an ordinary high water mark, where aquatic vegetation is either non-emergent, sparse, or absent". Additionally for this project, no drainage pattern pattern was counted as "open water".

6.0 CLOSING

In closing, we trust that this letter report and supporting data are sufficient for your needs at this time. The services performed for this project were performed with the care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No other warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made. This report has been prepared for the exclusive use of Williamson Energy, LLC.



If you have any questions or require clarification, please do not hesitate to call.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Clay Warner
Staff Scientist

Braden A. Hoffman
Project Manager

ACW/BAH:knb
Enclosures

FILE: 08467-13

APPENDIX A

DRAINAGE PATTER DELINEATION TABLES AND PHOTOGRAPHS

Stream Delineation Table

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A
Watershed Acreage: 294 acres

Project of Facility Name: Pond Creek No. 1 Mine and Coal Refuse Disposal Facility
Segment Name or ID: Pond Creek Delineations
Location: Northwest of Johnston City, IL

STATION No.	LENGTH (FT)	WIDTH (FT)	WIDTH AVG	SQ FEET	ACRES	DEPTH L	DEPTH M	DEPTH R	DESCRIPTION FIELD COMMENTS
0+00	0	5.0	0.00	0.0	0.0000	0.50	0.50	0.60	Undefined Channel
1+00	100	5.0	1.00	100.0	0.0023	0.50	0.72	0.60	Undefined Channel
1+40	40	5.0	2.00	80.0	0.0018	0.50	0.72	0.60	Undefined Channel
2+00	60	5.0	3.00	180.0	0.0041	0.50	0.72	0.60	
3+00	100	4.0	4.00	400.0	0.0092	0.80	0.70	0.45	
4+00	100	7.0	5.00	500.0	0.0115	0.20	0.30	0.20	
5+00	100		6.00	600.0	0.0138				EOC

R09320

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 1
Drainage Pattern A at Station 0+00, looking upstream



Photograph No. 2
Drainage Pattern A at Station 0+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 3
Drainage Pattern at Station 2+00, looking upstream



Photograph No. 4
Drainage Pattern at Station 2+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 5
Drainage Pattern A at Station 3+00, looking upstream



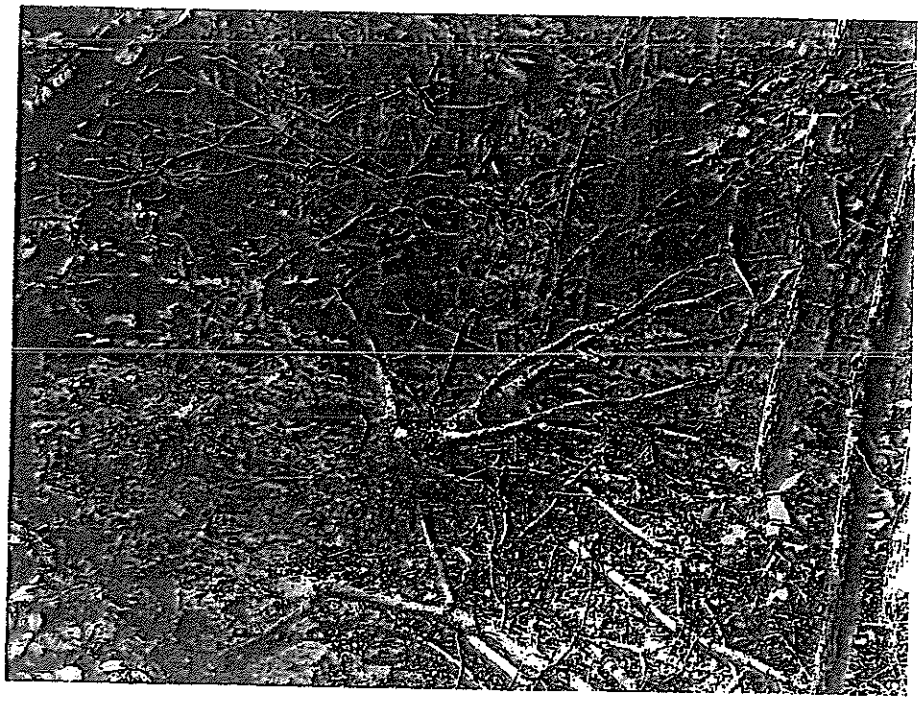
Photograph No. 6
Drainage Pattern A at Station 3+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



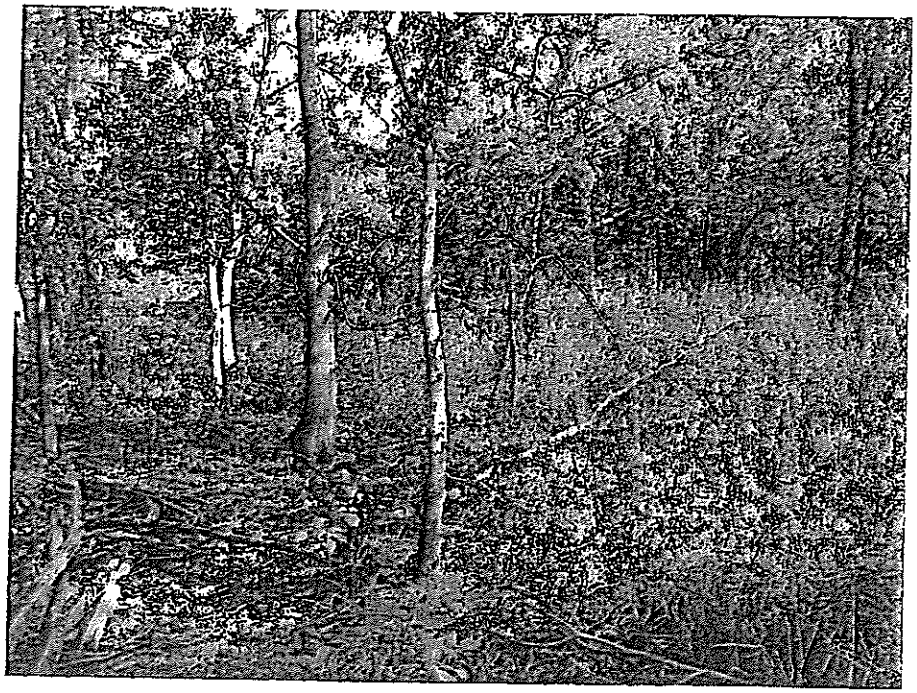
Photograph No. 7
Drainage Pattern A at Station 4+00, looking upstream



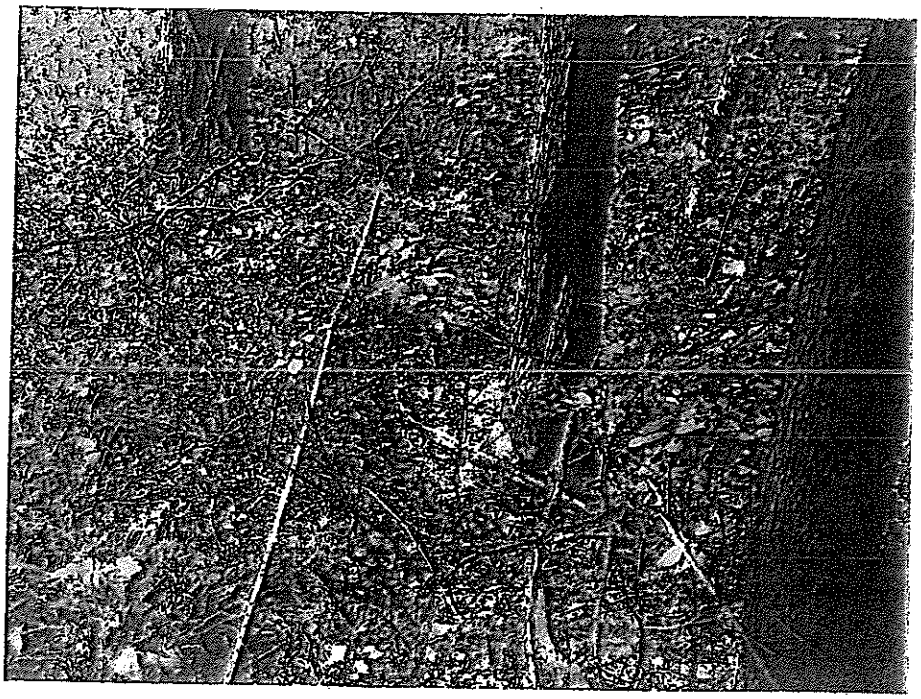
Photograph No. 8
Drainage Pattern 1 A at Station 4+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 9
Drainage Pattern A at Station 5+00, looking up from the EOC. Above here the channel is undefined.



Photograph No. 10
Drainage Pattern A at Station 5+00, looking downstream from where the channel becomes undefined



Photograph No. 11
Drainage Pattern B at Station 0+00, looking upstream through an undefined channel.



Photograph No. 12
Drainage Pattern B at Station 0+00, looking down

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 13
Drainage Pattern B at Station 1+00, looking upstream



Photograph No. 14
Drainage Pattern B at Station 1+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 15
Drainage Pattern B at Station 2+00, looking upstream



Photograph No. 16
Drainage Pattern B at Station 2+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 17
Drainage Pattern B at Station 3+00, looking upstream



Photograph No. 18
Drainage Pattern B at Station 3+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 19
Drainage Pattern B at Station 4+00, looking upstream



Photograph No. 20
Drainage Pattern B at Station 4+00, looking downstream

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility No. 3 Permit Area



Photograph No. 21
Drainage Pattern B at Station 4+78, looking up from the EOC



Photograph No. 22
Drainage Pattern B at Station 4+78, looking downstream from the EOC

APPENDIX B

WETLAND DELINEATION DATA FORMS AND PHOTOGRAPHS

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/27/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-1(W)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 46" Long: 37° 50' 49" Datum: NADA 27 East

Soil Map Unit Name: Bluford 2-5% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No	
Hydric Soil Present?	Yes X No	Is the Sample Area within a Wetland? Yes X No
Wetland Hydrology Present?	Yes X No	
Remarks:		

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus palustris*	10	Y	FACW
2. *Ulmus alata*	5	N	FACU
3. *Betula nigra*	20	Y	FACW
4.			
5.			
	35	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Taxicodendron radicans*	20	Y	FAC+
2.			
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size:)			
1. *Pilea pumila*	10	N	FACW
2. *Galium asprellum*	10	N	OBL
3. *Rorippa palustris*	10	N	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	30	= Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Parthenocissus quinquefolia*	20	Y	FAC-
2.			
	20	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	20	x 1 =	20
FACW species	40	x 2 =	80
FAC species	40	x 3 =	120
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	105	(A)	240 (B)

Prevalence Index = B/A = 2.29

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

X Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: (Include photo numbers here or on a separate sheet): photos: 1, 2 TP-1, 3-wetland overview

SOIL

Sampling Point: TP-1(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	100	None				Clay, loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes__X__ No____

Remarks: Hydric soil is present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- X Saturation (A3)
- __Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- X Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____

Water Table Present? Yes_X_ No__ Depth (inches):__8__

Saturation Present? (includes capillary fringe) Yes_X_ No__ Depth (inches):__2__

Wetland Hydrology Present? Yes_X__ No___

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

None

Remarks: Soil is saturated and wet throughout

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/27/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-2(U)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 48" Long: 37° 50' 45" Datum: NADA 27 East

Soil Map Unit Name: Bluford 2-5% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil __, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	
Hydric Soil Present?	Yes ____ No X	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes ____ No X	
Remarks:		

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. *Solidago altissima*	20	N	FACU-
2. *Panlaum virgatum*	10	N	FAC
3. *Poa sp.*	5	N	--
4. Andropogon scoparius	30	Y	FAC-
5.			
6.			
7.			
8.			
9.			
10.			
	65 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	2	x 3 =	6
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	3 (A)		10 (B)

Prevalence Index = B/A = 3.33

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≥3.0[1]

___ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet): Majority of plants are not wetland plants.

Photos: 4, 5 TP-2

6 upland overview

SOIL

Sampling Point: TP-2(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/4	100	None				Clay, loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes____ No _X__

Remarks: Hydric soil is present, site is located in a previous farm field

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- __ Saturation (A3)
- __Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- __ Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____

Water Table Present? Yes__ No_X_ Depth (inches):_____

Saturation Present? (includes capillary fringe) Yes__ No_X_ Depth (inches):_____

Wetland Hydrology Present? Yes___ No_X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

None

Remarks: No hydrology indicators present

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-3(W)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 53" Long: 37° 50' 42" Datum: NADA 27 East

Soil Map Unit Name: Belknap 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	
Hydric Soil Present?	Yes X No ____	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes X No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus palustris*	30	Y	FACW
2. *Betula nigra*	20	Y	FACW
3. *Acer rubrum*	20	Y	FAC
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. *Toxicodendron radicans*	10	N	FAC+
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. *Toxicodendron radicans*	30	Y	FAC+
2. *Parthenocissus quinquefolia*	10	N	FAC-
	40 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	50	x 2 =	100
FAC species	70	x 3 =	210
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		310 (B)

Prevalence Index = B/A = 2.58

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet): Wetland vegetation is present

Photos: 7, 8 TP-3

9, 10, 11 wetland overview

SOIL

Sampling Point: TP-3(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/4	100	None				Clay, loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes X No ____

Remarks: Aquic moisture regime present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- X Saturation (A3)
- __Water Marks (B1)
- __Sediment Deposits (B2)
- X Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No X Depth (inches):_____

Water Table Present? Yes X No__ Depth (inches): 1

Saturation Present? (includes capillary fringe) Yes X No__ Depth (inches): 6

Wetland Hydrology Present? Yes X No__

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

None

Remarks: Soil is saturated, drainage patterns present

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-4(U)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 53" Long: 37° 50' 43" Datum: NADA 27 East

Soil Map Unit Name: Bluford 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	
Hydric Soil Present?	Yes ___ No X	Is the Sample Area within a Wetland? Yes ___ No X
Wetland Hydrology Present?	Yes X No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Y	FAC
2.			
3.			
4.			
5.			
	30	= Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1. *Toxicodendron radicans*	20	N	FAC+
2.			
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size: ___)			
1. *Panicum virgaum*	10	N	FAC+
2. *Solidago altissima*	40	Y	FACU-
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	3	x 3 =	9
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	4 (A)		13 (B)

Prevalence Index = B/A = 3.25

Hydrophytic Vegetation Indicators:

____ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

___ Prevalence Index is $\geq 3.0^1$

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet): Recently cleared field

Photos: 12, 13 TP-4

14, 15 upland overview

SOIL

Sampling Point: TP-4(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/4	100	None				loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

__ Histosol (A1)
__Histic Epipedon (A2)
__Black Histic (A3)
__Hydrogen Sulfide (A4)
__Stratified Layers (A5)
__2 cm Muck (A10)
__Depleted Below Dark Surface(A11)
__Thick Dark Surface (A12)
__Sandy Muck Mineral (S1)
__5 cm Mucky Peat or Peat (S3)
__Sandy Gleyed Matrix (S4)
__Sandy Redox (S5)
__Stripped Matrix (S6)
__Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F3)
__Depleted Matrix (F3)
__Redox Dark Surface (F6)
__Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__Coast Prairie Redox (A16)
__Iron-Manganese Masses (F12)
__Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):
Type:_____
Depth (inches) :_____

Hydric Soil Present? Yes___ No _X__

Remarks: no hydric soils present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

__Surface Water (A1)
__High Water Table (A2)
__ Saturation (A3)
__Water Marks (B1)
__Sediment Deposits (B2)
__Drift Deposits (B3)
__Algal Mat or Crust (B4)
__Iron Deposits (B5)
__Inundation Visible on Aerial Imagery (B7)
__Sparsely Vegetated Concaved Surface (B8)
__Water-Stained Leaves (B9)
__Aquatic Fauna (B13)
__True Aquatic Plants (B14)
__Hydrogen Sulfide Odor (C1)
__Oxidized Rhizosperes on Living Roots (C3)
__Presence of Reduced Iron (C4)
__Recent Iron Reduction in Tilled Soils (C6)
__Thin Muck Surface (C7)
__Gauge or Well Data (D9)
__ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

__Surface Soil Cracks (B6)
__ Drainage Patterns (B10)
__Dry-Season Water Table (C2)
__Crayfish Burrows (C8)
__Saturation Visible on Aerial Imagery (C9)
__Stunted or Stressed Plants (D1)
__Geomorphic Position (D2)
__FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____
Water Table Present? Yes___ No_X_ Depth (inches):_____
Saturation Present? (includes capillary fringe) Yes___ No_X_ Depth (inches):_____

Wetland Hydrology Present? Yes___ No_X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

None

Remarks:

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-5(W)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 46" Long: 37° 50' 35" Datum: NADA 27 East

Soil Map Unit Name: Bluford 2-5% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	
Hydric Soil Present?	Yes X No ____	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes X No ____	
Remarks:		

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus palustris*	30	Y	FACW
2. *Oxydendrum arboreum*	20	Y	NI
3. *Carya ovate*	30	Y	FACU
4. *Acer rubrum*	20	Y	FAC
5.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Toxicodendron radicans*	20	N	FAC+
2. Rubus alumnus	10	N	FAC-
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Rubus alumnus*	10	N	FAC-
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1. *Parthenocissus quinquefolia*	10	N	FAC-
2.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	1	x 2 =	2
FAC species	5	x 3 =	15
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	7 (A)		21 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet):

Photos: 16, 17 TP-5

18, 19 wetland overview

SOIL

Sampling Point: TP-5(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	100	None				clay,loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes X No ____

Remarks: Soil is hydric

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- __FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No X Depth (inches):_____

Water Table Present? Yes X No__ Depth (inches): 8

Saturation Present? (includes capillary fringe) Yes__ No X Depth (inches):_____

Wetland Hydrology Present? Yes X No__

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: Drainage patterns, some surface waters in area pooled within drainage patterns, water in test pit

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-6(U)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 44" Long: 37° 50' 35" Datum: NADA 27 East

Soil Map Unit Name: Rend 5-10% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ___ No X Hydric Soil Present? Yes ___ No X Wetland Hydrology Present? Yes ___ No X	Is the Sample Area within a Wetland? Yes ___ No X
Remarks: upland site within a previously mowed/farmed field	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. *Rorippa palustris*	10	N	OBL
2. *Erigeron annuus*	30	Y	FAC-
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	1	x 1 =	1
FACW species	0	x 2 =	0
FAC species	1	x 3 =	3
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	2	(A)	4 (B)

Prevalence Index = B/A = 2

Hydrophytic Vegetation Indicators:

____ Rapid Test for Hydrophytic Vegetation

____ Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet): Field dominated by these two plants

Photos: 20, 21 TP-6

22, 23 upland overview

SOIL

Sampling Point: TP-6(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/4	100	None				loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes___ No_X_

Remarks: no hydric soil present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- __ Saturation (A3)
- __Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- __ Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- __FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____

Water Table Present? Yes__ No_X_ Depth (inches):_____

Saturation Present? (includes capillary fringe) Yes__ No_X_ Depth (inches):_____

Wetland Hydrology Present? Yes___ No_X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: no hydrology present

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-7(W)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 56" Long: 37° 50' 35" Datum: NADA 27 East

Soil Map Unit Name: Belknap 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	
Hydric Soil Present?	Yes X No ____	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes X No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula nigra*	30	Y	FACW
2. *Acer rubrum*	30	Y	FAC
3.			
4.			
5.			
	____	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Betula nigra*	10	Y	FACW
2. Toxicodendron radicans	20	Y	FAC+
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Poa sp.*	10	N	--
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	2	x 2 =	4
FAC species	2	x 3 =	6
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	4	(A)	10 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet): Wetland vegetation present

Photos: 24, 25 TP-7

26, 27 wetland overview

SOIL

Sampling Point: TP-7(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 4/2	100	None				clay, loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes X No ____

Remarks: hydric soil present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction In Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- __ Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- __FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No X Depth (inches):_____

Water Table Present? Yes X No__ Depth (inches): 5

Saturation Present? (includes capillary fringe) Yes__ No X Depth (inches):_____

Wetland Hydrology Present? Yes X No__

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: Some standing water in drainage pattern, soil is very saturated

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-8(U)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 54" Long: 37° 50' 35" Datum: NADA 27 East

Soil Map Unit Name: Bluford 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	
Hydric Soil Present?	Yes ___ No X	Is the Sample Area within a Wetland? Yes ___ No X
Wetland Hydrology Present?	Yes ___ No X	
Remarks:		

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Acer rubrum*	30	Y	FAC
2. *Betula nigra*	20	Y	FACW
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Solidago altissima*	30	Y	FAC+
2. *Erigeron annuus*	10	N	FAC-
3. *Panicum virgatum*	10	N	FAC+
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	1	x 2 =	2
FAC species	4	x 3 =	12
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	5	(A)	14 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is $\geq 3.0^1$

___ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet):

Photos: 28, 29 TP-8

30, 31 wetland overview

SOIL

Sampling Point: TP-8(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/6	100	None				loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

__ Histosol (A1)
__Histic Epipedon (A2)
__Black Histic (A3)
__Hydrogen Sulfide (A4)
__Stratified Layers (A5)
__2 cm Muck (A10)
__Depleted Below Dark Surface(A11)
__Thick Dark Surface (A12)
__Sandy Muck Mineral (S1)
__5 cm Mucky Peat or Peat (S3)
__Sandy Gleyed Matrix (S4)
__Sandy Redox (S5)
__Stripped Matrix (S6)
__Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F3)
__Depleted Matrix (F3)
__Redox Dark Surface (F6)
__Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__Coast Prairie Redox (A16)
__Iron-Manganese Masses (F12)
__Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):
Type:_____
Depth (inches) :_____

Hydric Soil Present? Yes___ No __X__

Remarks: no hydric soils present

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required: check all that apply)

__Surface Water (A1)
__High Water Table (A2)
___ Saturation (A3)
___Water Marks (B1)
__Sediment Deposits (B2)
__Drift Deposits (B3)
__Algal Mat or Crust (B4)
__Iron Deposits (B5)
__Inundation Visible on Aerial Imagery (B7)
__Sparsely Vegetated Concaved Surface (B8)
__Water-Stained Leaves (B9)
__Aquatic Fauna (B13)
__True Aquatic Plants (B14)
__Hydrogen Sulfide Odor (C1)
__Oxidized Rhizosperes on Living Roots (C3)
__Presence of Reduced Iron (C4)
__Recent Iron Reduction in Tilled Soils (C6)
__Thin Muck Surface (C7)
__Gauge or Well Data (D9)
__ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

__Surface Soil Cracks (B6)
__ Drainage Patterns (B10)
__Dry-Season Water Table (C2)
__Crayfish Burrows (C8)
__Saturation Visible on Aerial Imagery (C9)
__Stunted or Stressed Plants (D1)
__Geomorphic Position (D2)
__FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____
Water Table Present? Yes__ No_X_ Depth (inches):_____
Saturation Present? (includes capillary fringe) Yes__ No_X_ Depth (inches):_____

Wetland Hydrology Present? Yes___ No_X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: no hydrology present

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-9(W)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 59" Long: 37° 50' 34" Datum: NADA 27 East

Soil Map Unit Name: Belknap 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	
Hydric Soil Present?	Yes X No ____	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes X No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Y	FAC
2. *Betula nigra*	20	Y	FACW
3. *Gleditsia triacanthos*	40	Y	FAC
4. *Carya ovata*	10	N	FACU
5.			
	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Toxicodendron radicans*	20	Y	FAC+
2. *Sassafras albidum*	10	Y	FACU
3. *Rubus alumnus*	10	Y	FAC-
4. Rosa multiflora	10	N	FACU
5.			
	50	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Poa sp.*	5	N	–
2.			
3.			
5.			
5.			
6.			
7.			
8.			
9.			
10.			
	5	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1. *Parthenocissus quinquefolia*	10	N	FAC-
2.			
	10	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	1	x 2 =	2
FAC species	5	x 3 =	15
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column Totals:	9	(A)	29 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- X Prevalence Index is ≥3.0[1]
- ____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet):

Photos: 32, 33 TP-9

34, 35 wetland overview

SOIL

Sampling Point: TP-9(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/2	100	None				clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- __Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- _X_ Loamy Gleyed Matrix (F3)
- _X_ Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes_X__ No ____

Remarks: hydric soils present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- _X_ Saturation (A3)
- ___Water Marks (B1)
- _X_ Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __Surface Soil Cracks (B6)
- __ Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- ___FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____

Water Table Present? Yes_X_ No__ Depth (inches):____4_____

Saturation Present? (includes capillary fringe) Yes__ No_X_ Depth (inches):_____

Wetland Hydrology Present? Yes_X__ No___

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: Water is standing in drainage areas, free water in test pit, saturated soils

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 4/28/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-10(U)

Investigator(s): TSB, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 49' 0" Long: 37° 50' 34" Datum: NADA 27 East

Soil Map Unit Name: Bluford 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	
Hydric Soil Present?	Yes ___ No X	Is the Sample Area within a Wetland? Yes ___ No X
Wetland Hydrology Present?	Yes ___ No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Y	FAC
2. *Betula nigra*	20	Y	FACW
3.			
4.			
5.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Betula nigra*	20	Y	FACW
2. *Elaeagnus umbellata*	10	Y	--
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Panicum virgatum*	10	N	FAC+
2. *Erigeron annuus*	10	N	FAC-
3. *Solidago altissima*	20	Y	FAC+
5.			
5.			
6.			
7.			
8.			
9.			
10.			
	40	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1. *Lonicera japonica*	30	Y	FACU
2.			
	30	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	2	x 2 =	4
FAC species	4	x 3 =	12
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	7 (A)		20 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

___ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (Include photo numbers here or on a separate sheet):

Photos: 37, 38 TP-10

39, 40 upland overview

SOIL

Sampling Point: TP-10(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/4	100	None				loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

__ Histosol (A1)
__Histic Epipedon (A2)
__Black Histic (A3)
__Hydrogen Sulfide (A4)
__Stratified Layers (A5)
__2 cm Muck (A10)
__Depleted Below Dark Surface(A11)
__Thick Dark Surface (A12)
__Sandy Muck Mineral (S1)
__5 cm Mucky Peat or Peat (S3)
__Sandy Gleyed Matrix (S4)
__Sandy Redox (S5)
__Stripped Matrix (S6)
__Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F3)
__Depleted Matrix (F3)
__Redox Dark Surface (F6)
__Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__Coast Prairie Redox (A16)
__Iron-Manganese Masses (F12)
__Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):
Type:_____
Depth (inches) :_____

Hydric Soil Present? Yes__ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

__Surface Water (A1)
__High Water Table (A2)
__ Saturation (A3)
__Water Marks (B1)
__Sediment Deposits (B2)
__Drift Deposits (B3)
__Algal Mat or Crust (B4)
__Iron Deposits (B5)
__Inundation Visible on Aerial Imagery (B7)
__Sparsely Vegetated Concaved Surface (B8)
__Water-Stained Leaves (B9)
__Aquatic Fauna (B13)
__True Aquatic Plants (B14)
__Hydrogen Sulfide Odor (C1)
__Oxidized Rhizosperes on Living Roots (C3)
__Presence of Reduced Iron (C4)
__Recent Iron Reduction in Tilled Soils (C6)
__Thin Muck Surface (C7)
__Gauge or Well Data (D9)
__ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

__Surface Soil Cracks (B6)
__ Drainage Patterns (B10)
__Dry-Season Water Table (C2)
__Crayfish Burrows (C8)
__Saturation Visible on Aerial Imagery (C9)
__Stunted or Stressed Plants (D1)
__Geomorphic Position (D2)
__FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No X Depth (inches):_____
Water Table Present? Yes__ No X Depth (inches):_____
Saturation Present? (includes capillary fringe) Yes__ No X Depth (inches):_____

Wetland Hydrology Present? Yes___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 10/6/10

Applicant/Owner: Williamson Energy, LLC State: IL Sampling Point: TP-21(W)

Investigator(s): ACW, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%): <1 Lat: 88° 48' 27" Long: 37° 50' 17" Datum: NADA 27 East

Soil Map Unit Name: Belknap 0-2% NWI or WWI classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation no, Soil no, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	
Hydric Soil Present?	Yes X No ____	Is the Sample Area within a Wetland? Yes X No ____
Wetland Hydrology Present?	Yes X No ____	

Remarks: low-chrome soils present, drought conditions present

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	20	Y	FAC
2. *Betula nigra*	20	Y	FACW
3.			
4.			
5.			
	40	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. *Toxicodendron radicans*	15	Y	FAC+
2.			
3.			
4.			
5.			
	15	= Total Cover	
Herb Stratum (Plot size: ____)			
1. *Eupatorium purpureum*	5	N	FAC
2. *Panicum virgatum*	5	N	FAC+
3.			
5.			
5.			
6.			
7.			
8.			
9.			
10.			
	10	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	1	x 2 =	2
FAC species	4	x 3 =	12
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	5	(A)	14 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

____ Rapid Test for Hydrophytic Vegetation

____ Dominance Test is >50%

X Prevalence Index is ≥3.0[1]

____ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet):

Photo: 41 TP-21

SOIL

Sampling Point: TP-21(W)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1.5	10YR 6/2		10YR 6/6/				silt, loam	
1.5-8.5	10YR 6/1		73.5 YR 5/8				silt, loam	
								Refuse at 8.5"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __Histic Epipedon (A2)
- __Black Histic (A3)
- __Hydrogen Sulfide (A4)
- _X_Stratified Layers (A5)
- __2 cm Muck (A10)
- __Depleted Below Dark Surface(A11)
- __Thick Dark Surface (A12)
- __Sandy Muck Mineral (S1)
- __5 cm Mucky Peat or Peat (S3)
- __Sandy Gleyed Matrix (S4)
- __Sandy Redox (S5)
- __Stripped Matrix (S6)
- __Loamy Mucky Mineral (F1)
- _X__ Loamy Gleyed Matrix (F3)
- __Depleted Matrix (F3)
- __Redox Dark Surface (F6)
- __Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __Coast Prairie Redox (A16)
- __Iron-Manganese Masses (F12)
- __Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):

Type:_____

Depth (inches) :_____

Hydric Soil Present? Yes_X__ No ____

Remarks: soils are low-chrome

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- __Surface Water (A1)
- __High Water Table (A2)
- ___ Saturation (A3)
- _X__Water Marks (B1)
- __Sediment Deposits (B2)
- __Drift Deposits (B3)
- __Algal Mat or Crust (B4)
- __Iron Deposits (B5)
- __Inundation Visible on Aerial Imagery (B7)
- __Sparsely Vegetated Concaved Surface (B8)
- __Water-Stained Leaves (B9)
- __Aquatic Fauna (B13)
- __True Aquatic Plants (B14)
- __Hydrogen Sulfide Odor (C1)
- __Oxidized Rhizosperes on Living Roots (C3)
- __Presence of Reduced Iron (C4)
- __Recent Iron Reduction in Tilled Soils (C6)
- __Thin Muck Surface (C7)
- __Gauge or Well Data (D9)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- _X_Surface Soil Cracks (B6)
- _X_ Drainage Patterns (B10)
- __Dry-Season Water Table (C2)
- __Crayfish Burrows (C8)
- __Saturation Visible on Aerial Imagery (C9)
- __Stunted or Stressed Plants (D1)
- __Geomorphic Position (D2)
- __FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____

Water Table Present? Yes__ No__ Depth (inches):_N/A_____

Saturation Present? (includes capillary fringe) Yes__ No__ Depth (inches):_N/A_____

Wetland Hydrology Present? Yes_X__ No___

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: Pond Creek City/County: Williamson Sampling Date: 10/6/10

Applicant/Owner: Williamson Energy, LLC State IL Sampling Point: TP-23(U)

Investigator(s): ACW, BAH Section, Township, Range: 9, T8S, R4E

Landform (hillslope, terrace, etc.): none Local relief (concave, convex, none): none

Slope(%) <1 Lat: 88° 48' 27" Long: 37° 50' 17" Datum: NADA 27 East

Soil Map Unit Name: Belknap 0-2% NWI or WWI classification N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No_____ (If no, explain in Remarks.)

Are Vegetation yes, Soil yes, or Hydrology yes significantly disturbed? Are "Normal Circumstances" present? Yes X No_____

Are Vegetation no, Soil no, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	
Hydric Soil Present?	Yes ___ No X	Is the Sample Area within a Wetland? Yes ___ No X
Wetland Hydrology Present?	Yes ___ No X	

Remarks: site is located within a farm field adjacent to wetland B

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. *Zea mays*	100	Y	N/A
2.			
3.			
4.			
5.			
	100 = Total Cover		
Herb Stratum (Plot size: 5%)			
1.			
2.			
3.			
5.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiple by:
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≥3.0[1]

___ Morphological Adaptations[1] (Provided supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes_____ No X

Remarks: (Include photo numbers here or on a separate sheet):

Photo:

SOIL

Sampling Point: TP-23(U)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(Inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 6/3	100%	None				silt, loam	Plowed field
								Refuse @ 12"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

__ Histosol (A1)
__Histic Epipedon (A2)
__Black Histic (A3)
__Hydrogen Sulfide (A4)
__Stratified Layers (A5)
__2 cm Muck (A10)
__Depleted Below Dark Surface(A11)
__Thick Dark Surface (A12)
__Sandy Muck Mineral (S1)
__5 cm Mucky Peat or Peat (S3)
__Sandy Gleyed Matrix (S4)
__Sandy Redox (S5)
__Stripped Matrix (S6)
__Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F3)
__Depleted Matrix (F3)
__Redox Dark Surface (F6)
__Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__Coast Prairie Redox (A16)
__Iron-Manganese Masses (F12)
__Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive layer (if observed):
Type:_____
Depth (inches) :_____

Hydric Soil Present? Yes__ No _X__

Remarks: upland test pit located in corn field

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

__Surface Water (A1)
__High Water Table (A2)
__ Saturation (A3)
__Water Marks (B1)
__Sediment Deposits (B2)
__Drift Deposits (B3)
__Algal Mat or Crust (B4)
__Iron Deposits (B5)
_X_Inundation Visible on Aerial Imagery (B7)
__Sparsely Vegetated Concaved Surface (B8)
__Water-Stained Leaves (B9)
__Aquatic Fauna (B13)
__True Aquatic Plants (B14)
__Hydrogen Sulfide Odor (C1)
__Oxidized Rhizosperes on Living Roots (C3)
__Presence of Reduced Iron (C4)
__Recent Iron Reduction in Tilled Soils (C6)
__Thin Muck Surface (C7)
__Gauge or Well Data (D9)
__ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

__Surface Soil Cracks (B6)
__ Drainage Patterns (B10)
__Dry-Season Water Table (C2)
__Crayfish Burrows (C8)
__Saturation Visible on Aerial Imagery (C9)
__Stunted or Stressed Plants (D1)
__Geomorphic Position (D2)
__FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes__ No_X_ Depth (inches):_____
Water Table Present? Yes__ No_X_ Depth (inches):_____
Saturation Present? (includes capillary fringe) Yes__ No_x_ Depth (inches):_____

Wetland Hydrology Present? Yes_X__ No__

Describe Recorded Data (stream gauge, monitoring well, aerial photos inspections), if available:

Remarks: Test pit is located in within the 100 year flood zone of an adjacent stream.

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



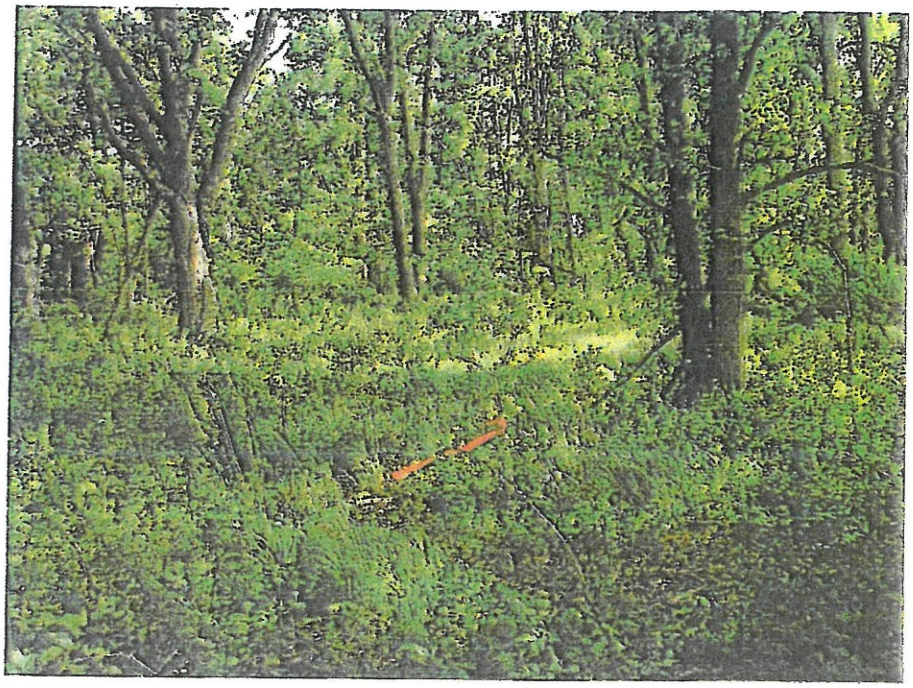
Photograph No. 1
Test Pit 1, Wetland



Photograph No. 2
Test Pit 1, Wetland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 3
Test Pit 1, Wetland Overview



Photograph No. 4
Test Pit 2, Upland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 5
Test Pit 2, Upland



Photograph No. 6
Test Pit 2, Upland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 7
Test Pit 3, Wetland



Photograph No. 8
Test Pit 3, Wetland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



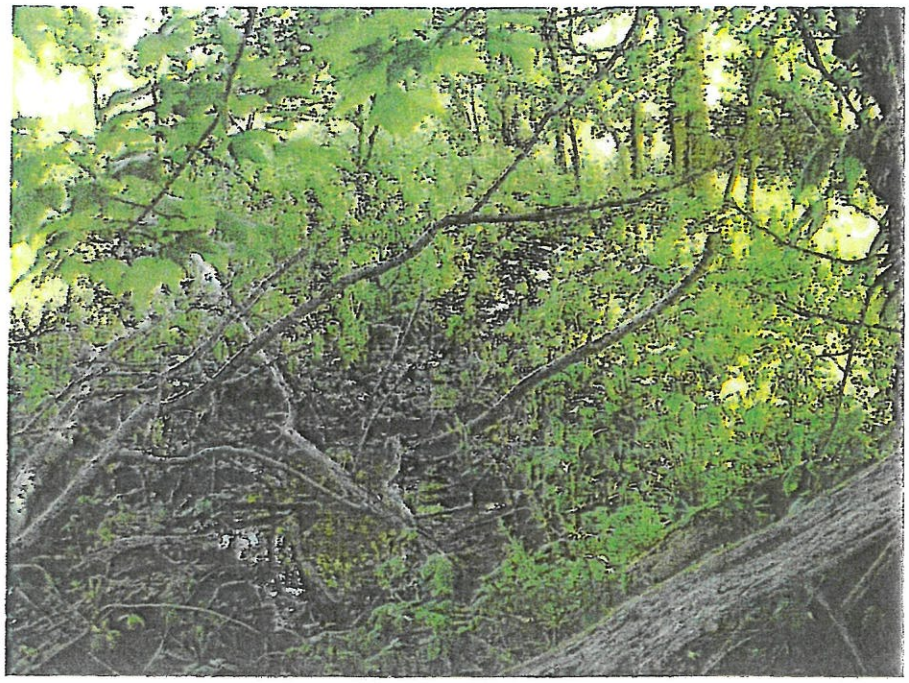
Photograph No. 9
Test Pit 3, Wetland Overview



Photograph No. 10
Test Pit 3, Wetland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 11
Test Pit 3, Wetland Overview



Photograph No. 12
Test Pit 4, Upland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 13
Test Pit 4, Upland



Photograph No. 14
Test Pit 4, Upland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 15
Test Pit 5, Wetland



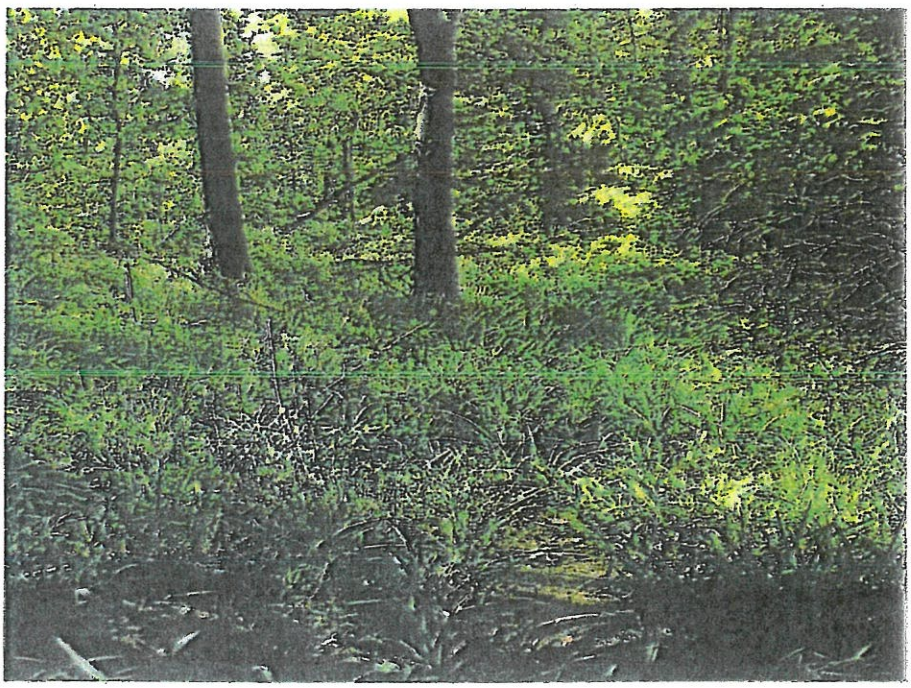
Photograph No. 16
Test Pit 5, Wetland

Project No. B08-467-1413

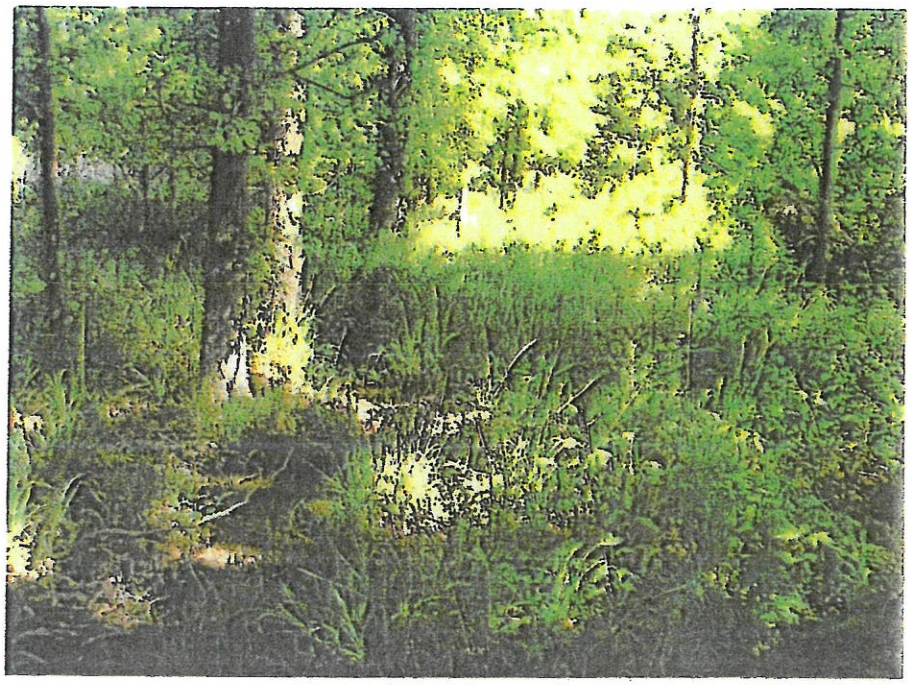
Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



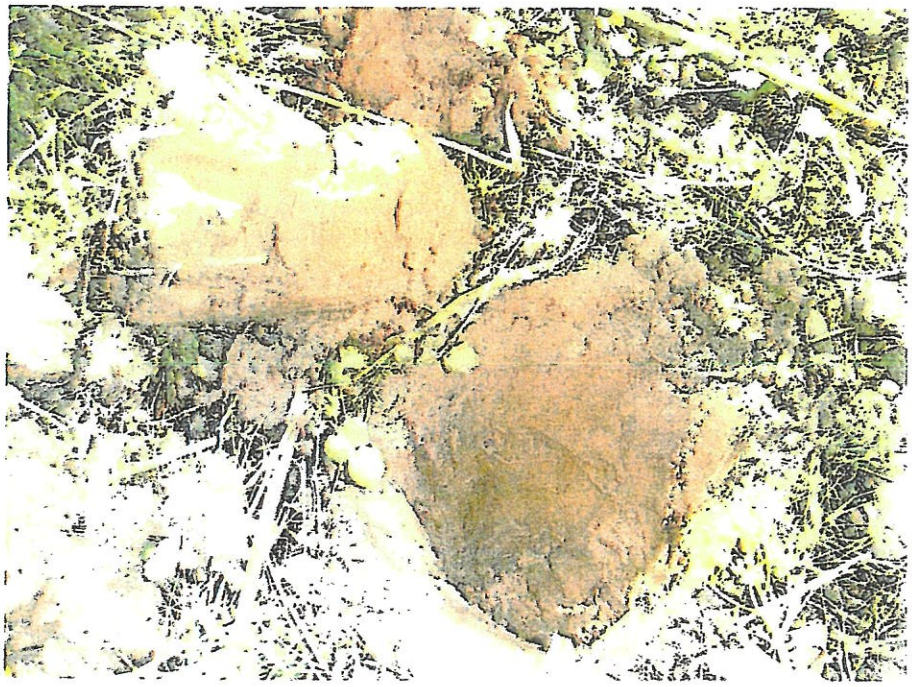
Photograph No. 17
Test Pit 5, Wetland



Photograph No. 18
Test Pit 5, Wetland Overview



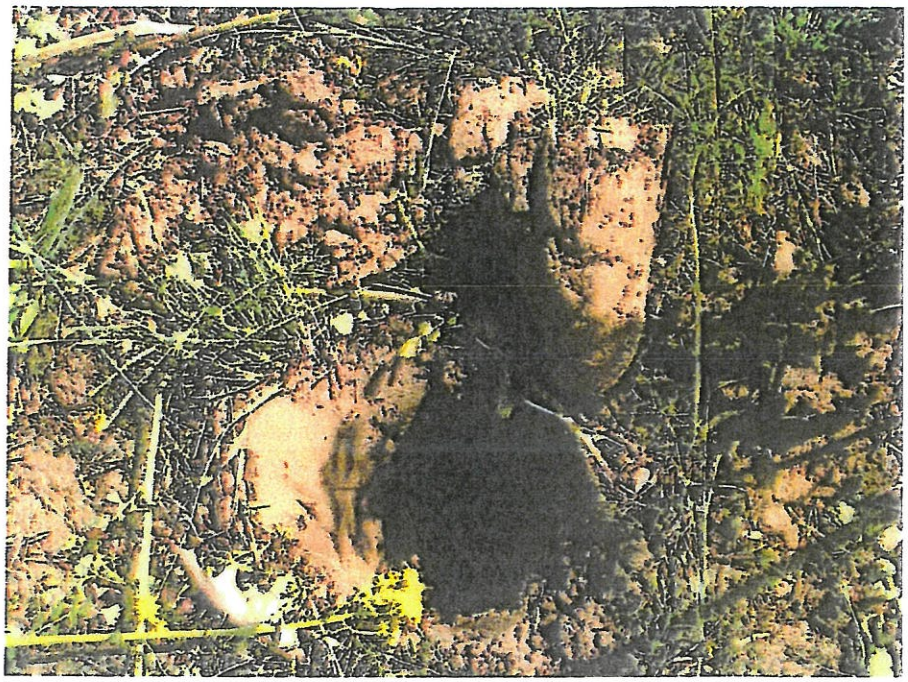
Photograph No. 19
Test Pit 5, Wetland Overview



Photograph No. 20
Test Pit 6, Upland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 21
Test Pit 6, Upland



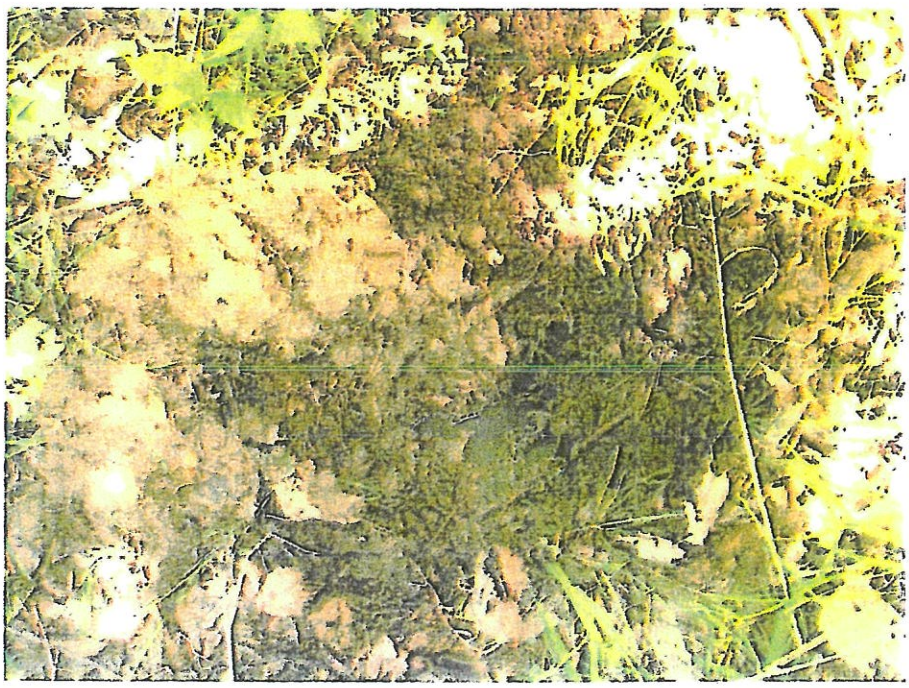
Photograph No. 22
Test Pit 6, Upland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 23
Test Pit 6, Upland Overview



Photograph No. 24
Test Pit 7, Wetland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 25
Test Pit 7, Wetland



Photograph No. 26
Test Pit 7, Wetland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 27
Test Pit 7, Wetland Overview



Photograph No. 28
Test Pit 8, Upland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 29
Test Pit 8, Upland



Photograph No. 30
Test Pit 8, Upland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 31
Test Pit 8, Upland Overview



Photograph No. 32
Test Pit 9, Wetland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 33
Test Pit 9, Wetland



Photograph No. 34
Test Pit 9, Wetland Overview



Photograph No. 35
Test Pit 9, Wetland Overview



Photograph No. 36
Test Pit 9, Wetland Overview



Photograph No. 37
Test Pit 10, Upland



Photograph No. 38
Test Pit 10, Upland

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 39
Test Pit 10, Upland Overview



Photograph No. 40
Test Pit 10, Upland Overview

Project No. B08-467-1413

Pond Creek 1 Mine and Coal Refuse Disposal Facility IBR



Photograph No. 41
Test Pit 21, Wetland

APPENDIX C

DRIVING DIRECTIONS

DRIVING DIRECTIONS FROM ST. LOUIS, MISSOURI TO JOHNSTON CITY, ILLINOIS

Start out going East on Market Street toward S. 11th Street and travel approximately 0.4 mile. Turn right onto S. Broadway, approximately 0.1 mile, turn left onto Walnut Street, approximately 0.1 mile, turn right on S. Memorial Drive, approximately 0.1 mile. Merge onto I-64 E, via the ramp on the left toward Illinois (crossing into Illinois) and travel approximately 78.3 miles. Take I-57 S toward Memphis, approximately 32.8 miles. Take Exit 59 toward Johnston City/Herrin, approximately 0.3 mile. Turn left onto CR-2/Herrin Road, continue to follow CR-2, approximately 1.1 mile, turn left onto Water Avenue, approximately 0.2 mile, turn right onto W. 9th Street, approximately 0.1 mile, turn left onto Washington Avenue, approximately 0.1 mile, arrive at Johnston City, IL. From Johnston City continue east on Corinth Road approximately 6 miles until Dwina Road. Turn left on Dwina Road. The project site is located east of Dwina Road before the confluence with Dean Road.

APPENDIX D

U.S. ARMY COPS OF ENGINEERS
APPROVED JURISDICTIONAL DETERMINATION FORMS

WETLAND A

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION:
State:ILLINOIS County/parish/borough: WILLIAMSON City: JOHNNSTON CITY
Center coordinates of site (lat/long in degree decimal format): Lat. 37.843056° N, Long. 88.8125° W.
Universal Transverse Mercator:
Name of nearest waterbody: UNT OF POND CREEK
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Big Muddy River
Name of watershed or Hydrologic Unit Code (HUC): 071401060501
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** *"navigable waters of the U.S."* within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☒ Waters subject to the ebb and flow of the tide.
☒ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** *"waters of the U.S."* within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☒ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet: width (ft) and/or acres.
      Wetlands: 32.72 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **1987 Delineation Manual**
      Elevation of established OHWM (if known):

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain:

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW:

   Summarize rationale supporting determination:

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent":

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) **General Area Conditions:**
   Watershed size: **Pick List**
   Drainage area: **Pick List**
   Average annual rainfall: 44.49 inches
   Average annual snowfall: 10.3 inches

   (ii) **Physical Characteristics:**
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☒ Tributary flows through 2 tributaries before entering TNW.

   Project waters are **Pick List** river miles from TNW.
   Project waters are **Pick List** river miles from RPW.
   Project waters are **Pick List** aerial (straight) miles from TNW.
   Project waters are **Pick List** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain:

   Identify flow route to TNW[5]:
   Tributary stream order, if known:

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain:
☐ Manipulated (man-altered). Explain: The stream channel has been and continues to be impacted by agricultural activities. Also the channel was recently undermined by Pond Creek No. 1.

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain:		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: Erosion is present on both banks of the stream channel in limited capacities.
Presence of run/riffle/pool complexes. Explain:
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: Flow is intermittent.
Other information on duration and volume:

Surface flow is: **Pick List.** Characteristics: Channel is distinct but not confined .

Subsurface flow: **Pick List.** Explain findings:
☐ Dye (or other) test performed:

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain:The channel lacked clear bed and bank definition throughout the downstream reaches of the channel as it approached Dwina Rd.

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain:
Identify specific pollutants, if known:

---

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width): Riparian zone is narrow and lacking in some instances along the channel. In some places the riparian corridor is lacking completely due to farming practices.

☐ Wetland fringe. Characteristics: .

☐ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain: .

Wetland quality. Explain:W. .

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: Seasonally water does inundate the wetland from channel a during wet seasons.

Surface flow is: **Pick List**

Characteristics: flow is distinct in the wetland with a large component of overland sheetflow .

Subsurface flow: **Pick List**. Explain findings: .

☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

☐ Directly abutting

☐ Not directly abutting

☐ Discrete wetland hydrologic connection. Explain: .

☐ Ecological connection. Explain: .

☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List.**

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

☐ Riparian buffer. Characteristics (type, average width):Riparian buffer is extremely limited to no upland buffer in width .

☐ Vegetation type/percent cover. Explain:Wetland is almost exclusely covered by emergent, shrub and forested vegetation.

☐ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

---

[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  - Identify type(s) of waters: .
- ☒ Wetlands:32.72 acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
- ☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☐ Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☒ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name:1,000 & U.S.G.S. 7.5 Minute Pitsburg Quadrangle Digital Raster Graphic.
- ☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Pitsburg IL., DOQQ.
- ☒ National wetlands inventory map(s). Cite name: Pitsburg IL., DOQQ.
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): Pitsburg IL., DOQQ.
  - or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

3001-15
part 6

WETLAND B

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State:ILLINOIS County/parish/borough: WILLIAMSON City: JOHNNSTON CITY
Center coordinates of site (lat/long in degree decimal format): Lat. 37.843056° N, Long. 88.8125° W.
Universal Transverse Mercator:
Name of nearest waterbody: UNT OF POND CREEK
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Big Muddy River
Name of watershed or Hydrologic Unit Code (HUC): 071401060501

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc...) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** *"navigable waters of the U.S."* within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☒ Waters subject to the ebb and flow of the tide.
☒ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** *"waters of the U.S."* within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☒ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet: width (ft) and/or acres.
      Wetlands: 1.25 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **1987 Delineation Manual**
      Elevation of established OHWM (if known):

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain:

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW: .

   Summarize rationale supporting determination: .

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) General Area Conditions:
   Watershed size: **Pick List**
   Drainage area: **Pick List**
   Average annual rainfall: inches
   Average annual snowfall: inches

   (ii) Physical Characteristics:
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☐ Tributary flows through 2 tributaries before entering TNW.

   Project waters are **Pick List** river miles from TNW.
   Project waters are **Pick List** river miles from RPW.
   Project waters are **Pick List** aerial (straight) miles from TNW.
   Project waters are **Pick List** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain:

   Identify flow route to TNW[5]: NNE.
   Tributary stream order, if known: 1st order stream.

---

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain:
☐ Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List**.

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain:		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain:
Presence of run/riffle/pool complexes. Explain:
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime:
Other information on duration and volume:

Surface flow is: **Pick List**. Characteristics: Channel is distinct but not confined .

Subsurface flow: **Pick List**. Explain findings:
☐ Dye (or other) test performed:

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain:THE CHANNEL LACKED CLEAR BED AND BANK DEFINITION THROUGHOUT THE MAJORITY OF THE MEASURED REACH.

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain:
Identify specific pollutants, if known:

---

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width): Riparian zone is narrow and lacking in some instances along the channel. In some places the riparian corridor is lacking completely due to farming practices.

☐ Wetland fringe. Characteristics:

☐ Habitat for:

☐ Federally Listed species. Explain findings:

☐ Fish/spawn areas. Explain findings:

☐ Other environmentally-sensitive species. Explain findings:

☐ Aquatic/wildlife diversity. Explain findings:

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain:

Wetland quality. Explain:

Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: Seasonally water does inundate the wetland from channel a during wet seasons.

Surface flow is: **Pick List**

Characteristics: flow is distinct in the wetland with a large component of overland sheetflow .

Subsurface flow: **Pick List**. Explain findings:

☐ Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW:

☐ Directly abutting

☐ Not directly abutting

☐ Discrete wetland hydrologic connection. Explain:

☐ Ecological connection. Explain:

☐ Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List**.

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:

Identify specific pollutants, if known:

(iii) Biological Characteristics. Wetland supports (check all that apply):

☐ Riparian buffer. Characteristics (type, average width):

☐ Vegetation type/percent cover. Explain:Wetland is almost exclusely covered by emergent, shrub and forested vegetation.

☐ Habitat for:

☐ Federally Listed species. Explain findings:

☐ Fish/spawn areas. Explain findings:

☐ Other environmentally-sensitive species. Explain findings:

☐ Aquatic/wildlife diversity. Explain findings:

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  Identify type(s) of waters:

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
   ☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional waters within the review area (check all that apply):
   - ☐ Tributary waters: linear feet width (ft).
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters:

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
   - ☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:
   - ☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:

   Provide acreage estimates for jurisdictional wetlands in the review area: **32.72** acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
   ☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
   As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
   - ☐ Demonstrate that impoundment was created from "waters of the U.S.," or
   - ☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
   - ☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
- ☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
- ☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
- ☐ which are or could be used for industrial purposes by industries in interstate commerce.
- ☐ Interstate isolated waters. Explain:
- ☐ Other factors. Explain:

Identify water body and summarize rationale supporting determination:

---

[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  - Identify type(s) of waters: .
- ☒ Wetlands:1.25acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
- ☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☐ Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

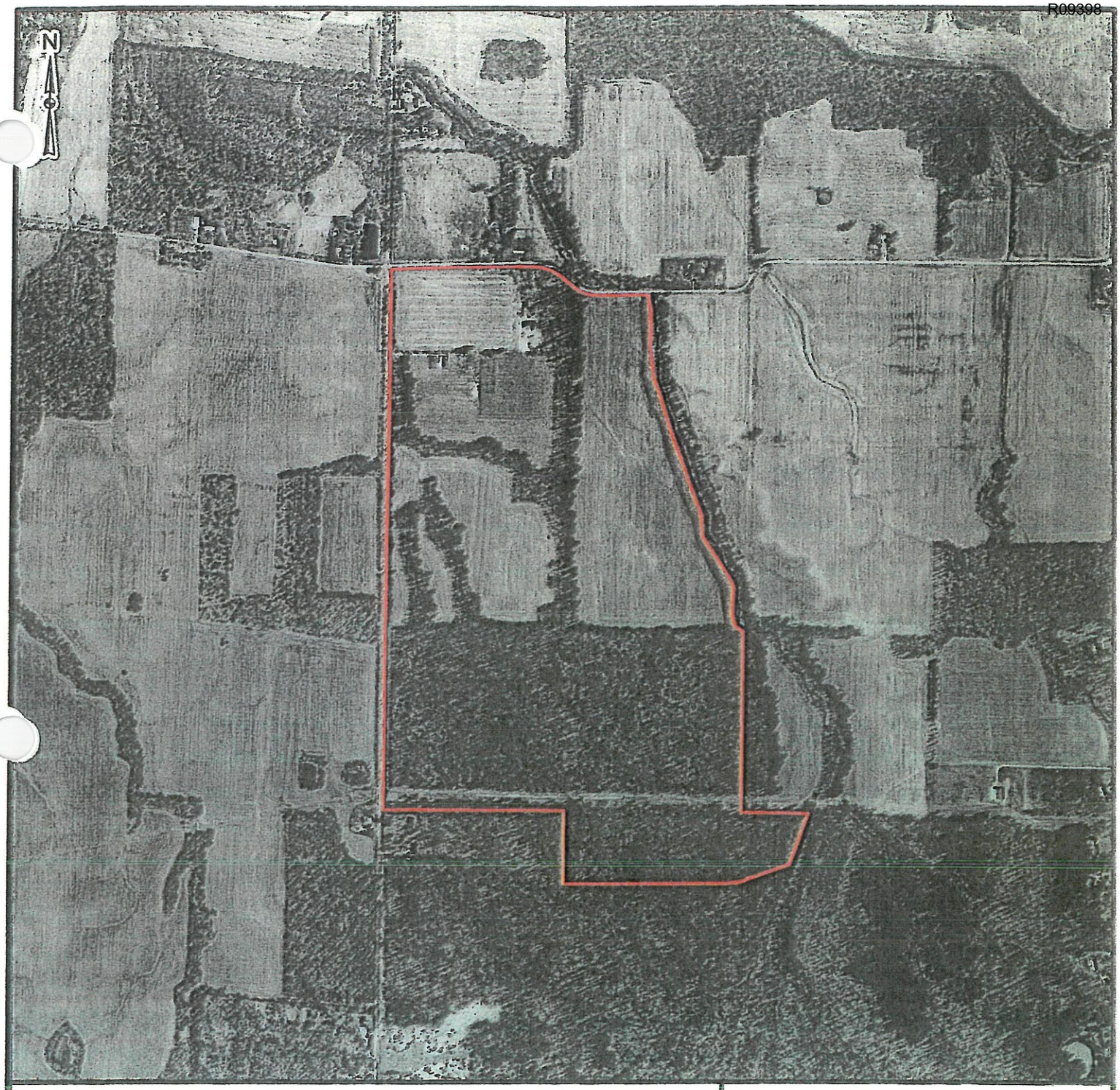
SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☒ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name:1,000 & U.S.G.S. 7.5 Minute Pitsburg Quadrangle Digital Raster Graphic.
- ☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Pitsburg IL., DOQQ.
- ☒ National wetlands inventory map(s). Cite name: Pitsburg IL., DOQQ.
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): Pitsburg IL., DOQQ.
  - or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

FIGURES

R09398



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 500 1,000 2,000 3,000 Feet

Legend

MINING PERMIT #417 PENDING PERMIT AREA

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

AERIAL LOCATION MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A2		

R09399



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 500 1,000 2,000 3,000 Feet

Legend

MINING PERMIT #417 PENDING PERMIT AREA

NWI LISTED WETLANDS

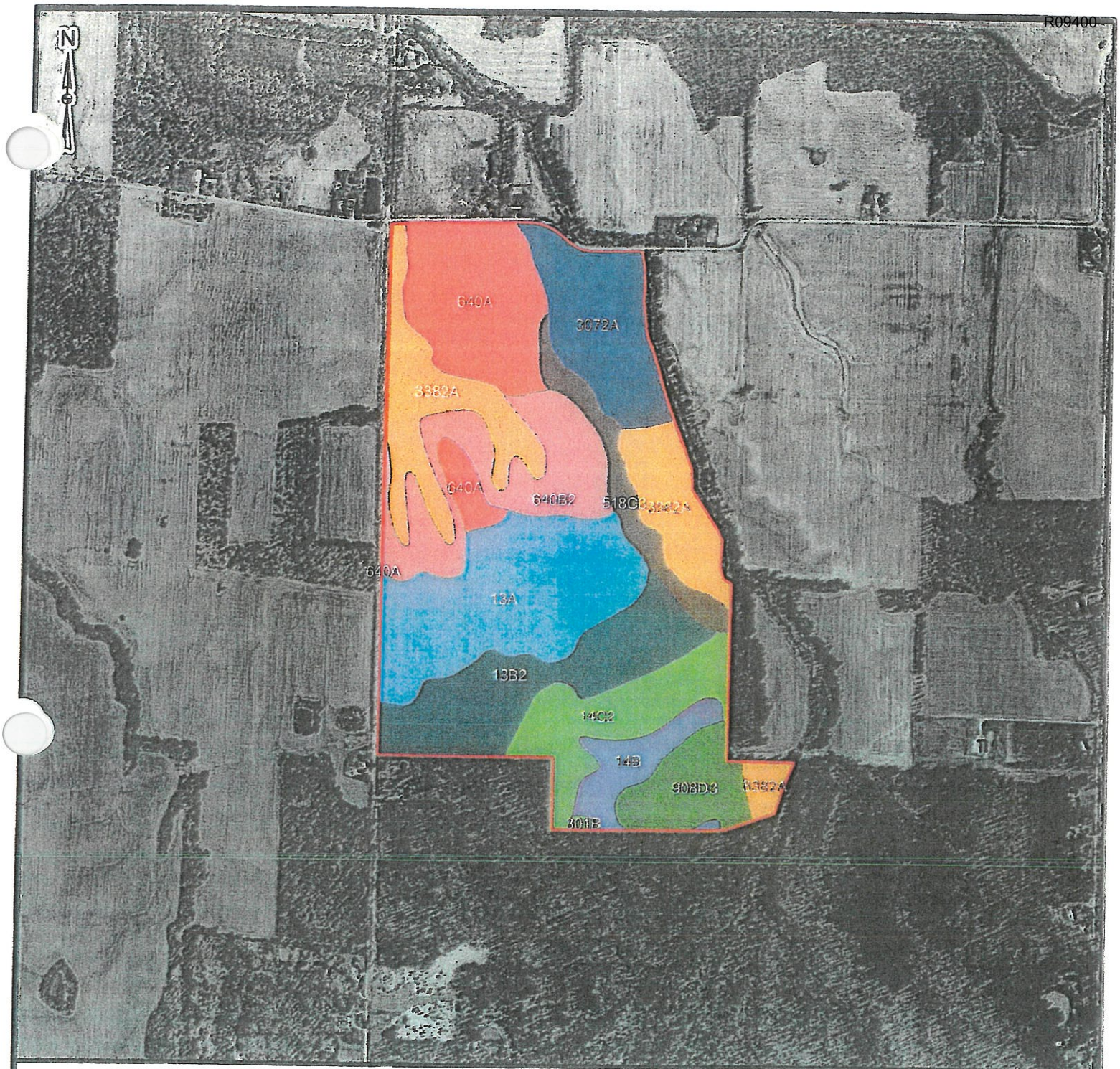
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

NATIONAL WETLAND INVENTORY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A3		

R09400



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 500 1,000 2,000 3,000 Feet

Legend

MINING PERMIT 8417 PENDING PERMIT AREA

SOILS

- 13A- Bluford silt loam, 0 to 2 percent slopes
- 13B2- Bluford silt loam, 2 to 5 percent slopes, eroded
- 14B- Ava silt loam, 2 to 5 percent slopes
- 14C2- Ava silt loam, 5 to 10 percent slopes, eroded
- 301B- Grantsburg silt loam, 2 to 5 percent slopes
- 3072A- Sharon silt loam, 0 to 2 percent slopes, frequently flooded
- 3382A- Belknap silt loam, 0 to 2 percent slopes, frequently flooded
- 518C3- Rend silty clay loam, 5 to 10 percent slopes, severely eroded
- 640A- Bluford silt loam, bench, 0 to 2 percent slopes
- 640B2- Bluford silt loam, bench, 2 to 5 percent slopes, eroded
- 908D3- Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

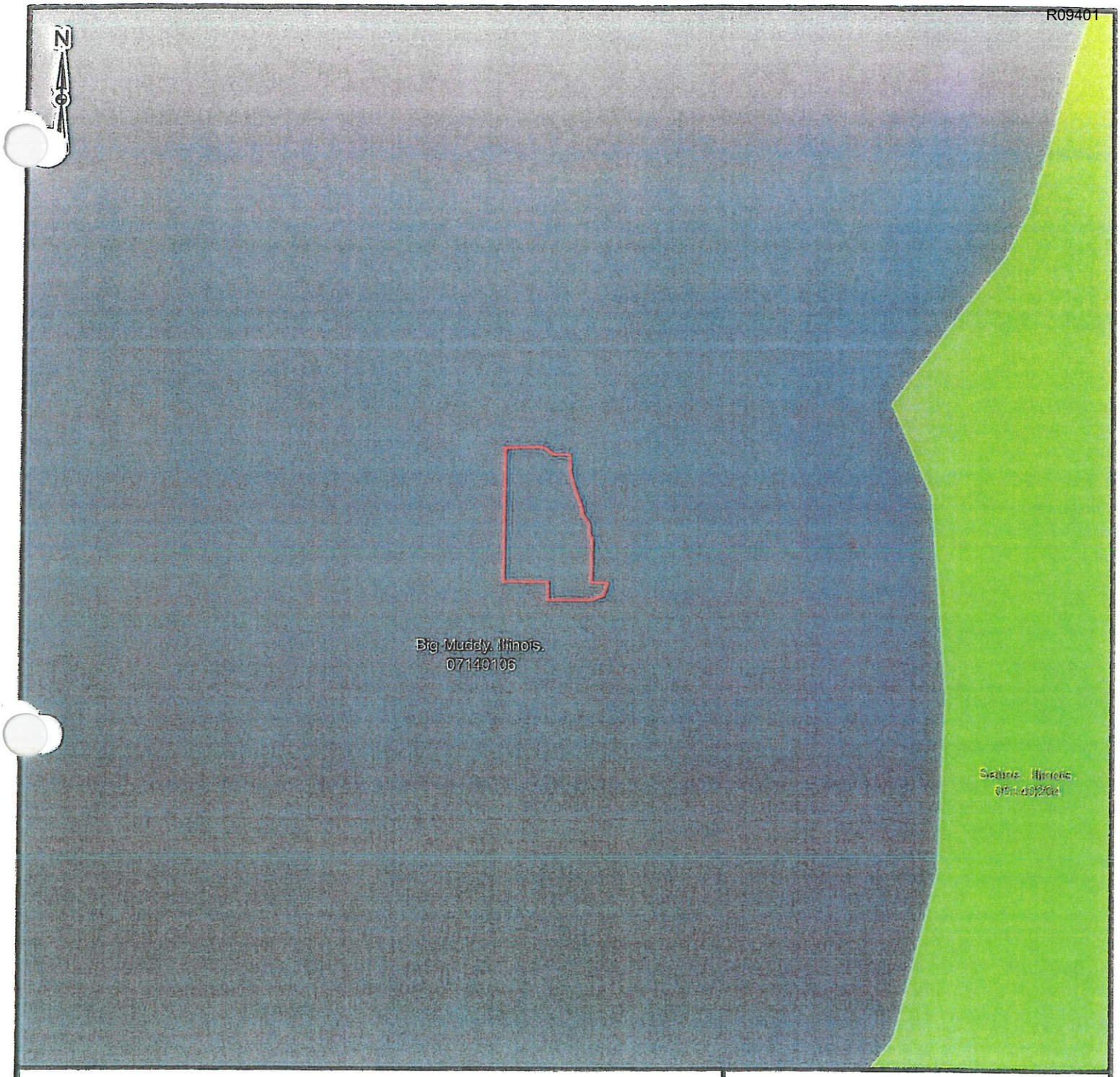
SOILS MAP
POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A4		

R09401



REFERENCE:

8 DIGIT HYDROLOGIC UNIT CODE (HUC) OF THE BIG MUDDY AND SALINE RIVER WATERSHEDS

SCALE

0 2,000 4,000 8,000 12,000 Feet

Legend

MINING PERMIT #417 PENDING PERMIT AREA

8 DIGIT HUC

Big Muddy, Illinois

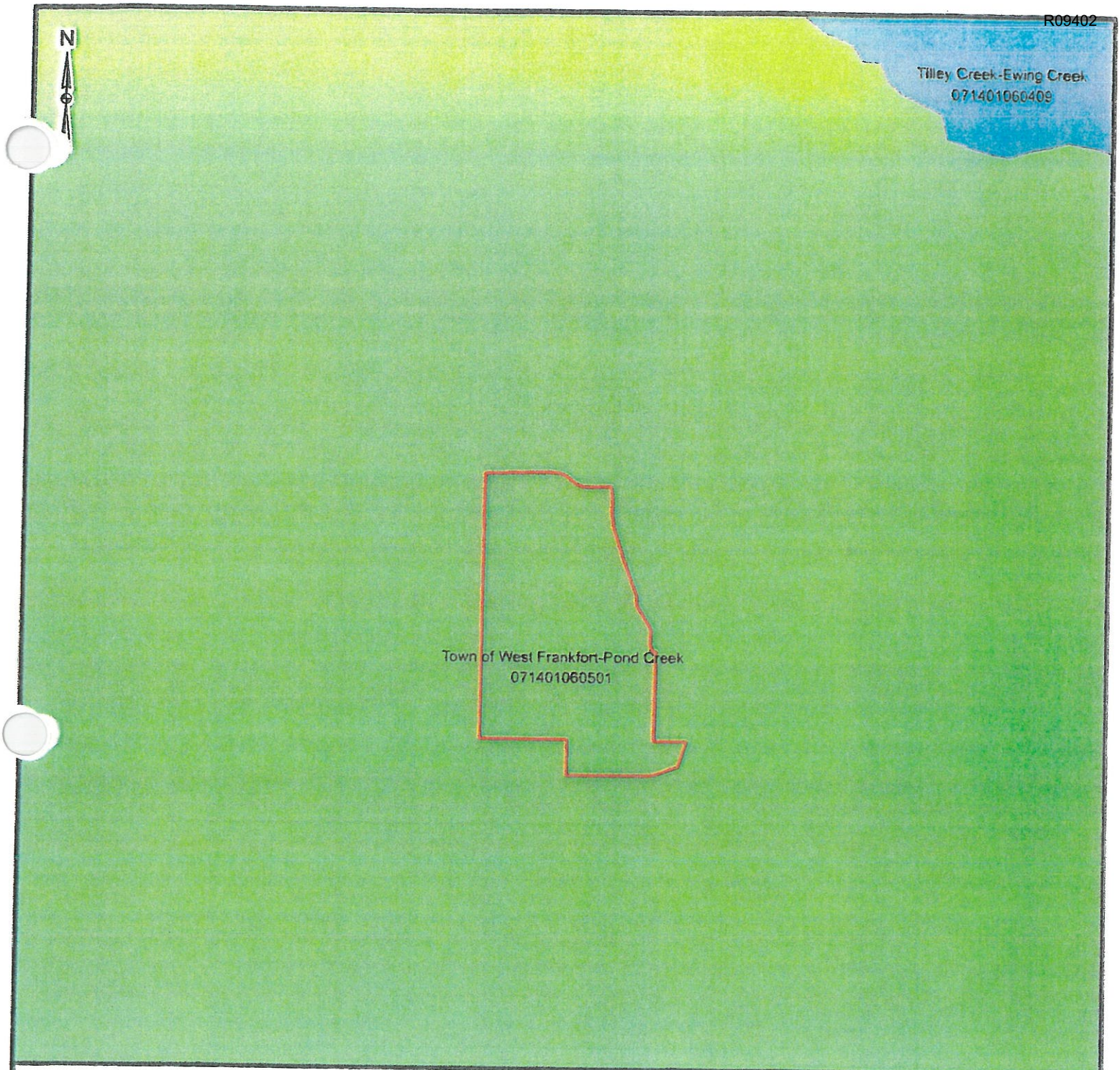
Saline, Illinois

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

8 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A6		



REFERENCE:
12 DIGIT HYDROLOGIC UNIT CODE (HUC) OF TILLEY CREEK-EWING CREEK AND TOWN OF WEST FRANKFORT-POND CREEK WATERSHEDS

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

- MINING PERMIT #417 PENDING PERMIT AREA

12 DIGIT HUC

- Tilley Creek-Ewing Creek
- Town of West Frankfort-Pond Creek

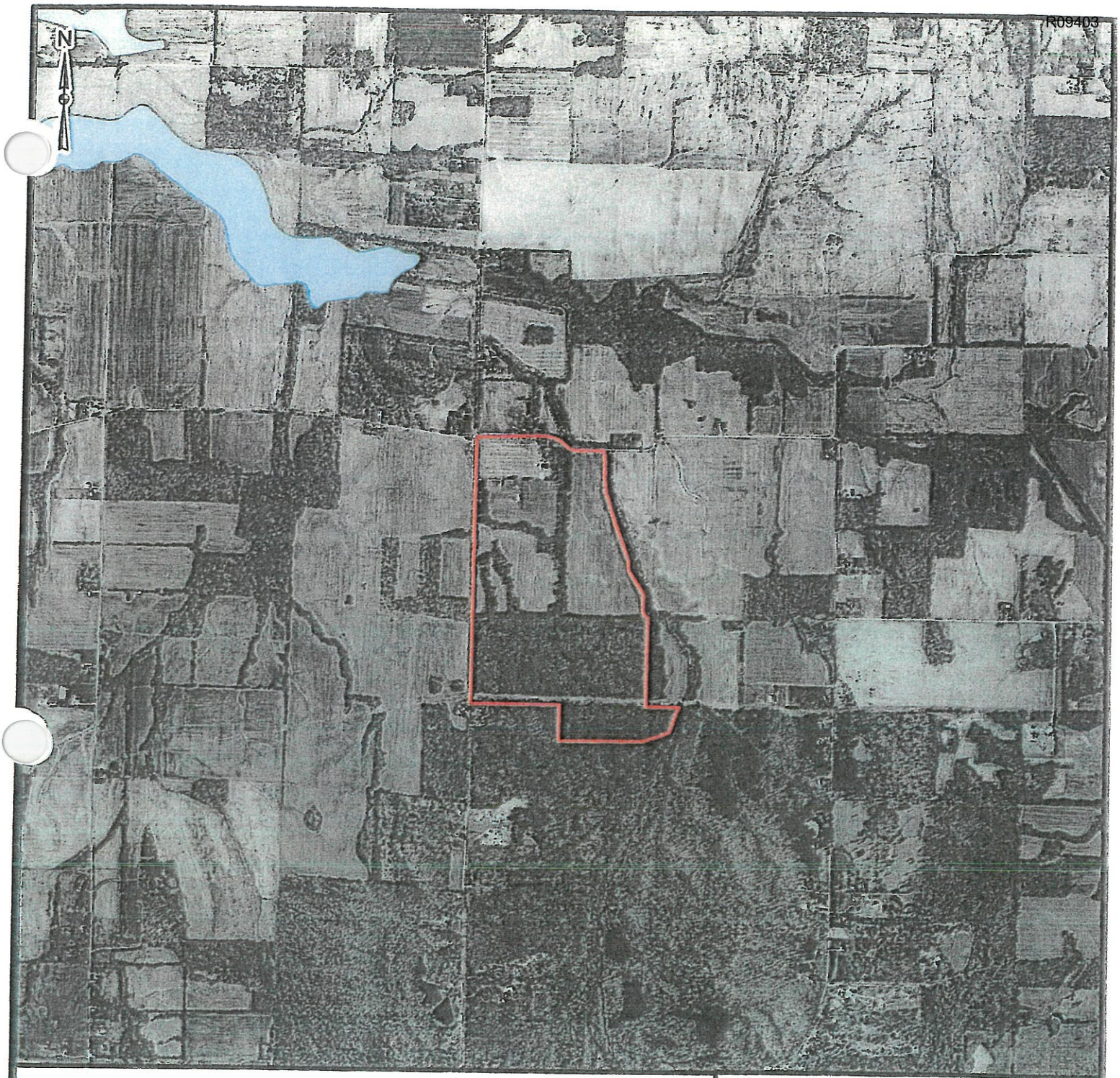
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

12 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A7		

R09403



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

MINING PERMIT #417 PENDING PERMIT AREA

FLOODPLAIN

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

FLOODPLAIN MAP

POND CREEK MINE NO. 1

COAL REFUSE DISPOSAL FACILITY NO. 3

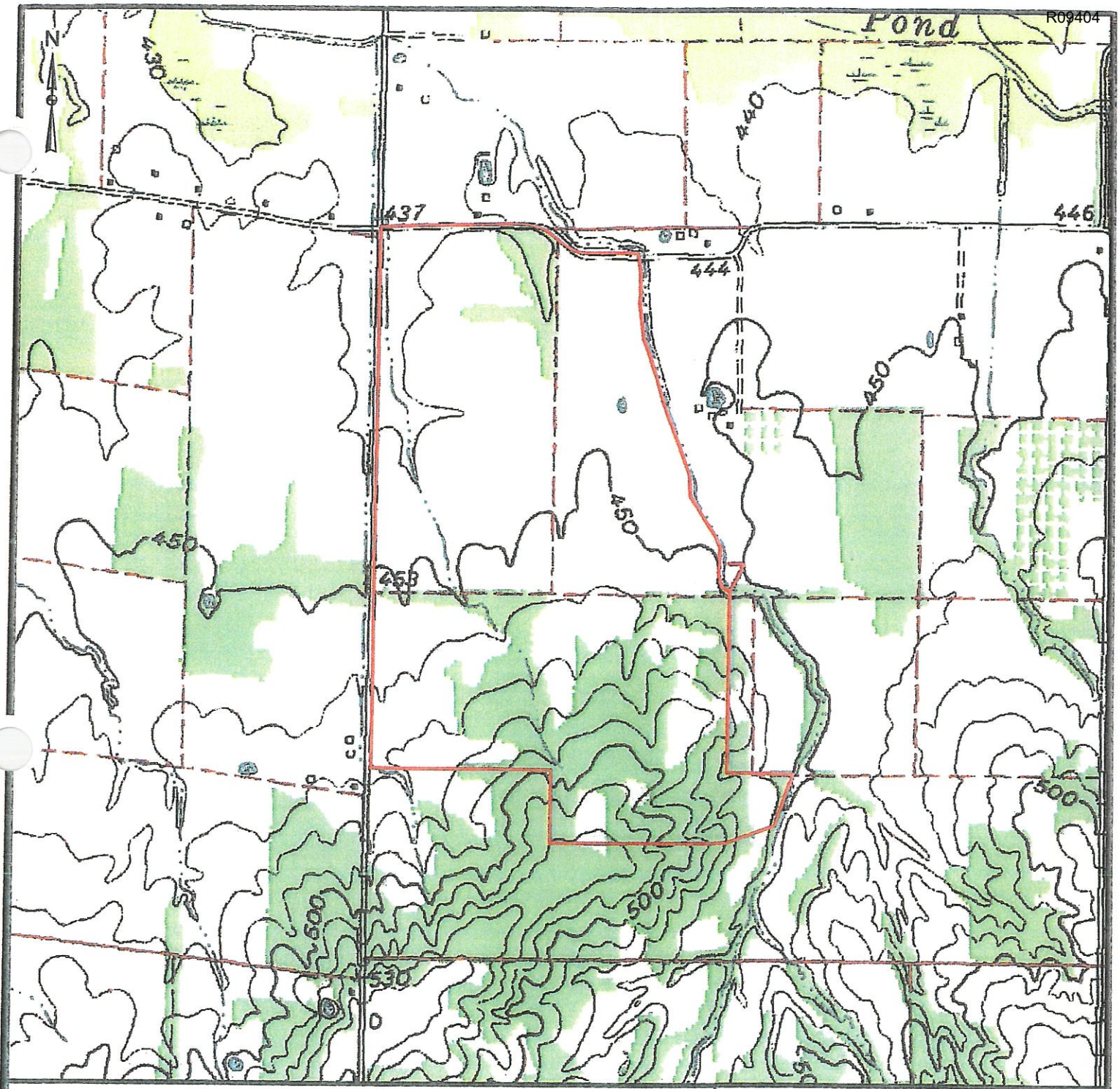
PREPARED FOR

WILLIAMSON ENERGY, LLC.

JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A8		

R09404



REFERENCE:

U.S.G.S. 7.5 MINUTE PITSBURG QUADRANGLE
DIGITAL RASTER GRAPHIC (DRG)

SCALE

0 500 1,000 2,000 3,000 Feet

Legend

MINING PERMIT #417 PENDING PERMIT AREA

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

PRE-LAW MINING MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A9		

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO
ATTENTION OF:

August 3, 2011

Regulatory Branch
File Number: MVS-2009-829

Braden A. Hoffman
Alliance Consulting, Inc.
124 Philpott Lane
Raleigh County Airport Industrial Park
Beaver, West Virginia 25813-9502
Dear Ms. Foust:

We appreciate the opportunity to review the revised Preliminary Jurisdictional Determination dated July 14, 2011, concerning the project known as Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area near Johnston City, Williamson County, Illinois. The proposed project involves the construction of the coal refuse disposal facility. We concur with the wetland determination you submitted .

Section 404 of the Clean Water Act assigns responsibility to the Secretary of the Army to administer a permit program to regulate the placement of dredged or fill material into waters of the United States. The placement of any dredged or fill material or grading within waters of the United States below the ordinary high water elevation, or in wetlands adjacent to these waters, must be authorized by a Section 404 permit.

As a result of the potential impacts to any wetland and waters of the United States, the project will require further permit review from the Corps of Engineers, under Section 404 of the Clean Water Act. The Corps will require the submittal of a 404-permit application, a detailed site plan and a summary of each impact to any wetland or waterway, including temporary crossings, prior to the commencement of project construction.

If you have any questions concerning this matter, do not hesitate to contact Jerry Berning at (314) 331-8372. Please refer to file number MVS-2009-829. The St. Louis District Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete the enclosed postage paid card or go to our Customer Service Survey found on our web site at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Keith A. McMullen

Keith McMullen
Illinois Section Chief
Regulatory Branch

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

ADDENDUM FOR JURISDICTIONAL DETERMINATION – UNNAMED TRIBUTARIES OF POND CREEK

POND CREEK MINE NO. 1 AND COAL REFUSE DISPOSAL FACILITY NO. 3 PERMIT AREA PERMIT NO. 417 NEAR JOHNSTON CITY, WILLIAMSON COUNTY, ILLINOIS

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
JULY 2012

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
151 East Pike Street
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 12, 2012

Project No.: B08-467-1413

Mr. Keith McMullen
U. S. ARMY CORPS OF ENGINEERS
St. Louis District
1222 Spruce Street
St. Louis, MO 63103-2833

Transmittal
Addendum Report
Request for U. S. Army Corps of Engineers' Jurisdictional Determination
Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area
Permit No. 417
Near Johnston City, Williamson County, Illinois

Dear Mr. McMullen:

On behalf of our client, Williamson Energy, LLC, please find enclosed, the Addendum Report to the Request for U. S. Army Corps of Engineers' Jurisdictional Determination Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area. Due to permit boundary revisions, aquatic resources within the revised permit area were delineated for your approval.

Should you have any questions or require any additional information, please do not hesitate to contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Jennifer R. Arp-Bazzie P.W.S.
Project Scientist

Bethany A. Wolfe for
Braden A. Hoffman
Project Manager

JRA/BAH:jra
Enclosures

ADDENDUM FOR JURISDICTIONAL DETERMINATION – UNNAMED TRIBUTARIES OF POND CREEK

POND CREEK MINE NO. 1 AND COAL REFUSE DISPOSAL FACILITY NO. 3 PERMIT AREA PERMIT NO. 417 NEAR JOHNSTON CITY, WILLIAMSON COUNTY, ILLINOIS

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B08-467-1413
JULY 2012

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 12, 2012

Project No. B08-467-1413

Mr. Keith McMullen
U. S. ARMY CORPS OF ENGINEERS
St. Louis District
1222 Spruce Street
St. Louis, MO 63103-2833

Addendum Report
Request for U. S. Army Corps of Engineers' Jurisdictional Determination
Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area
Permit No. 417
Near Johnston City, Williamson County, Illinois

Dear Mr. McMullen:

On behalf of our client, Williamson Energy, LLC (Williamson), this letter has been prepared as an addendum to the January 24, 2011 Request for Jurisdictional Determination Letter Report for the Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 (Permit 417). A revised Preliminary Jurisdictional Determination dated July 24, 2011 was reviewed and U.S. Army Corps of Engineers' comments were received on August 3, 2011 (Appendix A).

1.0 PURPOSE

The purpose of this addendum report was to identify "Waters of the United States" within the revised Permit 417 boundary. Both Alliance and PDC realize that all determinations are preliminary until verified by the Corps of Engineers. However, this document represents our interpretation of current U. S. Army Corps of Engineers jurisdictional determination guidelines.

2.0 SITE DESCRIPTION

The coal refuse disposal facility No. 3 permit area is located northwest of Johnston City in Williamson County, Illinois and has its approximate center at Latitude 37.8430 and Longitude -88.8125. Drawing No. B08-467-A2, entitled "Aerial Location Map" documents the revised boundaries of the permit area for the proposed coal refuse disposal facility. The permit area has been previously been utilized for farming and residential activities; current land use is predominately old field and forest habitat. The revised permit boundary totals approximately

229 acres in size (Figures, Drawing No. B08-467-A2). The proposed permit area will include property to be utilized for the disposal of coal refuse from the preparation plant. The permit area is currently bonded under Surface Coal Mining and Reclamation Operation Permit No. 375.

2.1 Drainage

The permit area is situated within the Town of West Frankfort – Pond Creek watershed (HUC 12: 071401060501) of the Big Muddy River (HUC 8: 07140106) (NRCS, 2004) (Figures, Drawing No. B08-467-A6 & A7). Drainage of the revised permit area occurs primarily by way of several ephemeral and intermittent streams that drain to Pond Creek a perennial tributary to the Big Muddy River, a traditional navigable water (TNW). The Big Muddy River flows to the Mississippi River (TWN). The permit area is situated outside of the 100 year floodplain (Figures, Drawing No. B08-467-A8).

2.2 Soils

There was no change in soil type from the January 2011 Request for Jurisdictional Determination Report (Figures, Drawing No. B08-467-A4).

3.0 METHODS

Field investigation of the revised permit area was conducted on February 28, 2012. The weather conditions were overcast and cool. Suspect water resources including streams, wetlands, ponds or lakes, and ditches, were initially sought using the offsite method in which secondary source information was evaluated prior to the site visit. Utilizing secondary data including; topographic maps (U.S. Geological Service [USGS], 1963), National Wetlands Inventory (NWI) maps (U.S. Fish & Wildlife Service [USFWS], 1987), National Aerial Photography Program (NAPP) (2005), hydrography (National Hydrography Dataset [NHD], 2005), the Soil Survey Geographic (SSURGO) database and Watershed Boundary Dataset (Natural Resources Conservation Service [NRCS], 2007 & 1999), the evaluation was completed to attempt to identify the apparent or the most probable stream and wetland locations prior to the field review.

3.1 Stream Resources

Alliance conducted stream measurements to determine the total acreage of streams within the revised permit area. The WVDEP document entitled "Guidance for Delineation of Ephemeral/Intermittent Streams for purposes of the Memorandum Opinion and Order of October 20, 1999" was used as guidance in determining the upper limit of intermittent/ephemeral streams. All points identified within the revised permit area were located using a TRIMBLE GEO XH, (subfoot accuracy) GPS unit. The total acreage for each channel segment was calculated by multiplying the channel width (bank to bank at the high water mark) by the length of stream at 100-foot intervals.

The U.S Army Corps of Engineers "Jurisdictional Determination" forms have been included on a CD. Stream measurement tables and photographs have been included within Appendix B.

3.2 Wetland Resources

Wetland resources within the revised permit area were identified and their boundaries delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (1987 Manual) (Environmental Laboratory, 1987) utilizing the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (USACE, 2010). The 1987 Manual was followed in which wetlands are identified based on three criteria: hydrophytic vegetation, hydric soils, and wetland hydrology.

In areas determined to be wetlands, the wetland boundaries were flagged in the field and flag locations were surveyed using a Global Positioning System (GPS) unit. The GPS flag points were then converted into a shape file which was then displayed using Geographic Information Systems (GIS) technology to create a graphic showing the site resources. The wetland areas were then calculated using the GIS area utility.

3.3 Open Water Resources

Open water resources within the study area were identified and surveyed using a Global Positioning System (GPS) unit. The GPS flag points were then converted into a shape file which was then displayed using Geographic Information Systems (GIS) technology to create a graphic showing the site resources. The open water areas were then calculated using the GIS area utility.

4.0 ECOLOGICAL RESOURCES RESULTS

4.1 Stream Measurements

The USGS Topographical map and NHD data set identified an additional stream as occurring within the revised permit area (Figures, Drawing No. B08-467-A13 & B08-467-A3). The stream is mapped as an intermittent unnamed tributary to Pond Creek.

Field investigation identified five (5) potentially jurisdictional stream channels within the revised permit area (Table 2) (Figures, Drawing No. B08-467-E20). Two streams were determined to be intermittent; the remaining streams were determined to be ephemeral in their entirety. All delineated stream segments discharge Pond Creek. Stream Measurement Tables and Photographs are included in Appendix B.

Table 2. Location of Streams within the Study Area.

Stream Channel	Latitude	Longitude	Elevation (ft)	Length w/in Permit Area (ft)	Stream Type
Channel A	37.8367	-88.8160	485	693	Intermittent/Ephemeral
Channel A1	37.8366	-88.8142	495	600	Intermittent
Channel A2	37.8378	-88.8159	478	64	Ephemeral
Channel A3	37.8376	-88.8159	478	75	Ephemeral
Channel A3a	37.8379	-88.8157	478	85	Ephemeral
Total				1,517	

5.2 Wetland Resources

Alliance consulted the National Wetlands Inventory (NWI) for the study area. NWI mapping did not identify any wetland systems as occurring within the revised permit area (Figures, Drawing B08-467-A3).

5.3 Wetland Delineation

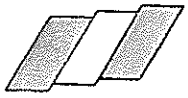
No wetland resources were identified as occurring within the revised permit area (Figures, Drawing No. B08-467-E20).

5.4 Open Water

Alliance surveyed the study area for areas that are considered "open water" by the U. S. Army Corps of Engineers. For this project, open water was considered to be "*an area that, during a year with normal patters of precipitation, has standing or flowing water for sufficient duration to establish an ordinary high water mark, where aquatic vegetation is either non-emergent, sparse, or absent*". One (1) open water feature was identified within the revised permit area (Figures, Drawing B08-467-E20). This area appears to be a septic lagoon associated with the house on the property (Appendix C, Open Water Photos). The open water area was provisionally determined to be non-jurisdictional waters.

5.5 Ditches

A roadside ditch, which is located wholly in upland and drains upland habitat, runs along the abandoned roadway (Figures, Drawing No. B08-467-E20). The roadside ditch was provisionally determined to be non-jurisdictional.



6.0 CLOSING

In closing, we trust that this letter report and supporting data are sufficient for your needs at this time. The services performed for this project were performed with the care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No other warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made. This report has been prepared for the exclusive use of Williamson, LLC.

If you have any questions or require clarification, please do not hesitate to call.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Jennifer R. Arp-Bazzie, PWS
Project Scientist

Bethany L. Wolfe for
Braden A. Hoffman
Project Manager

Enclosures

JRB:jrb

REFERENCES CITED

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979, reprinted 1992. *Classification of wetlands and deepwater habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Environmental Laboratory. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region version 2.0 (USACE, 2010). ERDC/EL TR-10-9, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Natural Resource Conservation Service (NRCS). 1999. Watershed Boundary Dataset. U.S. Department of Agriculture.

Natural Resource Conservation Service (NRCS). 2007. SSURGO DATA. U.S. Department of Agriculture.

U.S. Fish and Wildlife Service (USFWS). 1987. National Wetlands Inventory maps, Pittsburg, IL quadrangle, U.S. Department of the Interior Madison, WI.

U.S. Geological Survey (USGS). 1963. Topographical quadrangle map (7.5 minute series). Pittsburg, IL quadrangle. U.S. Geological Survey, Denver Colorado.

U.S. Environmental Protection Agency (USEPA) and U.S. Geological Survey (USGS). 2010. EPA Office of Water: National Hydrography Dataset Plus – Smoothed. Washington, DC.



APPENDIX A

AGENCY COORDINATION

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO
ATTENTION OF:

August 3, 2011

Regulatory Branch
File Number: MVS-2009-829

Braden A. Hoffman
Alliance Consulting, Inc.
124 Philpott Lane
Raleigh County Airport Industrial Park
Beaver, West Virginia 25813-9502
Dear Ms. Foust:

We appreciate the opportunity to review the revised Preliminary Jurisdictional Determination dated July 14, 2011, concerning the project known as Pond Creek Mine No. 1 and Coal Refuse Disposal Facility No. 3 Permit Area near Johnston City, Williamson County, Illinois. The proposed project involves the construction of the coal refuse disposal facility. We concur with the wetland determination you submitted .

Section 404 of the Clean Water Act assigns responsibility to the Secretary of the Army to administer a permit program to regulate the placement of dredged or fill material into waters of the United States. The placement of any dredged or fill material or grading within waters of the United States below the ordinary high water elevation, or in wetlands adjacent to these waters, must be authorized by a Section 404 permit.

As a result of the potential impacts to any wetland and waters of the United States, the project will require further permit review from the Corps of Engineers, under Section 404 of the Clean Water Act. The Corps will require the submittal of a 404-permit application, a detailed site plan and a summary of each impact to any wetland or waterway, including temporary crossings, prior to the commencement of project construction.

If you have any questions concerning this matter, do not hesitate to contact Jerry Berning at (314) 331-8372. Please refer to file number MVS-2009-829. The St. Louis District Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete the enclosed postage paid card or go to our Customer Service Survey found on our web site at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Keith A. McMullen

Keith McMullen
Illinois Section Chief
Regulatory Branch

APPENDIX B

STREAM DELINEATION TABLES AND PHOTOGRAPHS

TABLE VI-A

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A
Watershed Acreage: 32 acres

Project of Facility Name: Pond Creek No. 1 Mine Coal Refuse Facility No. 3
Segment Name or ID: Permit 417 Addendum
Location: Johnson City, IL

STATION No.	LENGTH (FT)	WIDTH (FT)	WIDTH AVG	SQ FEET	ACRES	DEPTH L	DEPTH M	DEPTH R	DESCRIPTION FIELD COMMENTS
0+00	0	0.0	0.00	0.0	0.0000	0.00	0.00	0.00	Inter mittent
1+00	100	2.1	1.05	105.0	0.0024	0.20	0.31	0.24	Inter mittent
2+00	100	2.4	2.25	225.0	0.0052	0.25	0.26	0.21	Inter mittent
3+00	100	2.5	2.45	245.0	0.0056	0.15	0.31	0.34	Inter mittent
4+00	100	2.7	2.60	260.0	0.0060	0.23	0.28	0.30	Inter mittent
5+00	100	1.6	2.15	215.0	0.0049	0.13	0.17	0.19	Inter mittent
5+35	35	0.8	1.20	42.0	0.0010	0.07	0.09	0.10	E/I point
6+00	65	0.0	0.40	26.0	0.0006	0.00	0.00	0.00	Sheet Flow
6+93	93	0.0	0.00	0.0	0.0000	0.00	0.00	0.00	EOC

R09418

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



1. Channel A, Station 0+00, looking upstream



2. Channel A, Station 1+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



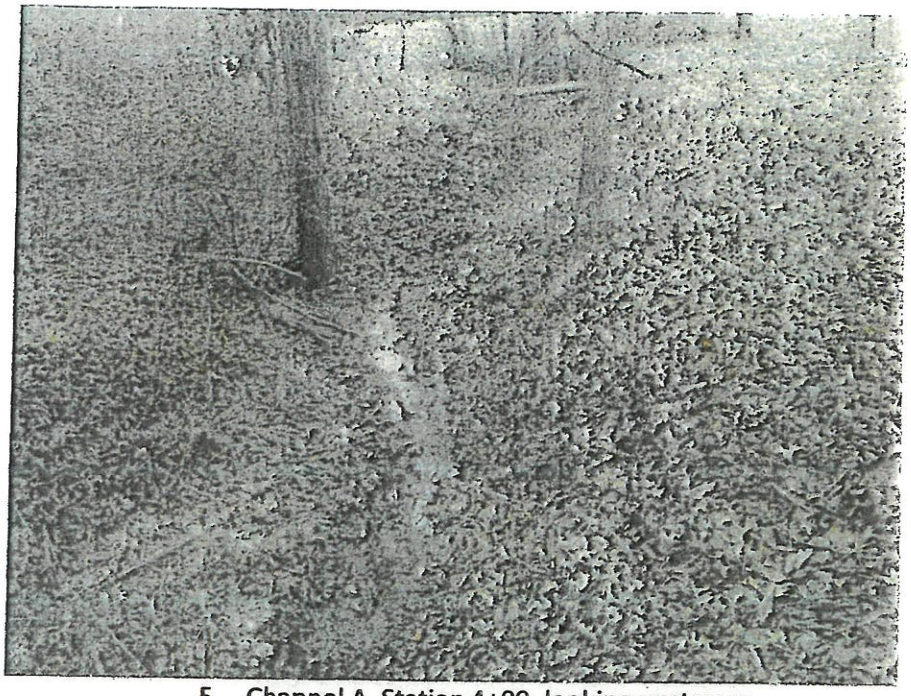
3. Channel A, Station 2+00, looking upstream



4. Channel A, Station 3+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



5. Channel A, Station 4+00, looking upstream



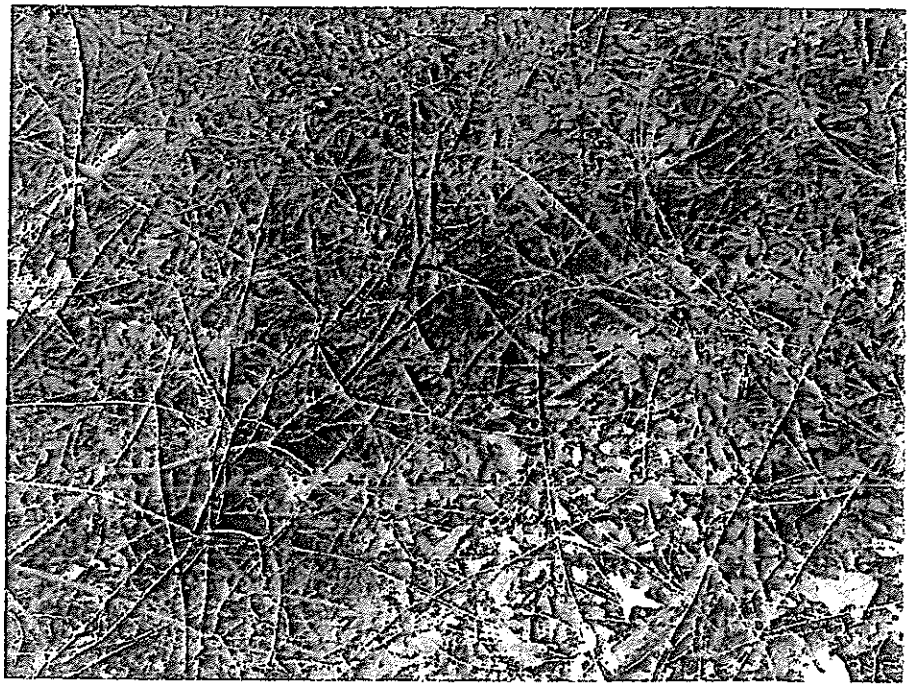
6. Channel A, Station 5+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



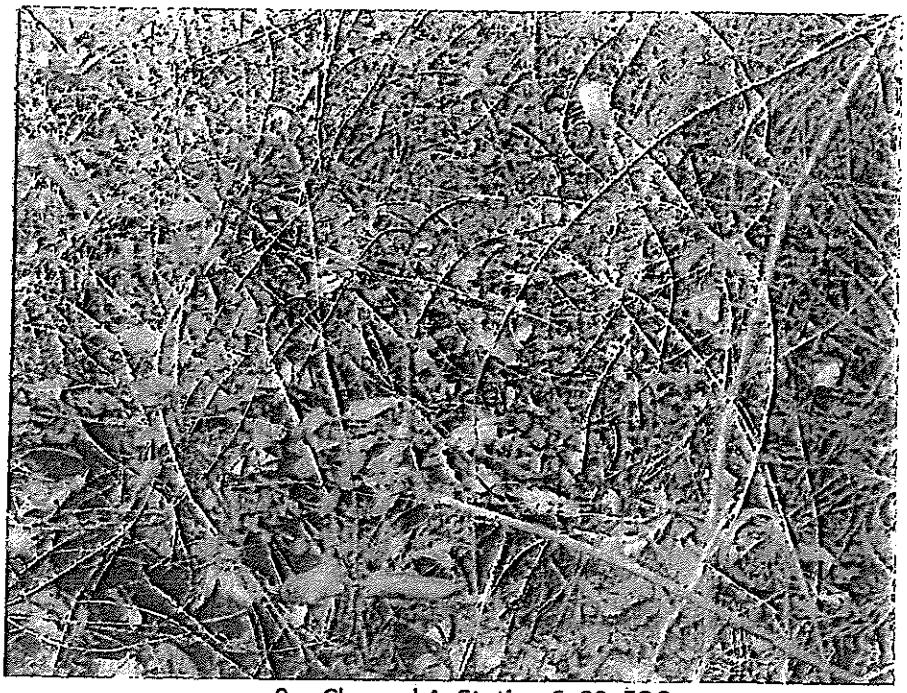
7. Channel A, Station 5+35, E/I location



8. Channel A, Station 6+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



9. Channel A, Station 6+93, EOC

TABLE VI-A

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A1
Watershed Acreage: 32 acres

Project of Facility Name: Pond Creek No. 1 Mine Coal Refuse Facility No. 3
Segment Name or ID: Permit 417 Addendum
Location: Johnson City, IL

STATION	LENGTH	WIDTH	WIDTH	SQ		DEPTH			DESCRIPTION
No.	(FT)	(FT)	AVG	FEET	ACRES	L	M	R	FIELD COMMENTS
0+00	0	2.1	0.00	0.0	0.0000	0.16	0.21	0.19	Inter mittent
1+00	100	2.6	2.33	232.5	0.0053	0.26	0.34	0.33	Sheet Flow
4+00	300	3.0	2.78	832.5	0.0191	0.35	0.46	0.46	Inter mittent
5+00	100	1.5	2.25	225.0	0.0052	0.15	0.19	0.18	Inter mittent
6+00	100	0.0	1.50	150.0	0.0034	0.00	0.00	0.00	E/I EOC

R09424

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



10. Channel A1, Station 0+00, looking upstream



11. Channel A1, Station 1+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



12. Channel A1, Station 4+00, looking upstream



13. Channel A1, Station 5+00, looking upstream

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



14. Channel A1, Station 6+00, EOC

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



15. Channel A2, Station 0+00, looking upstream



16. Channel A2, Station 0+66, EOC

TABLE VI-A

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A2
Watershed Acreage: 32 acres

Project of Facility Name: Pond Creek No. 1 Mine Coal Refuse Facility No. 3
Segment Name or ID: Permit 417 Addendum
Location: Johnson City, IL

STATION No.	LENGTH (FT)	WIDTH (FT)	WIDTH AVG	SQ FEET	ACRES	DEPTH L	DEPTH M	DEPTH R	DESCRIPTION FIELD COMMENTS
0+00	0	2.1	0.00	0.0	0.0000	0.45	0.62	0.31	Ephemeral
0+64	64	0.0	1.05	67.2	0.0015	0.00	0.00	0.00	EOC

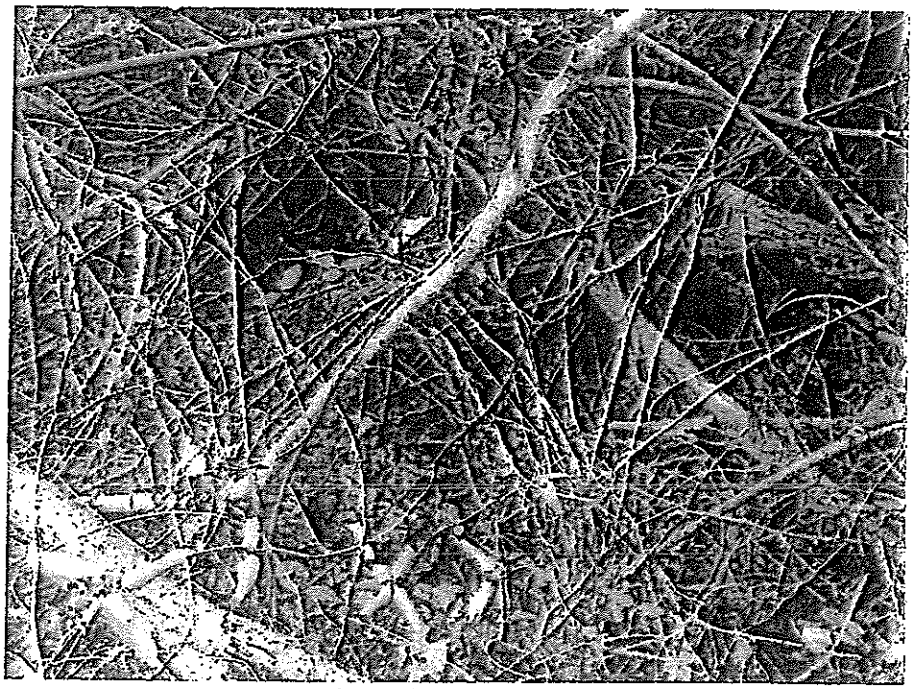
R09429

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



17. Channel A3, Station 0+00, looking upstream



18. Channel A3, Station 0+75, EOC

TABLE VI-A

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A3
Watershed Acreage: 32 acres

Project of Facility Name: Pond Creek No. 1 Mine Coal Refuse Facility No. 3
Segment Name or ID: Permit 417 Addendum
Location: Johnson City, IL

STATION	LENGTH	WIDTH	WIDTH	SQ		DEPTH			DESCRIPTION
No.	(FT)	(FT)	AVG	FEET	ACRES	L	M	R	FIELD COMMENTS
0+00	0	2.5	0.00	0.0	0.0000	0.20	0.24	0.20	Ephemeral
0+75	75	0.0	1.25	93.7	0.0022	0.00	0.00	0.00	EOC

R09431

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



19. Channel A3a, Station 0+00, looking upstream



20. Channel A3a, Station 0+85, EOC

TABLE VI-A

Name of Applicant: Williamson Energy, LLC
Counties: Williamson
Stream Name: Channel A3a
Watershed Acreage: 32 acres

Project of Facility Name: Pond Creek No. 1 Mine Coal Refuse Facility No. 3
Segment Name or ID: Permit 417 Addendum
Location: Johnson City, IL

STATION	LENGTH	WIDTH	WIDTH	SQ		DEPTH			DESCRIPTION
No.	(FT)	(FT)	AVG	FEET	ACRES	L	M	R	FIELD COMMENTS
0+00	0	1.4	0.00	0.0	0.0000	0.10	0.11	0.11	Ephemeral
0+85	85	0.0	0.70	59.5	0.0014	0.00	0.00	0.00	EOC

R09433

APPENDIX C

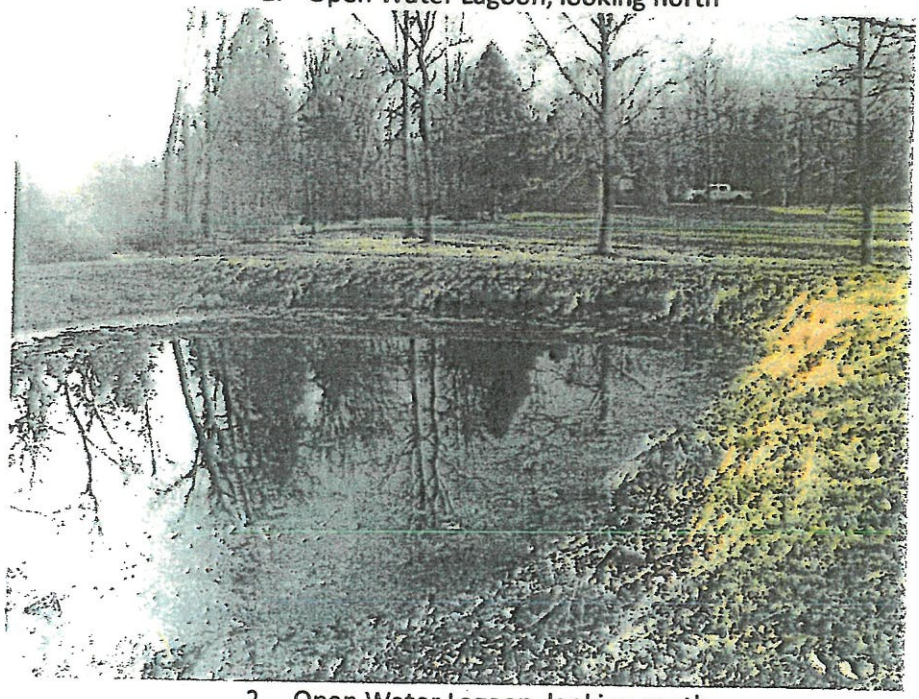
OPEN WATER PHOTOGRAPHS

Project No. B08-467-1413

POND CREEK NO. 1 MINE
COAL REFUSE FACILITY NO.3 ADDENDUM
WILLIAMSON ENERGY, LLC



1. Open Water Lagoon, looking north



2. Open Water Lagoon, looking south

FIGURES

R09437



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)

0 500 1,000 2,000 3,000 Feet

Legend

PERMIT 417 BOUNDARY

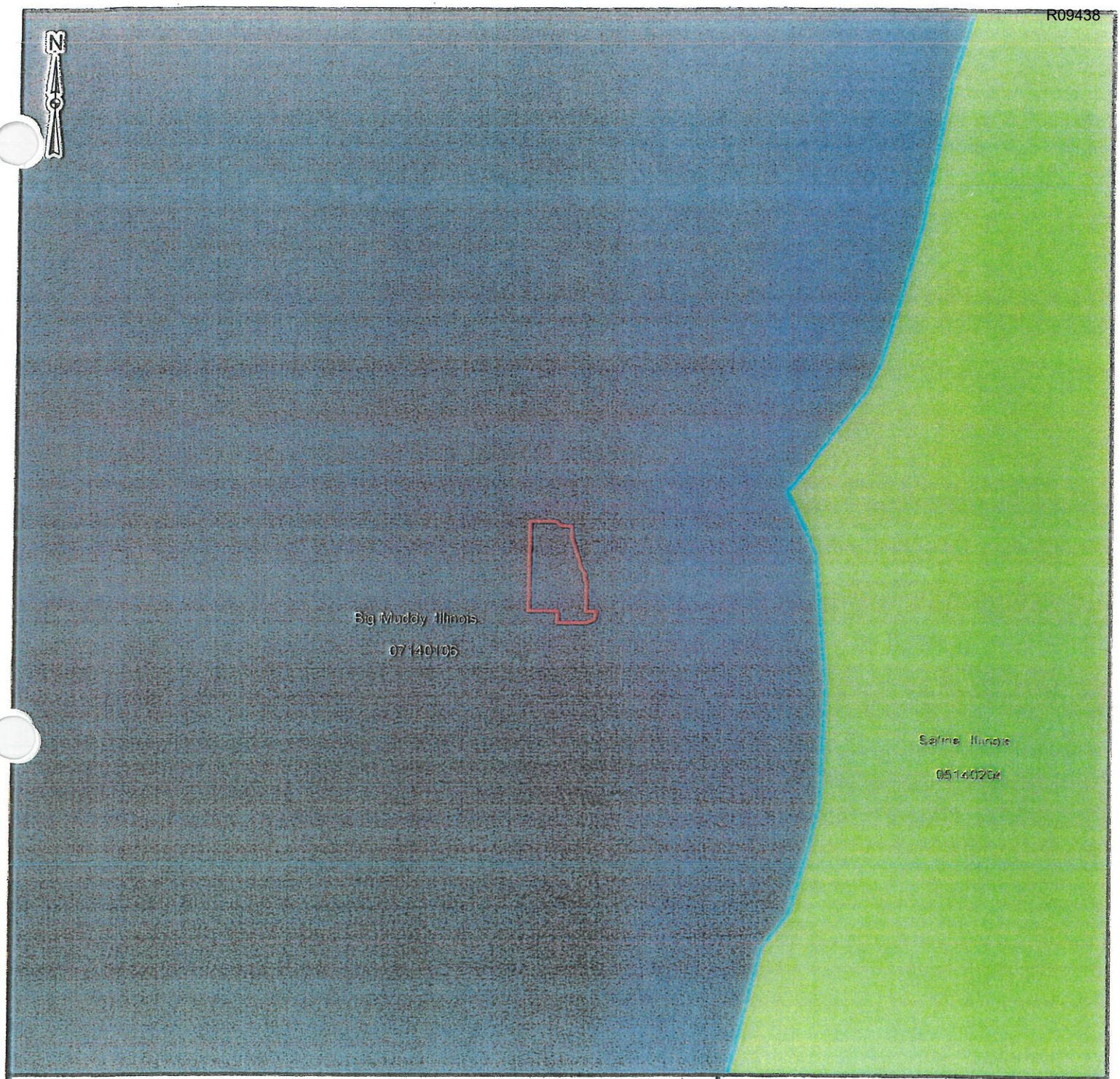
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

AERIAL LOCATION MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A2		

R09438



REFERENCE:

8 DIGIT HYDROLOGIC UNIT CODE (HUC) OF THE BIG MUDDY AND SALINE RIVER WATERSHEDS

SCALE

0 4,000 8,000 12,000 Feet

Legend

AREA OF INTEREST

8 DIGIT HUC

Big Muddy, Illinois

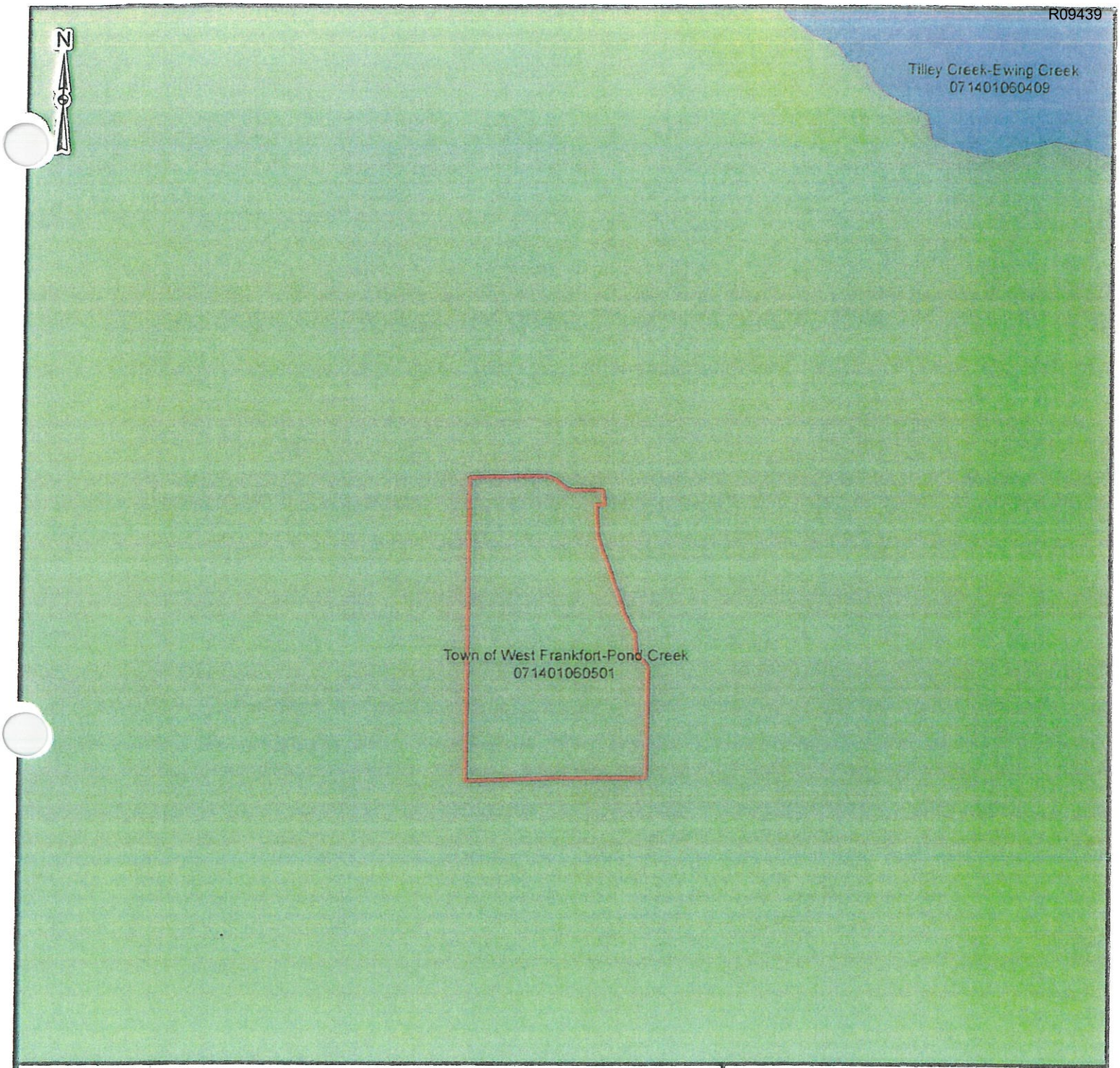
Saline, Illinois

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

8 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	03/23/11
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A6		



REFERENCE:
12 DIGIT HYDROLOGIC UNIT CODE (HUC) OF TILLEY CREEK-EWING CREEK AND TOWN OF WEST FRANKFORT-POND CREEK WATERSHEDS

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

12 DIGIT HUC

Tilley Creek-Ewing Creek

Town of West Frankfort-Pond Creek

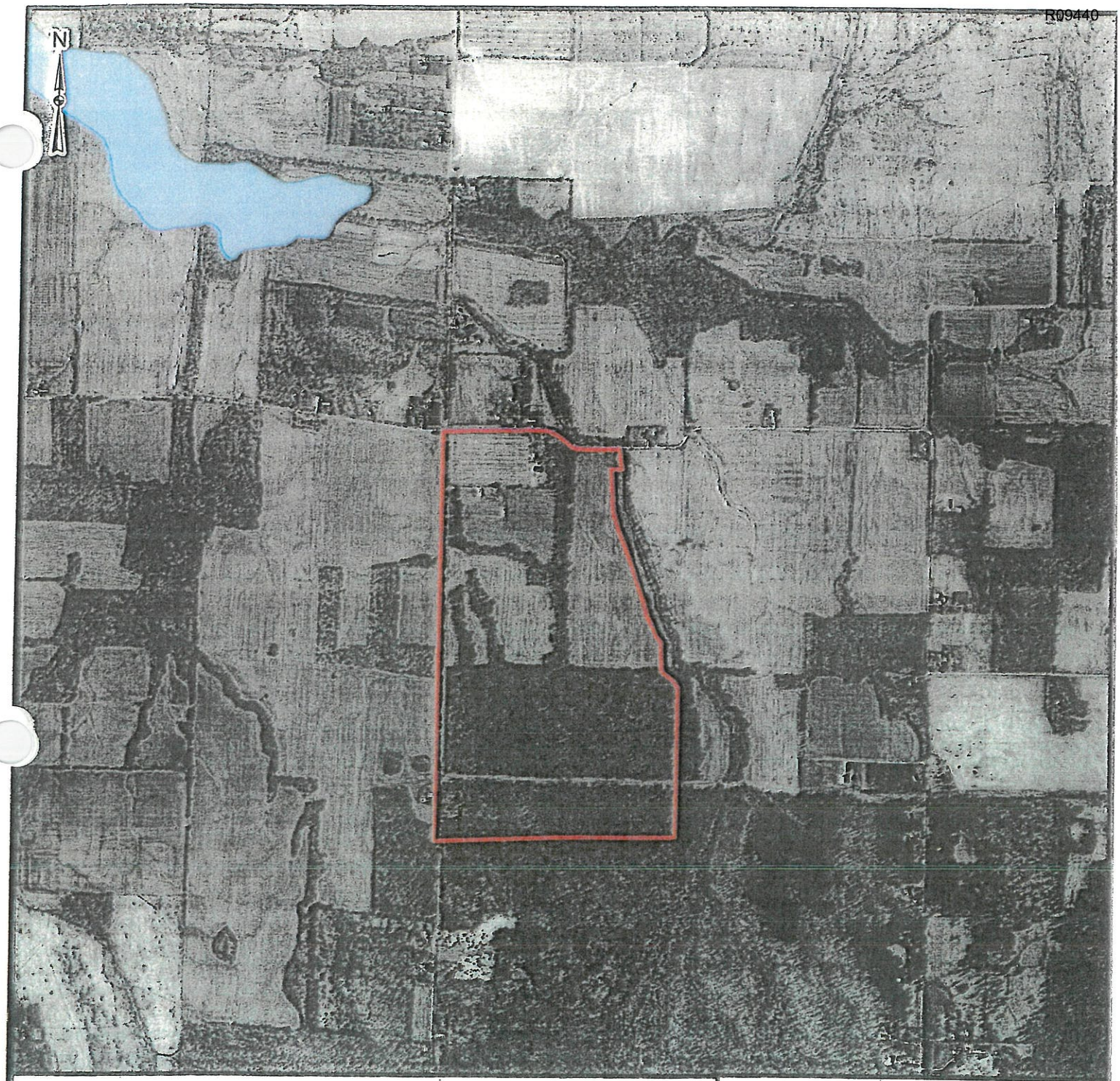
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

12 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A7		

R09440



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

FLOODPLAIN

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

124 PHILPOTT LANE

BEAVER, WV 25813

(304) 255-0491

FLOODPLAIN MAP

POND CREEK MINE NO. 1

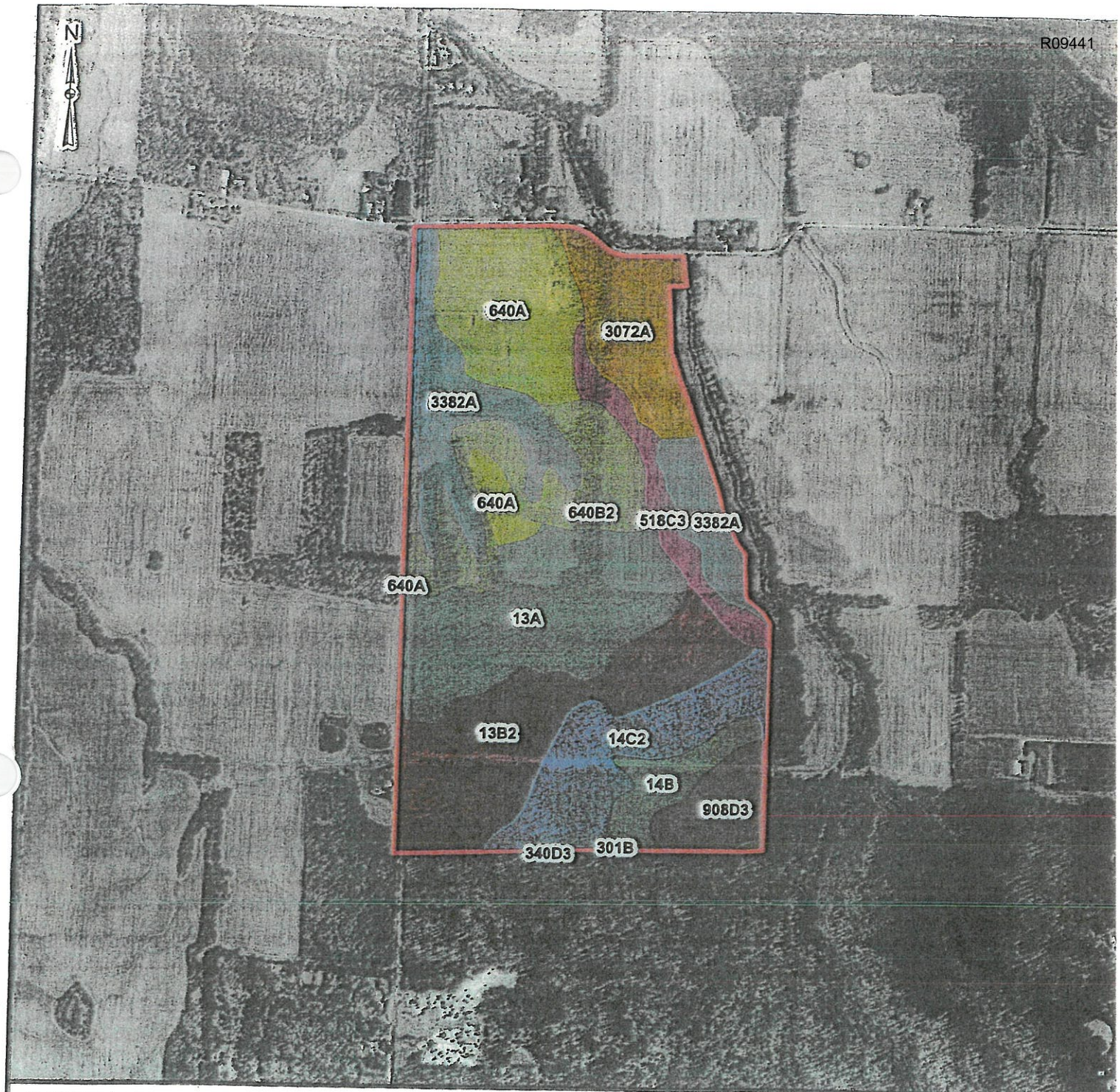
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.

JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A8		



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)

0 500 1,000 2,000 3,000 Feet

Legend

P417-BOUNDARY

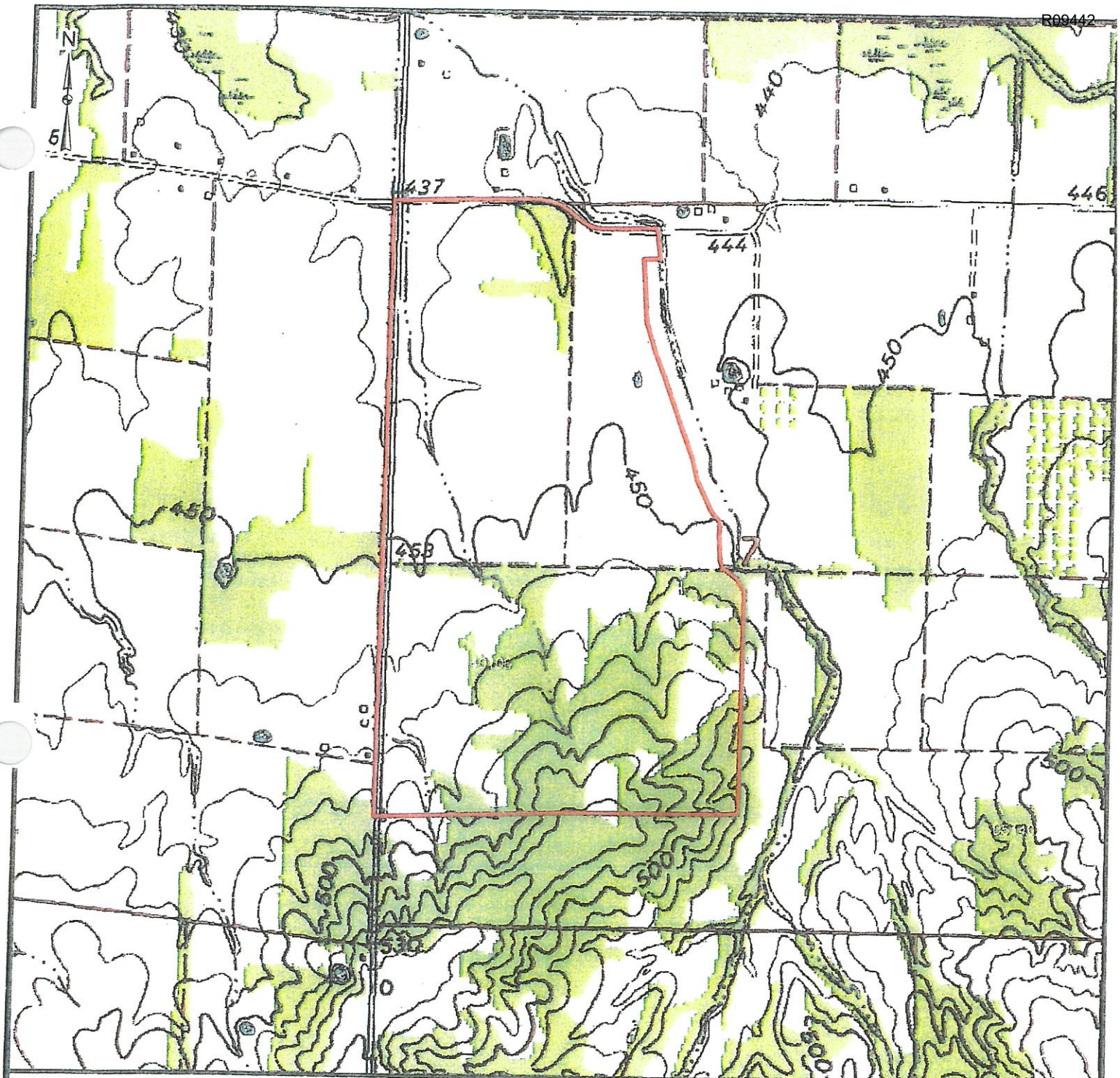
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

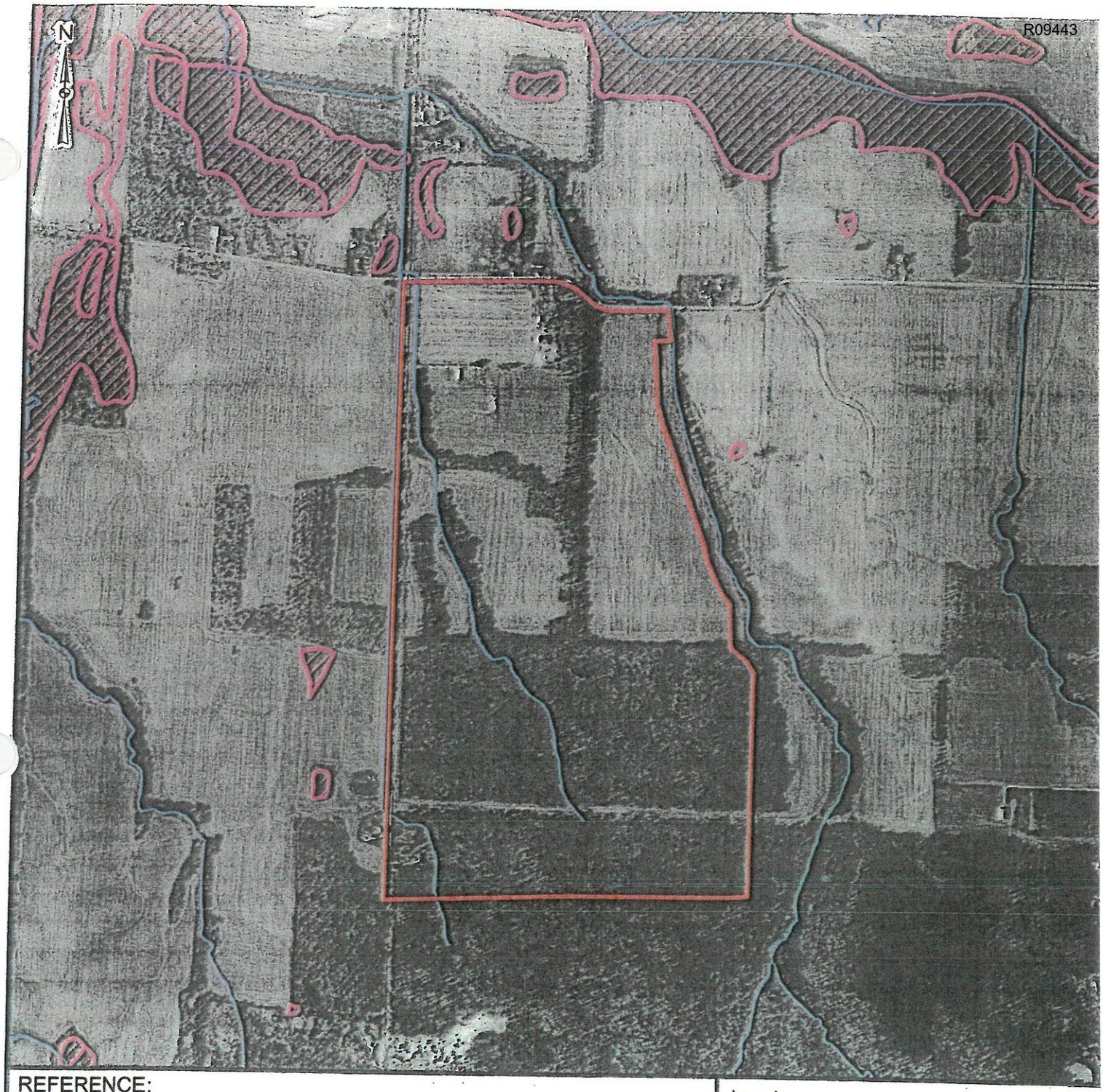
SOILS MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A4		

R09442


N
6
437
440
444
446
450
450
450
453
500
500
500



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)
STREAMS FROM THE NATIONAL HYDROGRAPHY DATASET (NHD)
WETLANDS FROM THE NATIONAL WETLAND INVENTORY (NWI)

0 500 1,000 2,000 3,000 Feet

Legend

- PERMIT 417 BOUNDARY
- NHD STREAMS
- NWI WETLANDS

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

NATIONAL WETLAND INVENTORY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A3		



LEGEND

- MINING PERMIT #375 SURFACE FACILITIES
- MINING PERMIT #417 PENDING PERMIT AREA
- DELINEATED DRAINAGE PATTERN
- UNDEFINED DRAINAGE PATTERN
- WETLAND
- TEST PIT LOCATIONS
- DRAINAGE BASED ON AERIAL MAPPING, MAY 2007
- INTERMITTENT STREAM CHANNEL
- EPHEMERAL STREAM CHANNEL
- EPHEMERAL/INTERMITTENT STREAM INTERFACE POINT
- EOC (END OF CHANNEL)
- OPEN WATER SITE

NOTE:
BOTH DRAINAGE PATTERNS A AND B ARE EPHEMERAL SWALES.
USAGE PRELIMINARY VERIFICATION, AUGUST 3, 2011.

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BEAVER, WV (304) 253-9411 · BLAIRSVILLE, WV (724) 459-8380 · CARROLLTOWN, PA (814) 344-3536

AQUATIC RESOURCES DELINEATION MAP
OPERATIONS PLAN MAP (SURFACE FACILITIES)
POND CREEK 1 MINE
COAL REFUSE DISPOSAL FACILITY NO. 3
Prepared For
WILLIAMSON ENERGY LLC.
JOHNSTON CITY, IL

CAD BY	DJS	07/02/12	PROJECT NO. B08-467-1413
CHECKED BY			DRAWING NO. B08-467-E20

ATTACHMENT II.9

Attachment II.9
Permit No. 417- Williamson Energy Pond Creek Mine.

The project area was surveyed for habitat and plant community characteristics and has been summarized below. This report in its entirety is contained within Part II-8.

The majority of the project area exists as grassland/herbaceous (GH) habitat (82.4 acres), indicating it is dominated by graminoid or herbaceous vegetation and is not subject to regular management (Figures, Drawing No. B08-467-D4). The majority of this area was historically farmland that produced soybean and corn monocultures generally in rotation. When the property was acquired by Williamson Energy it was taken out of farming rotation in advance of the proposed project which has allowed this are to become more of a grassland/shrubland habitat over time. Table 1 lists plants species identified within the grassland/herbaceous habitat; dominant species are in bold:

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION

Scientific Name	Common Name	C of C	Indicator Status	Federally Listed	State Listed
Abutilon theophrasti	velvet leaf	*	FACU	NO	NO
Agrostis gigantea	common redtop	0	FACW	NO	NO
Agrostis stolonifera	creeping bentgrass	8	FACW	NO	NO
Ambrosia artemislifolia	common ragweed	0	FACU	NO	NO
Ambrosia trifida	giant ragweed	0	FAC	NO	NO
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Apocynum cannabinum	Indian hemp	2	FAC	NO	NO
Arctium minus	burdock	*	UPL	NO	NO
Asclepias syriaca	common milkweed	0	UPL	NO	NO
Campsis radicans	trumpet creeper	2	FAC	NO	NO
Cirsium arvense	Canada thistle	*	FACU	NO	NO
Cirsium vulgaris	bull thistle	*	FACU	NO	NO
Conoclinium coelestinum	blue mistflower	3	FAC	NO	NO
Conyza canadensis	common horsetail	0	FAC	NO	NO

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION					
Scientific Name	**Common Name**	**C of C**	**Indicator Status**	**Federally Listed**	**State Listed**
Cyperus esculentus	yellow nut sedge	0	FACW	NO	NO
Cyperus strigosus	straw-color sedge	0	FACW	NO	NO
Daucus carota	wild carrot	*	FACU	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Elymus glaucus	blue wild rye	--	FACU	NO	NO
Elymus hystrix	bottlebrush grass	5	NI	NO	NO
Eupatorium perfoliatum	common boneset	4	FACW	NO	NO
Eupatorium serotinum	lateflower boneset	1	FAC	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO
Helianthus tuberosus	Jerusalem artichoke	3	FAC	NO	NO
Ipomoea lacunosa	small-flower white morning glory	*	FACW	NO	NO
Juncus tenuis	path rush	0	FAC	NO	NO
Juncus torreyi	Torey's rush	3	FACW	NO	NO
Juniperus virginiana	eastern red cedar	1	FACU	NO	NO
Lactuca canadensis	wild lettuce	1	FACU	NO	NO
Lactuca serrioloa	prickly lettuce	*	FAC	NO	NO
Lamium amplexicaule	henbit	*	UPL	NO	NO
Lolium perenne	rye grass	*	FACU	NO	NO
Oenothera biennis	common evening primrose	1	FACU	NO	NO
Panicum capillare	witch grass	0	FAC	NO	NO
Phleum pratense	timothy	*	FACU	NO	NO

TABLE 1. GRASSLAND/HERBACEOUS HABITAT VEGETATION					
Scientific Name	**Common Name**	**C of C**	**Indicator Status**	**Federally Listed**	**State Listed**
Phytolacca americana	poke weed	1	FAC	NO	NO
Polygonum lapathifolium	nodding smartweed	0	FACW	NO	NO
Polygonum pensylvanicum	pinkweed	1	FACW	NO	NO
Polygonum persicaria	lady's thumb	*	FACW	NO	NO
Portulaca oleracea	common purslane	*	FAC	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rumex crispus	curly dock	*	FAC	NO	NO
Scirpus cyperinus	wool grass	5	OBL	NO	NO
Setaria faberi	foxtail	*	FACU	NO	NO
Setaria glauca	yellow foxtail	*	FAC	NO	NO
Solidago canadensis	tall goldenrod	1	FACU	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Sorghum halepense	Johnson grass	*	FACU	NO	NO
Symphyotrichum lateriflorum	small white aster	2	FACW	NO	NO
Symphyotrichum novae-angliae	New England aster	4	FACW	NO	NO
Tridens flavus	grease grass	1	UPL	NO	NO
Trifolium pratense	red clover	*	FACU	NO	NO
Trifolium repens	white clover	*	FACU	NO	NO
Vernonia gigantea	tall ironweed	4	FAC	NO	NO
Xanthium strumarium	cocklebur	0	FAC	NO	NO

4.1.2 Upland Forest

The project area contained 31.4 acres of upland forest habitat (FOR), indicating it is dominated by trees and is not subject to regular management. Forested uplands were characterized by a dominance of woody vegetation six meters tall or taller with an understory of young trees or shrubs, and a herbaceous layer (Figures, Drawing No. B08-467-D4). Table 2 lists plant species identified within the upland forest habitat; dominant species are in bold:

TABLE 2. UPLAND FOREST HABITAT VEGETATION

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Acer saccharum	sugar maple	4	FACU	NO	NO
Ageratina altissima	white snakeroot	2	FACU	NO	NO
Agrimonia parviflora	common agrimony	5	FAC	NO	NO
Albizia julibrissin	silk tree	*	UPL	NO	NO
Arisaema triphyllum	Jack in the pulpit	4	FACW	NO	NO
Campsis radicans	trumpet creeper	2	FAC	NO	NO
Carya laciniosa	pignut hickory	7	FACW	NO	NO
Celtis occidentalis	hackberry	3	FAC	NO	NO
Commelina communis	Asiatic dayflower	*	FAC	NO	NO
Cornus florida	flowering dogwood	5	FACU	NO	NO
Desmodium canadensis	showy tick trefoil	5	FAC	NO	NO
Diospyros virginiana	common persimmon	2	FAC	NO	NO
Fraxinus americana	white ash	4	FACU	NO	NO
Gleditsia triacanthos	honey locust	2	FAC	NO	NO
Juglans nigra	black walnut	4	FACU	NO	NO
Leersia virginica	common cutgrass	3	FACW	NO	NO
Liquidambar styraciflua	sweet gum	6	FACW	NO	NO

TABLE 2. UPLAND FOREST HABITAT VEGETATION					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Liriodendron tulipifera	tulip tree	5	FACU	NO	NO
Lonicera japonica	Japanese honeysuckle	*	FACU	NO	NO
Morus alba	white mulberry	*	FAC	NO	NO
Oxydendrum arboreum	sourwood	*	NI	NO	NO
Parthenocissus quinquefolia	Virginia creeper	2	FAC	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Prunus serotina	black cherry	1	FACU	NO	NO
Pycnanthemum tenifolium	narrowleaf mountainmint	4	FAC	NO	NO
Quercus alba	white oak	5	FACU	NO	NO
Quercus coccinea	scarlet oak	7	UPL	NO	NO
Quercus imbricaria	shingle oak	2	FAC	NO	NO
Quercus macrocarpa	bur oak	5	FAC	NO	NO
Quercus rubra	red oak	5	FACU	NO	NO
Quercus velutina	black oak	5	UPL	NO	NO
Robinia pseudoacacia	black locust	1	FACU	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rubus allegheniensis	Allegheny blackberry	2	FACU	NO	NO
Rubus pennsylvanicus	blackberry	2	FAC	NO	NO
Sassafras albidum	sassafras	2	FACU	NO	NO
Smilax rotundifolia	greenbrier	4	FAC	NO	NO

TABLE 2. UPLAND FOREST HABITAT VEGETATION					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Tilia americana	American basswod	5	FACU	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Ulmus rubra	slippery elm	3	FAC	NO	NO
Vitis aestivalis	summer grape	4	FACU	NO	NO

4.1.3 Upland Scrub Shrub

The project area contained 5.6 acres of upland scrub shrub (SS) habitat, indicating it was dominated by shrub species and is not subject to regular management. Uplands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall (Figures, Drawing No. B08-467-D4). Table 3 lists plant species identified within the upland scrub shrub habitat; dominant species are in bold:

TABLE 3. UPLAND SCRUB SHRUB HABITAT VEGETATION					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Cornus florida	flowering dogwood	5	FACU	NO	NO
Diospyros virginiana	common persimmon	2	FAC	NO	NO
Elaeagnus umbellata	autumn olive	*	FACU	NO	NO
Gleditsia triacanthos	honey locust	1	FAC	NO	NO
Juniperus virginiana	eastern red cedar	1	FACU	NO	NO
Lonicera japonica	Japanese honeysuckle	*	FACU	NO	NO
Lonicera tatarica	Tartarian honeysuckle	*	FACU	NO	NO
Morus alba	white mulberry	*	FAC	NO	NO

TABLE 3. UPLAND SCRUB SHRUB HABITAT VEGETATION					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Rhus copallinum	winged sumac	3	UPL	NO	NO
Robinia pseudoacacia	black locust	1	FACU	NO	NO
Rosa multiflora	multiflora rose	*	FACU	NO	NO
Rubus allegheniensis	Allegheny blackberry	2	FACU	NO	NO
Rubus pennsylvanicus	blackberry	2	FAC	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Vitis aestivalis	summer grape	4	FACU	NO	NO

4.1.4 Upland Forest/Scrub Shrub

The project area contained 45.9 acres of forest/scrub shrub upland (FOR/SS) complex, which consists of an assemblage of upland forest and scrub shrub habitat types, and was dominated by mature and young trees as well as scrub shrub species (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.5 Scrub Shrub/Grassland/Herbaceous

The project area contained 3.2 acres of scrub shrub/grassland/herbaceous upland (SS/GH) complex, which consists of an assemblage of upland scrub shrub and herbaceous habitat types (Appendix C, Photograph 5) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.6 Palustrine Forest

The project area contained 21.3 acres of palustrine forest (PFO) habitat, indicating it was dominated by wetland tree species and is not subject to regular management (Appendix C, Photograph 6) (Figures, Drawing No. B08-467-D4). Wetlands identified as forested were characterized by a dominance of woody vegetation six meters tall or taller with an understory of

young trees or shrubs, and an herbaceous layer. Table 4 lists plants species identified within the palustrine forest habitat; dominant species are in bold:

TABLE 4. PALUSTRINE FOREST HABITAT VEGETATION TABLE

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Arisaema triphyllum	Jack in the pulpit	4	FACW	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Bidens cernua	nodding stick-tight	2	OBL	NO	NO
Bidens coronata	tickseed sunflower	7	OBL	NO	NO
Bidens frondosa	beggar's ticks	1	FACW	NO	NO
Bidens polylepis	awnless beggar's ticks	1	FACW	NO	NO
Boehmeria cylindrica	false nettle	3	OBL	NO	NO
Carex annectens	yellow fruit sedge	3	FACW	NO	NO
Carex lacustris	lakebank sedge	6	OBL	NO	NO
Carex squarrosa	squarrosa sedge	5	OBL	NO	NO
Carex tribuloides	blunt broom sedge	3	FACW	NO	NO
Carex vulpinoidea	fox sedge	3	OBL	NO	NO
Cinna arundinacea	wood reed grass	5	FACW	NO	NO
Fraxinus pennsylvanica	green ash	5	FACW	NO	NO
Impatiens capensis	spotted jewelweed	2	FACW	NO	NO
Leersia oryzoides	rice cutgrass	3	OBL	NO	NO
Leersia virginica	common cutgrass	4	FACW	NO	NO
Ludwigia alternifolia	seedbox	5	OBL	NO	NO
Lycopus americanus	water horehound	3	OBL	NO	NO

TABLE 4. PALUSTRINE FOREST HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Onoclea sensibilis	sensitive fern	5	FACW	NO	NO
Penthorum sedoides	ditch stonecrop	2	OBL	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Quercus palustris	pin oak	4	FACW	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Ulmus americana	American elm	5	FACW	NO	NO
Ulmus rubra	slippery elm	3	FAC	NO	NO

4.1.7 Palustrine Scrub Shrub

The project area contained 1.1 acres of palustrine scrub shrub (PSS) habitat, indicating it was dominated by wetland scrub shrub species and is not subject to regular management (Appendix C, Photograph 7) (Figures, Drawing No. B08-467-D4). Wetlands identified as scrub shrub were characterized by areas of woody vegetation less than six meters (20 feet) tall. Table 5 lists plant species identified within the palustrine scrub shrub habitat; dominant species are in bold:

TABLE 5. PALUSTRINE SCRUB SHRUB HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Acer negundo	box elder	1	FACW	NO	NO
Acer rubrum	red maple	5	FAC	NO	NO
Betula nigra	river birch	4	FACW	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO

TABLE 5. PALUSTRINE SCRUB SHRUB HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Fraxinus pennsylvanica	green ash	5	FACW	NO	NO
Ipomoea lacunosa	small-flower white morning glory	*	FACW	NO	NO
Paspalum pubiflorum	hairy-seed paspalum	3	FACW-	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Platanus occidentalis	American sycamore	3	FACW	NO	NO
Populus deltoides	eastern cottonwood	2	FAC	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Ulmus americana	American elm	2	FACW	NO	NO
Ulmus rubra	slippery elm	2	FAC	NO	NO

4.1.8 Palustrine Forest/Scrub Shrub

The project area contained 9.7 acres of palustrine forest/scrub shrub wetland (PFO/PSS) complex, which consists of an assemblage of forest and scrub shrub wetland types, and was dominated by mature and young trees as well as scrub shrub wetland species (Appendix C, Photograph 8) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.9 Palustrine Emergent

The project area contained 2.0 acres of palustrine emergent (PEM) habitat, indicating it was dominated by wetland emergent species and is not subject to regular management (Appendix C, Photograph 9) (Figures, Drawing No. B08-467-D4). Wetlands identified as emergent were characterized by a vast array of grasslike plants, true grasses, and broad-leaved plants. Table 6 lists plant species identified within the palustrine emergent habitat; dominant species are in bold:

TABLE 6. PALUSTRINE EMERGENT HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Acer rubrum	red maple	5	FAC	NO	NO
Agrimonia parviflora	common agrimony	5	FAC	NO	NO
Agrostis gigantea	common redtop	0	FACW	NO	NO
Agrostis stolonifera	creeping bentgrass	8	FACW	NO	NO
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Apocynum cannabinum	Indian hemp	2	FAC	NO	NO
Betula nigra	River birch	4	FACW	NO	NO
Bidens cernua	nodding stick-tight	2	OBL	NO	NO
Bidens coronata	tickseed sunflower	7	OBL	NO	NO
Bidens frondosa	beggar's ticks	1	FACW	NO	NO
Carex tribuloides	blunt broom sedge	3	FACW	NO	NO
Carex vulpinoidea	fox sedge	3	OBL	NO	NO
Cyperus esculentus	yellow nut sedge	0	FACW	NO	NO
Cyperus strigosus	straw-color sedge	0	FACW	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Eupatorium perfoliatum	common boneset	4	FACW	NO	NO
Eupatorium serotinum	lateflower boneset	1	FAC	NO	NO
Euthamia graminifolia	flat-topped goldenrod	3	FACW	NO	NO
Impatiens capensis	spotted jewelweed	2	FACW	NO	NO
Juncus effusus	soft rush	4	OBL	NO	NO
Juncus tenuis	path rush	0	FAC	NO	NO
Juncus torreyi	Torey's rush	3	FACW	NO	NO

TABLE 6. PALUSTRINE EMERGENT HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Leersia oryzoides	rice cutgrass	3	OBL	NO	NO
Leersia virginica	common cutgrass	4	FACW	NO	NO
Ludwigia alternifolia	seedbox	5	OBL	NO	NO
Ludwigia palustris	marsh seedbox	4	OBL	NO	NO
Panicum capillare	witch grass	0	FAC	NO	NO
Penthorum sedoides	ditch stonecrop	2	OBL	NO	NO
Phragmites australis	common reed	0	FACW	NO	NO
Polygonum lapathifolium	nodding smartweed	0	FACW	NO	NO
Polygonum pensylvanicum	pinkweed	1	FACW	NO	NO
Polygonum persicaria	lady's thumb	*	FACW	NO	NO
Polygonum sagittatum	tear thumb	5	OBL	NO	NO
Rumex verticillatus	swamp dock	5	OBL	NO	NO
Salix nigra	black willow	3	OBL	NO	NO
Scirpus atrovirens	green bulrush	4	OBL	NO	NO
Scirpus cyperinus	wool grass	5	OBL	NO	NO
Solidago gigantea	giant goldenrod	3	FACW	NO	NO
Symphyotrichum lateriflorum	small white aster	2	FACW	NO	NO
Symphyotrichum novae-angliae	New England aster	4	FACW	NO	NO
Typha angustifolia	narrow leaved cattail	*	OBL	NO	NO
Typha latifolia	broad leaved cattail	1	OBL	NO	NO
Ulmus americana	American elm	5	FACW	NO	NO
Verbena hastata	blue vervain	3	FACW	NO	NO

4.1.10 Palustrine Scrub Shrub/Emergent

The project area contained 7.4 acres of palustrine scrub shrub/emergent wetland (PSS/PEM) complex, which consists of an assemblage of wetland scrub shrub and emergent wetland types (Appendix C, Photograph 10) (Figures, Drawing No. B08-467-D4). The area was not subject to regular management.

4.1.11 Open Space Developed

The project area contained 6.9 acres of vegetation which consists predominately of disturbance tolerant grasses and forbs and is subject to regular management (mowing) (Appendix C, Photograph 11) (Figures, Drawing No. B08-467-D4). Table 7 lists plant species identified within the open space developed habitat; dominant species are in bold:

TABLE 7. OPEN SPACE DEVELOPED HABITAT VEGETATION TABLE

Scientific Name:	Common Name:	C of C:	Indicator Status:	Federally Listed:	State Listed:
Andropogon virginicus	broom sedge	1	FAC	NO	NO
Cirsium arvense	Canada thistle	*	FACU	NO	NO
Cirsium vulgaris	bull thistle	*	FACU	NO	NO
Echinochloa crusgalli	barnyard grass	*	FACW	NO	NO
Glechoma hederacea	ground ivy	*	FACU	NO	NO
Lamium amplexicaule	henbit	*	--	NO	NO
Lolium perenne	rye grass	*	FACU	NO	NO
Medicago lupulina	black medic	*	FAC	NO	NO
Oxalis stricta	common yellow wood sorrel	0	FACU	NO	NO
Phragmites australis	common reed	1	FACW	NO	NO
Portulaca oleracea	common purslane	*	FAC	NO	NO
Setaria faberi	foxtail	*	FACU	NO	NO
Setaria glauca	yellow foxtail	*	FAC	NO	NO
Sorghum halepense	Johnson grass	*	FACU	NO	NO
Taraxacum officinale	dandelion	*	FACU	NO	NO

TABLE 7. OPEN SPACE DEVELOPED HABITAT VEGETATION TABLE					
Scientific Name:	**Common Name:**	**C of C:**	**Indicator Status:**	**Federally Listed:**	**State Listed:**
Toxicodendron radicans	poison ivy	1	FAC	NO	NO
Tridens flavus	grease grass	1	UPL	NO	NO
Trifolium pratense	red clover	*	FACU	NO	NO
Trifolium repens	white clover	*	FACU	NO	NO

ATTACHMENT II.10

CULTURAL, ARCHEOLOGICAL AND HISTORICAL RESOURCES REPORT

ARCHAEOLOGICAL SURVEY SHORT REPORT **Reviewer:**
Illinois Historic Preservation Agency **Date:**
1 Old State Capitol Plaza, Springfield, Illinois 62701-1507 **Accept:** **Reject:**
(217) 782-4836

IHPA Log Number:

LOCATIONAL INFORMATION AND SURVEY CONDITIONS:
County: Williamson **Quadrangle:** Pittsburg, Illinois 7.5'

Project Type/Title: Phase I Cultural Resources Survey and Assessment of a 10-Acre Proposed Permit Area for Williamson Energy's Pond Creek No. 1 Mine, Williamson County, Illinois (ARG CRM 1875).
Funding and/or Permitting Federal/State Agencies: IDNR

Legal Location: Align SE Corner: N2, SW, SW **Section:** 7 **Township:** 8S **Range:** 4E

UTM Coordinates: Zone 16 (NAD 83)
UTM approximate center of project **UTM North:** 4189345 **UTM East:** 340314

Project Description: Phase I archaeological survey of a proposed mine permit area addition.
Topography: Ridge and slope
Elevation (' AMSL): 470'–510'
Soils: Ava-Bluford-Wynoose
Drainage: Unnamed intermittent, Pond Creek, Big Muddy River, Mississippi River
Land Use/Ground Cover (include % visibility): 80% woods (0% ground surface visibility); 20% weeds/ overgrown grass/yard (0-50% ground surface visibility)
Survey Limitations: None

ARCHAEOLOGICAL AND HISTORICAL INFORMATION:
Historic Plats/Atlases/Sources: IHPA Site File Search (ArcIMS Viewer),
1876 Atlas of the State of Illinois (Warner and Beers 1876) (Attachment B, Figure B-1), 1908 Standard Atlas of Williamson County, Illinois (George A. Ogle) (Attachment B, Figure B-2), 1909 West Frankfort, Illinois, 15 minute topographic map (Attachment B, Figure B-3); 1940s Plat Book of Williamson County, Illinois (W.W. Hixson) (Attachment B, Figure B-4); 1941 West Frankfort, Illinois, 15 minute topographic map (Attachment B, Figure B-5)

Previously Reported Sites: Within project area: None. Within one mile of project area, 52 sites: 11WM111–144, 11WM147–148, 11WM153, 11WM313, 11WM333–342, 11WM350, 11WM364–366
Previous Surveys: Within project area: None. Adjacent to project area: Doc #s: 11295, 90364. Within one mile of project area: Doc. #s: 669, 5025, 14961, 15634, 17643
Regional Archaeologist Contacted: None
Investigation Techniques: Systematic surface survey in portions of yard area where ground surface visibility was above 25 percent; systematic, screened shovel testing in weed-covered areas and in woods where visibility was below 25 percent

Time Expended: 6 Hours

Sites/Find Spots Located: None

Cultural Material: n/a

Curated At: n/a

Collection Techniques: n/a
Area Surveyed (acres and square meters): 10 acres; 40,470 square meters

OVER

RESULTS OF INVESTIGATIONS AND RECOMMENDATIONS: (check one)

_X_ **Phase I archaeological reconnaissance has located no archaeological material; project clearance is recommended.**

__ **Phase I archaeological reconnaissance has located archaeological materials; site(s) does(do) not meet requirements for National Register eligibility; project clearance is recommended.**

__ **Phase I archaeological reconnaissance has located archaeological materials; site(s) may meet requirements for National Register eligibility; further testing is recommended.**

__ **Phase II archaeological investigation has indicated that site(s) does(do) not meet requirements for National Register eligibility; project clearance is recommended.**

__ **Phase II archaeological investigation has indicated that site(s) meet requirements for National Register eligibility; formal report is pending and a determination of eligibility is recommended.**

Comments: No cultural resources were identified within the project area. It is recommended that the project proceed as planned. See Attachment C.

ARCHAEOLOGICAL CONTRACTOR INFORMATION:

Archaeological Contractor: American Resources Group, Ltd.
Address/Phone: 127 North Washington Street
Carbondale, Illinois 62901-1507 / (618) 529-2741

Surveyor(s): Steve Titus **Survey Date(s):** October 30, 2014
Report Completed by: Cally Lence **Date:** October 31, 2014
Submitted by (signature and title): Steve Titus, Principal Investigator

ATTACHMENT CHECK LIST: (#1 through #4 are mandatory)

_x_ 1) **Relevant portion of USGS 7.5' topographic quadrangle map(s) showing project location and any recorded site;**
_x_ 2) **Project map(s) depicting survey limits and, when applicable, approximate site limits and concentrations of cultural materials;**
__ 3) **Site form(s): (two copies of each form);**
_x_ 4) **All relevant project correspondence;**
_x_ 5) **Additional information sheets as necessary.**

Address of Owner/Agent/Agency To Whom SHPO Comment Should Be Mailed To:

Williamson Energy, LLC
208 Public Square, 4th Floor
Benton, Illinois 62812

American Resources Group, Ltd.
127 North Washington Street
Carbondale, Illinois 62901-1507

Contact Person: Mr. James Plumley
Telephone Number: (618) 439-4149, ext. 109

Contact Person: Mr. Steve Titus
Telephone Number: (618) 529-2741

REVIEWERS COMMENTS:

List of Attachments

Attachment A: **Project Area Map**

Figure A-1. Topographic location of the project area.

Attachment B: **Historic Plats/Atlases/Sources**

Figure B-1. Portion of the 1876 atlas of Illinois, illustrating the project area.

Figure B-2. Portion of the 1908 altas of Williamson County, Illinois, illustrating the project area.

Figure B-3. Portion of the 1909 West Frankfort, Illinois, USGS 15' series topographic quadrangle illustrating the project area.

Figure B-4. Portion of a 1940s plat of Williamson County, Illinois, illustrating the project area.

Figure B-5. Portion of the 1941 West Frankfort, Illinois, USGS 15' series topographic quadrangle illustrating the project area.

Attachment C: **Comments**

Attachment D: **Project Photographs**

Figure D-1. View of western portion of survey area (former house area), looking north.

Figure D-2. View of western portion of survey area (former house area), looking east from driveway.

Attachment A

Project Area Map

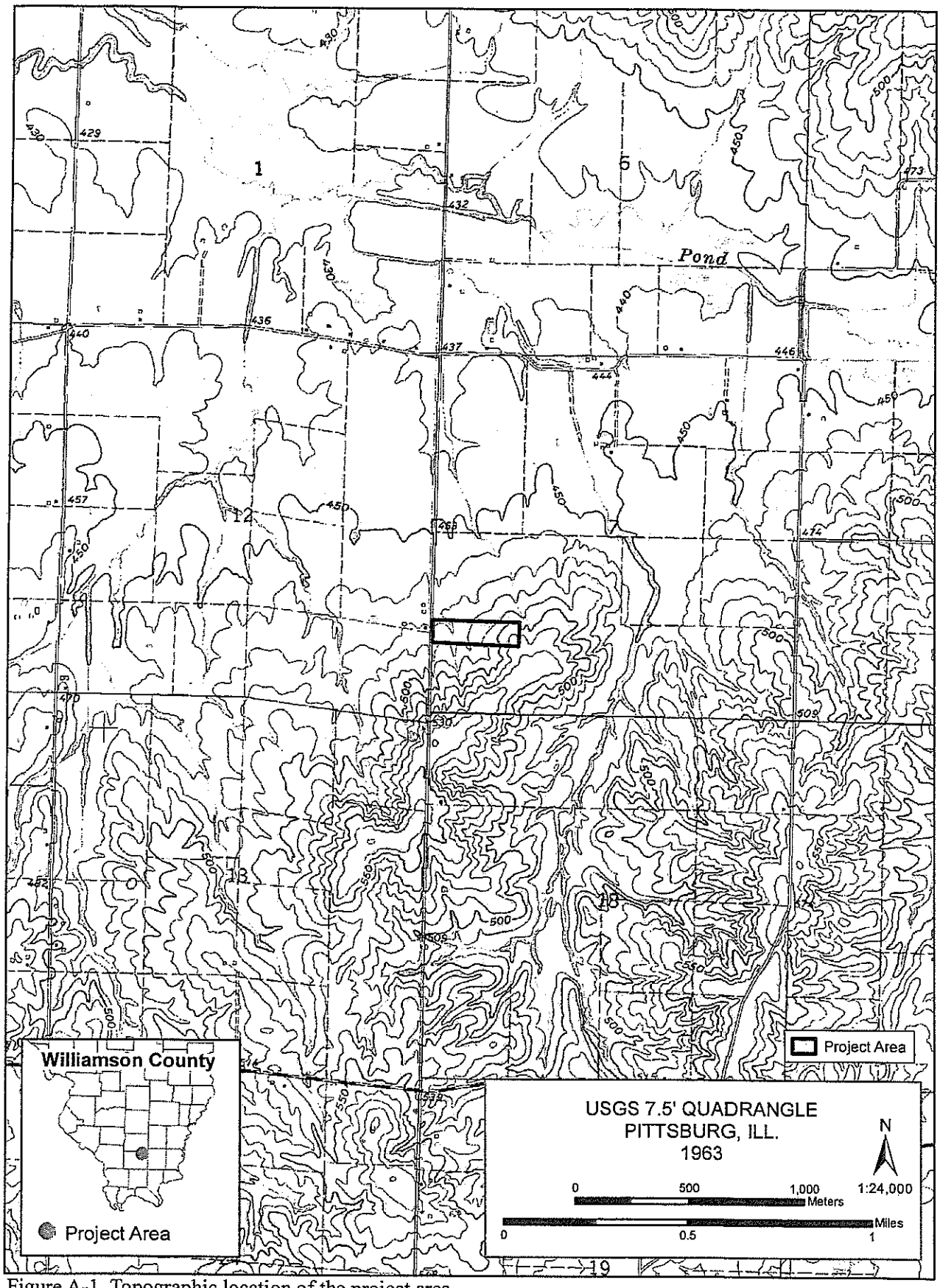


Figure A-1. Topographic location of the project area.

Attachment B

Historic Plats/Atlases/Sources

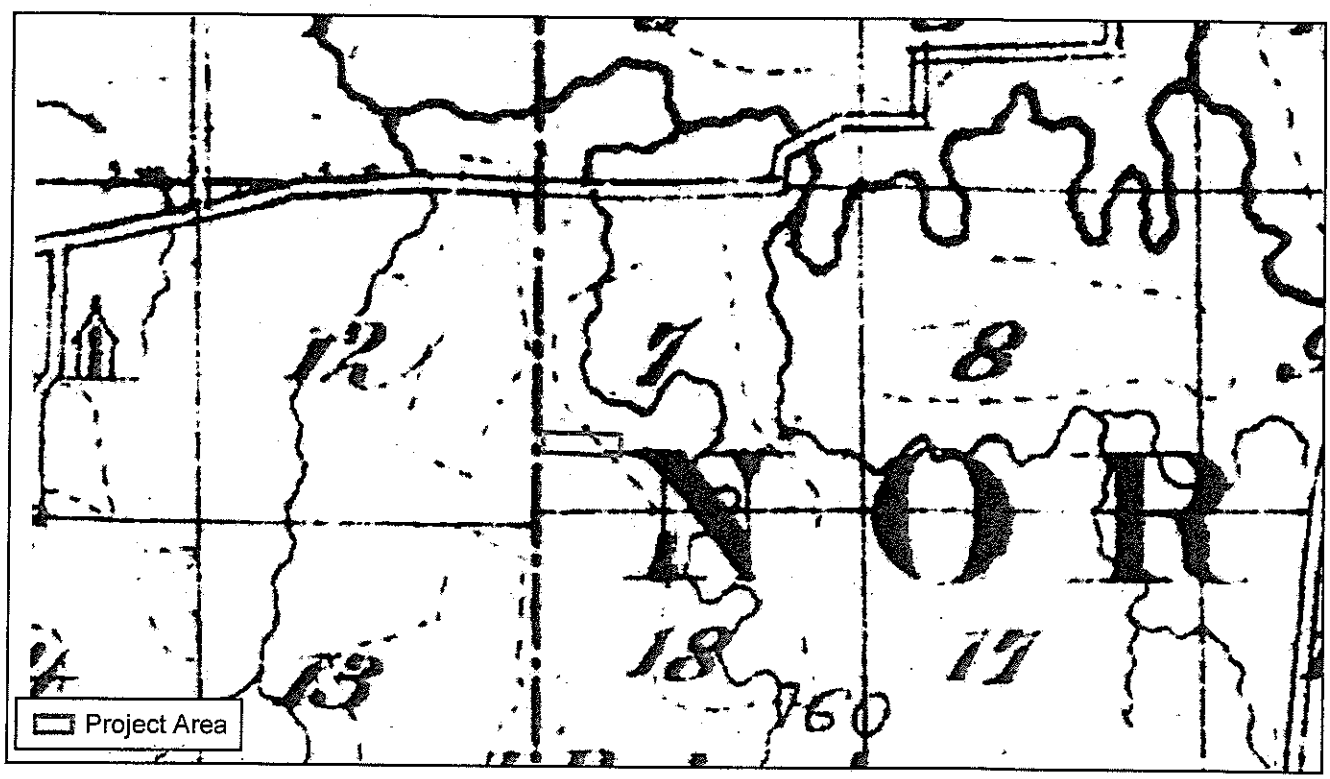


Figure B-1. Portion of the 1876 atlas of Illinois, illustrating the project area.

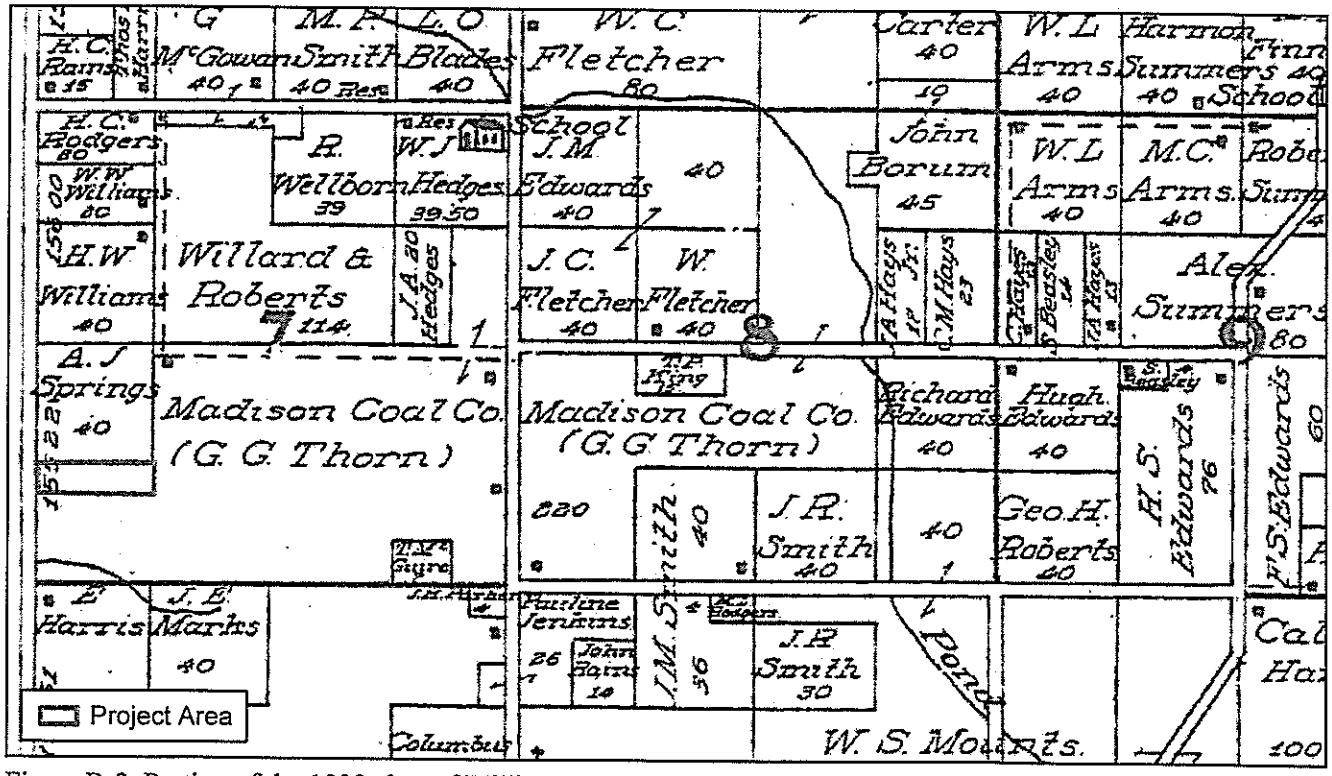


Figure B-2. Portion of the 1908 altas of Williamson County, Illinois, illustrating the project area.

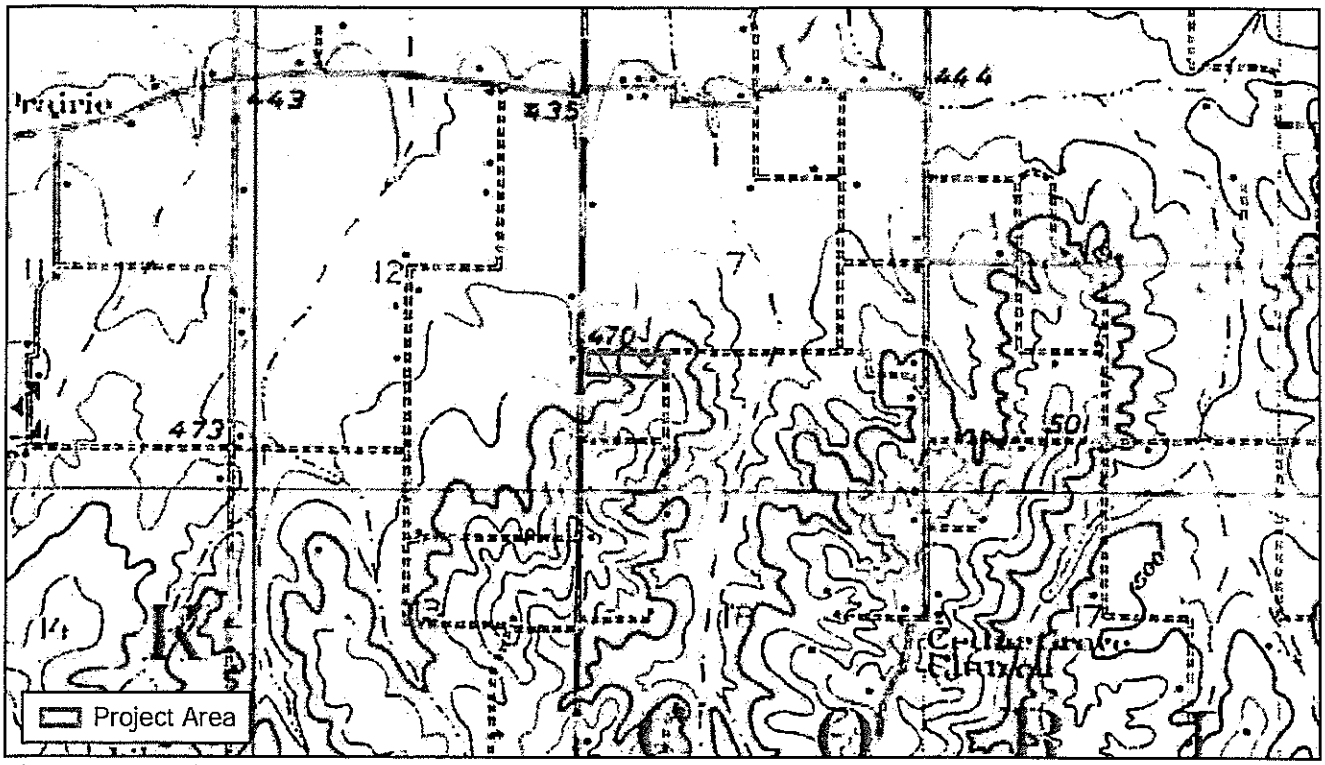


Figure B-3. Portion of the 1909 West Frankfort, Illinois, USGS 15' series topographic quadrangle illustrating the project area.

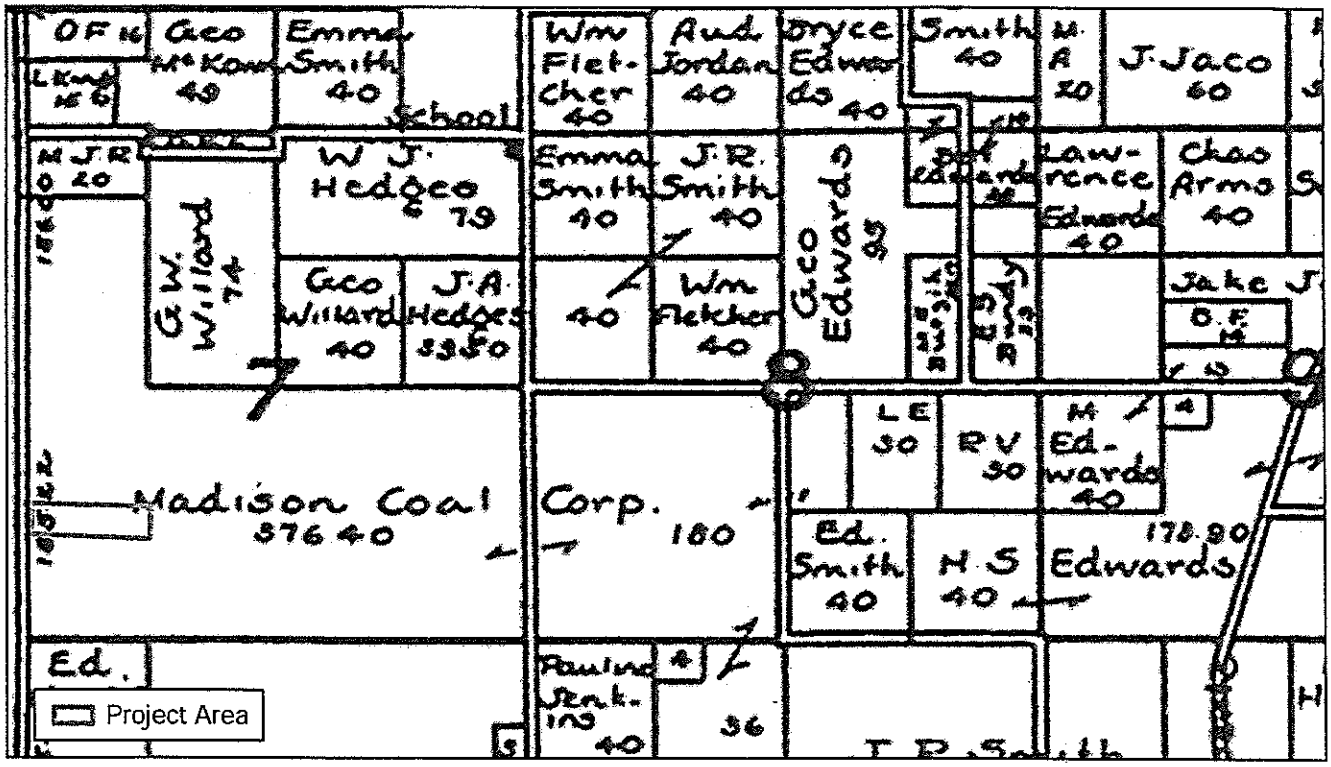


Figure B-4. Portion of a 1940s plat of Williamson County, Illinois, illustrating the project area.

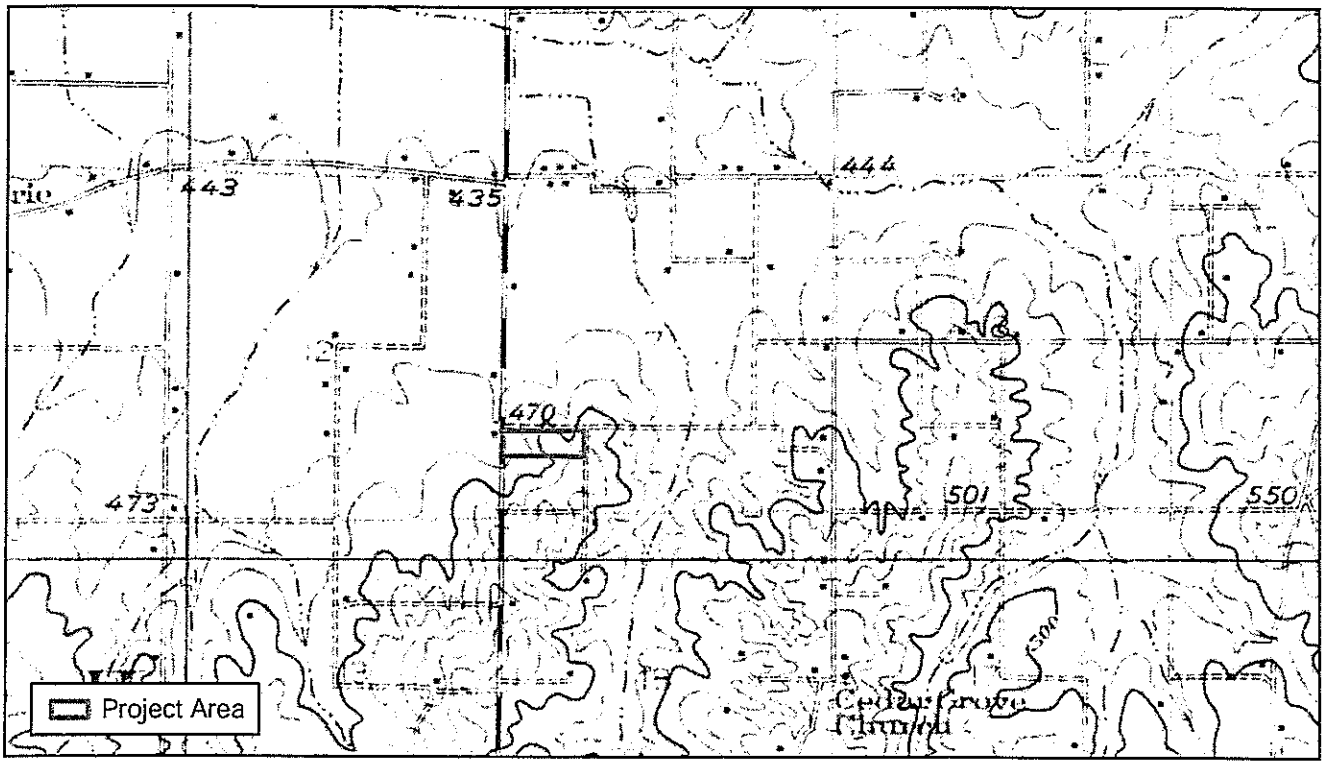


Figure B-5. Portion of the 1941 West Frankfort, Illinois, USGS 15' series topographic quadrangle illustrating the project area.

Attachment C

Comments

American Resources Group Ltd., conducted an intensive, Phase I cultural resources survey of a proposed, 10-acre (4 ha) addition to Williamson Energy's Pond Creek No. 1 Mine on October 30, 2014. The project area is located approximately 1.25 (2 km) north of the intersection of Corinth and Dwina roads, and approximately 2.5 miles (4 km) northwest of Corinth, Illinois, on the USGS 1963 Pittsburg, Illinois, 7.5 minute quadrangle map (Attachment A, Figure A-1). The project area consists of a rectangular area that is mostly wooded, but the western, approximate 1/5 of the project area is a former house location which is currently a weedy, overgrown yard. The pre-field site-file search and architectural records review revealed that no professional cultural resources surveys had been conducted, and no archaeological sites or architectural properties had been recorded, in the project area, although numerous sites and surveys have been conducted adjacent to and within one-mile of the project area. The pre-field review of maps and aerial photographs suggested that a modern house had been constructed in the western portion of the project area sometime in the 1980s/early 1990s; this was later confirmed by Williamson Energy personnel (personal correspondence, Mr. James Plumley 2014), who also noted that that the house was moved away from the project area in 2012.

The majority of the project area was subject to systematic, screened shovel testing along transects spaced 15 m apart. A small portion of the western area, specifically the area north of the driveway, was subject to surface survey, since ground surface visibility was approximately 30 to 50 percent in this area. Shovel testing in the western area containing the overgrown yard and former house area failed to produce cultural material. The area where the former modern house once stood contains disturbed soils. The wooded portion of the project area is characterized by a dense understory of saplings and vines, and the more mature trees (primarily oak and hickory) appear to be approximately 30- to 40-years old, and the entire area appears to have been timbered in the past. Topsoil observed in shovel tests in on gentle to moderately steep slopes flanking the ridge crest in the southeast corner of the project area were deflated, and in many was completely devoid of topsoil. Soils on the crest of the ridge were brown silt loam extending to a depth of 20 to 25 cm below surface. The low areas west and east of the small intermittent drainage in the western portion of the project area showed mottled and gleyed, poorly drained soils.

No archaeological sites were identified during the present investigation, and it was confirmed that the modern house location at the western edge of the project area was, in fact, occupied during the latter part of the twentieth century and early twenty-first century. Since no archaeological sites were identified and recorded during the present investigation, the proposed undertaking will not have an adverse effect on significant cultural properties. It is recommended that the proposed undertaking be allowed to proceed as planned without further archaeological investigation.

Attachment D

Project Photographs



Figure D-1. View of western portion of survey area (former house area), looking north.

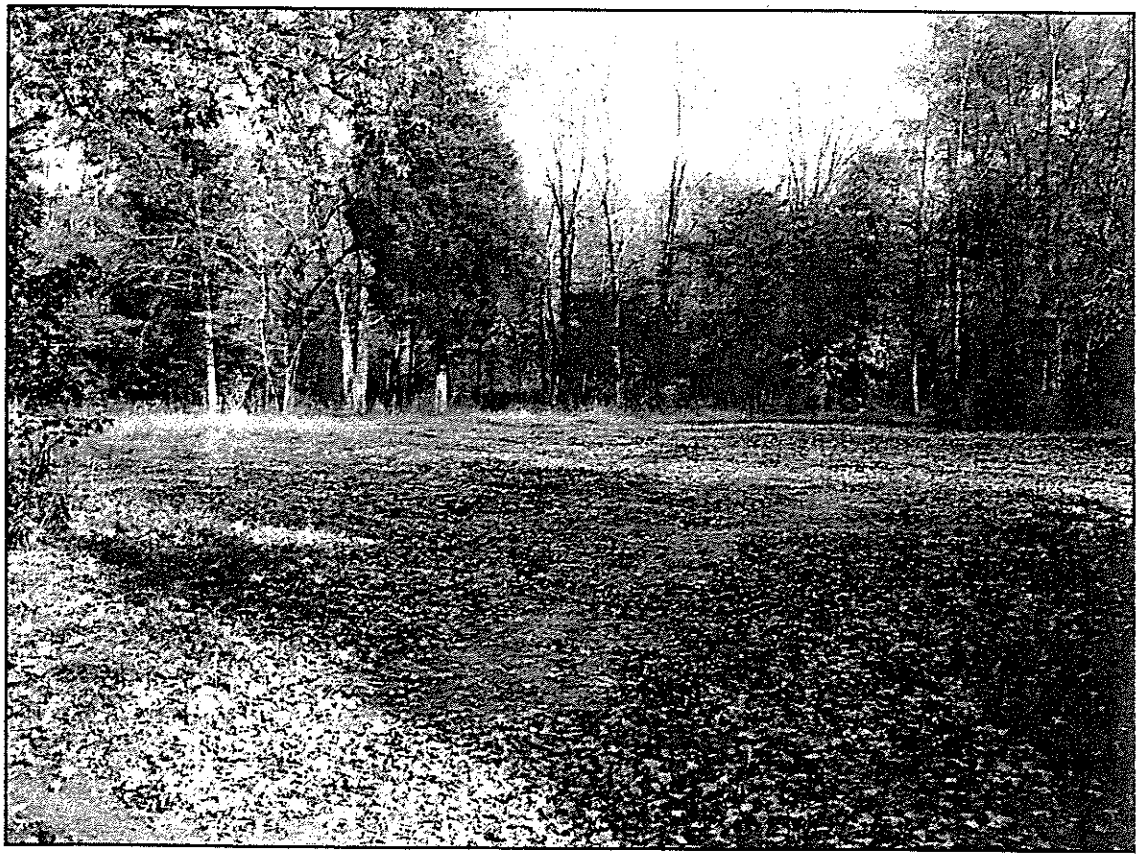


Figure D-2. View of western portion of survey area (former house area), looking east from driveway.

PART II ATTACHMENT II.10
CULTURAL, ARCHEOLOGICAL AND HISTORICAL RESOURCES REPORT

cra
cultural resource analysts, inc

March 26, 2010

James Slapak
Williamson Energy
P.O. Box 99
Johnston City, Illinois 62951

RE: A Cultural Resource Survey for the Williamson Energy Expansion of the Existing Facilities Associated with the Pond Creek No. 1 Coal Mine in Williamson County, Illinois
CRA Project No.: K09W003
Contract Publication Series No.: 09-179

Dear Mr. Slapak:

Enclosed find two bound copies of the report for the above referenced project. We have forwarded four copies (three bound and one on cd) to Hal Hassen at the Illinois Department of Natural Resources and one copy to Claudio Yon at Alliance Consulting, Inc. The enclosed copies are for your files.

Please find the invoice enclosed.

Thank you very much; we appreciate your business. If you have any questions, or if we can be of further assistance, please do not hesitate to give us a call.

Sincerely,

Charles M. Niquette, RPA
President

cc w/attach: Hal Hassen, Claudio Yon

sjw

rporate Headquarters
Valton Avenue
Lexington, KY 40508
office 859.252.4737
fax 859.254.3747
www.cral-ky.com

cra
cultural resource analysts inc

May 6, 2010

James Slapak
Williamson Energy
P.O. Box 99
Johnston City, Illinois 62951

RE: A Cultural Resource Survey for the Williamson Energy Expansion of the Existing Facilities Associated with the Pond Creek No. 1 Coal Mine in Williamson County, Illinois
CRA Project No.: K09W003
Contract Publication Series No.: 09-179

Dear Mr. Slapak:

Enclosed find two copies of the replacement pages for the report for the above referenced project. We have forwarded three copies of the replacement pages to Hal Hassen at the Illinois Department of Natural Resources and one copy to Claudio Yon at Alliance Consulting, Inc. The enclosed copies are for your files.

If you have any questions, or if we can be of further assistance, please do not hesitate to give us a call.

Sincerely,

Charles M. Niquette, RPA
President

cc: Hal Hassen, Claudio Yon

cek

Corporate Headquarters
Dalton Avenue
Lexington KY 40508
Office 859.252.4737
Fax 859.254.3747
www.cra-ky.com

LIST OF ATTACHMENTS

ATTACHMENT A. PROJECT MAPPING AND OVERVIEW PHOTOGRAPHS A-1
ATTACHMENT B. HISTORIC MAPS A-7
ATTACHMENT C. HISTORIC CONTEXT A-13
ATTACHMENT D. SITE DESCRIPTION A-17
ATTACHMENT E. REFERENCES A-33
ATTACHMENT F. SITE FORM A-39
ATTACHMENT G. HISTORIC ARTIFACT DATABASE A-43
ATTACHMENT H. VITA A-47

LIST OF FIGURES

Figure 1. Map of Illinois showing the location of Williamson County. A-2
Figure 2. Location of project area on topographic quadrangle. A-3
Figure 3. Project area plan map showing survey methods and the location of Site 11WM364. ..... A-4
Figure 4. Project overview showing topography and field conditions in the agricultural field. A-5
Figure 5. Project overview showing topography and field conditions, including logging debris A-5
Figure 6. The 1876 Illinois Atlas showing project area and lack of structures in the project area. A-10
Figure 7. The 1908 Map of Corinth Township showing two structures in the project area A-11
Figure 8. The 1909 West Frankfort, Illinois, 15-minute topographic quadrangle A-12
Figure 9. Schematic plan map of 11WM364. ..... A-20
Figure 10. Overview of 11WM364 (facing north). A-21
Figure 11. Historic artifacts recovered A-27

LIST OF TABLES

Table 1. Chain of Ownership of Property Containing Site 11WM364. ..... A-23
Table 2. Historic Artifacts Recovered According to Functional Group. A-24
Table 3. Historic Artifacts Recovered From Site 11WM364. ..... A-30
Table G-1. Historic Materials Recovered. A-45

cra
cultural resource analysts, inc

May 6, 2010

James Slapak
Williamson Energy
P.O. Box 99
Johnston City, Illinois 62951

RE: A Cultural Resource Survey for the Williamson Energy Pump Station, Bore Holes, and Access Roads in Williamson County, Illinois
CRA Project No.: K10W006
Contract Publication Series No.: 10-036

Dear Mr. Slapak:

Enclosed find two copies of the replacement pages for the report for the above referenced project. We have forwarded three copies of the replacement pages to Hal Hassen at the Illinois Department of Natural Resources and one copy to Claudio Yon at Alliance Consulting, Inc. The enclosed copies are for your files.

If you have any questions, or if we can be of further assistance, please do not hesitate to give us a call.

Sincerely,

Charles M. Niquette, RPA
President

cc: Hal Hassen, Claudio Yon

cek

rporate Headquarters
Vallon Avenue
.exington, KY 40508
ffice 859.252.4737
ax 859.254.3747
ww.crai-ky.com

ARCHAEOLOGICAL SURVEY SHORT REPORT
Illinois Historic Preservation Agency
Old State Capital Building
Springfield, Illinois 62701 (217/785-4997)

IHPA Log #_____

REVIEWER_____
Date: _____
_____Accepted _____Rejected
IHPA USE ONLY (Form ASSR0886)

Locational Information and Survey Conditions

County: Williamson County, Illinois

Quadrangle: Pittsburg, IL 7.5 min

Project Type/Title: *A Cultural Resource Survey for the Williamson Energy Pump Station, Bore Holes, and Access Roads in Williamson County, Illinois*

Funding and/or Permitting Federal/State Agencies: Illinois Department of Natural Resources (IDNR)
(i.e., CoE, HUD, IEPA, FmHA, etc.)

Sec: 9, 10 T.: 6 South R.: 4 East Natural Division (No.): 9B

U.T.M.: Pump station center: NAD 83 Zone 16: 4189087m N, 344995m E; North end of access road: 4190024m N 344634m E

Project Description: Phase I survey conducted for a pump station, bore holes, and access roads associated with a current coal mining operation.

Topography: Dissected Uplands (Southern Till Plains of the Central Lowland Province)

(Soils) Ava silt loam, Belknap silt loam, Grantsburg silt loam, Hickory-Kell clay loams, Plumfield silty clay loam, Plumfield silty clay loam, Sharon silt loam, Zanesville silty clay loam

Drainage: Big Muddy River Drainage (Pond Creek - a tributary to the Middle Fork of the Big Muddy River)

Land Use/Ground Cover (Include % Visibility): The pump station area was primarily wooded but also consisted of tall grass and weeds. A gravel road ran through a portion of the area. An existing gravel road ran parallel to most of the proposed access roads. In most places the ground surface was exposed to subsoil (100 percent visibility) in a narrow strip (1 to 2 m in width) along the existing gravel road. Back dirt from construction of the existing road was also present in most of the proposed access road areas.

Survey Limitations: The archaeological survey was bounded by the project area and consisted of two components, an access road and a pump station. The access road had been built prior to the survey so this portion of the project area was mostly disturbed. The proposed pump station had not been constructed at the time of the survey, although one bore hole was in place and operating. Most of this latter area was undisturbed and therefore was intensively surveyed. Undisturbed areas adjacent to the existing access road were also surveyed to identify possible sites that may have been impacted by the road construction but no such evidence was found.

Archaeological and Historical Information

Historic Plats/Atlases/Sources: 1807 and 1837 Government Land Office; 1876 Williamson County Map, Atlas of the State of Illinois; 1908 Williamson County, Illinois Plat Book; 1909 West Frankfort, Illinois 15-minute topo; 1920 Williamson County, Illinois Plat Book; 1940 Williamson County, Illinois Plat Book; 1963 Pittsburg, Illinois 7.5-minute topo map (ISGS map o37088g7).

(see attachment below for relevant historic maps)

Previously Reported Sites: No previously reported archaeological sites were noted within the project area

Previous Surveys: No previous archaeological surveys were conducted within the project area

Regional Archaeologists Contacted: Hal Hassen (IDNR)

Investigation Techniques: Because visibility in the undisturbed portion of the pump station area was less than 25 percent, it was shovel tested. Shovel testing was also conducted in undisturbed portions of the proposed access roads. However, because most of the access road areas had visibility over 40 percent, they were pedestrian surveyed.

Time Expended: 10 person-hours

Sites/Find Spots Located: No archaeological sites identified in the project area. A cemetery site (11WM367) was identified approximately 15 meters to the east of the project area.

Cultural Material: No cultural materials were recovered and/or collected from the project area during the current survey.

(Curated at) -NA-

Collection Techniques: Survey was conducted by pedestrian survey and shovel testing of the project area.

Area Surveyed (Acres & Square Meters): approximately 8.5 acres (34,400 sq m; 3.44 hectares)

(OVER)

Results Of Investigation And Recommendations: *(Check One)*

☒ Phase I Archaeological Reconnaissance Has Located No Archaeological Material; Project Clearance Is Recommended.

☐ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) Does (Do) Not Meet Requirements For National Register Eligibility; Project Clearance Is Recommended.

☐ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) May Meet Requirements for National Register Eligibility; Phase II Testing Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Does (Do) Not Meet Requirements For National Register Eligibility; Project Clearance Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Meet Requirements For National Register Eligibility; Formal Report Is Pending And A Determination Of Eligibility Is Recommended.

Comments: Since the survey identified no cultural resources in the project area, CRA recommends no additional work be conducted. The existing buffer should be kept around the cemetery site (11WM367), which is outside of the project area. There should be no construction to the east of the existing gravel road in the vicinity of the cemetery. If that area will be disturbed by future expansion, then additional archaeological investigation will be necessary for the site.

Archaeological Contractor Information:

Archaeological Contractor: Cultural Resource Analysts, Inc.

Address/Phone: 152 Walton Avenue Lexington, Kentucky 40508

Surveyor(s): Jason M. Anderson Survey Dates(s): 02 March 2010

Report Completed By: Jason M. Anderson Date: March 2010

Submitted By (Signature And Title):

Attachment Check List: *(#1 Through #4 Are MANDATORY)*

X	1)	Relevant Portion Of USGS 7.5' Topographic Quadrangle Map(s) Showing Project Location And Any Recorded Sites;
X	2)	Project Map(s) Depicting Survey Limits And, When Applicable, Approximate Site Limits, And Concentrations Of Cultural Materials;
X	3)	Site Form(s): Two Copies Of Each Form;
X	4)	All Relevant Project Correspondence;
	5)	Additional Information Sheets As Necessary.

Address Of Owner/Agent/Agency To Whom SHPO Comment Should Be Mailed:

LEAD AGENCY: IDNR - Hal Hassen, PhD., Cultural Resources (Planning and Analysis Section), One Natural Resources Way, Springfield, IL 62702-1271 CLIENT: Williamson Energy, LLC, James Slepak; Williamson Energy, LLC PO Box 300 Johnston City, Illinois 62951

Contact Person: Hal Hassen (IDNR) and Jim Slepak (Williamson Energy, LLC) Phone Number: Hal Hassen - (217) 524-3759; Jim Slepak (618) 231-2640

Reviewers Comments:



Figure 4. Project overview showing topography and field conditions in the agricultural field in the eastern portion of the project area (photo facing south).



Figure 5. Project overview showing topography and field conditions, including logging debris, in the non-agricultural field portion of the project area to the east of Site 11WM364 (photo facing south).

ARCHAEOLOGICAL SURVEY SHORT REPORT
Illinois Historic Preservation Agency
Old State Capital Building
Springfield, Illinois 62701 (217/785-4997)

IHPA Log #_____

REVIEWER_____
Date: _____
_____Accepted _____Rejected
IHPA USE ONLY (Form ASSR0886)

Locational Information and Survey Conditions

County: Williamson County, Illinois

Quadrangle: Pittsburg, IL 7.5 min

Project Type/Title: *A Cultural Resource Survey for the Williamson Energy Expansion of the Existing Facilities Associated with the Pond Creek No. 1 Coal Mine in Williamson County, Illinois*

Funding and/or Permitting Federal/State Agencies: Illinois Department of Natural Resources (IDNR)
(i.e., CoE, HUD, IEPA, FmHA, etc.)

Sec: 7 T.: 8 South R.: 4 East Natural Division (No.): 9B

U.T.M.: NAD 83 Zone 16N NW corner - 4190580m N, 340423m E; SE corner - 41877744m N 340912m E

Project Description: Phase I survey conducted for a proposed coal operation.

Topography: Dissected Uplands (Southern Till Plains of the Central Lowland Province)

(Soils) Belknap silt loam, Bluford silt loam, Rend silty clay loam, Sharon silt loam

Drainage: Big Muddy River Drainage (Pond Creek - a tributary to the Middle Fork of the Big Muddy River)

Land Use/Ground Cover (Include % Visibility): The project area consisted of approximately 55 acres, of which approximately 50 acres were in a bean field. Visibility in the bean field was good (ranging from 35 to 60 percent). The rest of the project area was primarily in woodland but also in tall grass and weeds. Visibility in this portion of the project area was less than 25 percent.

Survey Limitations: The archaeological survey was bounded by the project area.

Archaeological and Historical Information

Historic Plats/Atlases/Sources: 1807 and 1837 Government Land Office; 1876 Williamson County Map, Atlas of the State of Illinois; 1908 Williamson County, Illinois Plat Book; 1909 West Frankfort, Illinois 15-minute topo; 1920 Williamson County, Illinois Plat Book; 1940 Williamson County, Illinois Plat Book; 1963 Pittsburg, Illinois 7.5-minute topo map (ISGS map o37088g7).

(see attachment below for relevant historic maps)

Previously Reported Sites: Site 11WM364 was recorded just west of the project area. Its eastern boundary was expanded as a result of the current survey.

Previous Surveys: No previous archaeological surveys were conducted within the project area

Regional Archaeologists Contacted: Hal Hassen (IDNR)

Investigation Techniques: The project area consisted of approximately 55 acres, of which approximately 50 acres were in a bean field. Because visibility in the bean field was good (ranging from 35 to 60 percent), it was subjected to pedestrian survey. The rest of the project area was primarily in woodland but also in tall grass and weeds. Because visibility in this portion of the project area was less than 25 percent, it was shovel tested.

Time Expended: 20 person-hours

Sites/Find Spots Located: The eastern edge of previously recorded site 11WM364 was expanded. No other sites or find spots were located in the project area.

Cultural Material: 1 BIM clear container glass frag., 1 amethyst glass tableware frag., 2 indeterminate brick frag., 1 tile frag., 1 window glass sherd, 3 plate glass sherds, 2 wire nails, and 1 opaque white glass cosmetics jar frag. Some charcoal and brick flecks were observed but not collected.

(Curated at) ISM

Collection Techniques: Survey was conducted by shovel testing and pedestrian survey of the project area.

Area Surveyed (Acres & Square Meters): approximately 55 acres (222,574 sq m)

(OVER)

Page 2

Results Of Investigation And Recommendations: *(Check One)*

☐ Phase I Archaeological Reconnaissance Has Located No Archaeological Material; Project Clearance Is Recommended.

☒ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) Does (Do) Not Meet Requirements For National Register Eligibility; Project Clearance Is Recommended.

☐ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) May Meet Requirements for National Register Eligibility; Phase II Testing Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Does (Do) Not Meet Requirements For National Register Eligibility; Project Clearance Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Meet Requirements For National Register Eligibility; Formal Report Is Pending And A Determination Of Eligibility Is Recommended.

Comments: CRA recommended no additional archaeological work for Site 11WM364.

Archaeological Contractor Information:

Archaeological Contractor: Cultural Resource Analysts, Inc.

Address/Phone: 151 Walton Avenue Lexington, Kentucky 40508

Surveyor(s): Jason M. Anderson Survey Dates(s): 02 March 2010

Report Completed By: Jason M. Anderson Date: March 2010

Submitted By (Signature And Title): Jason M Anderson Staff Archaeologist

Attachment Check List: *(#1 Through #4 Are MANDATORY)*

X	1)	Relevant Portion Of USGS 7.5' Topographic Quadrangle Map(s) Showing Project Location And Any Recorded Sites;
X	2)	Project Map(s) Depicting Survey Limits And, When Applicable, Approximate Site Limits, And Concentrations Of Cultural Materials;
X	3)	Site Form(s): Two Copies Of Each Form;
X	4)	All Relevant Project Correspondence;
____	5)	Additional Information Sheets As Necessary.

Address Of Owner/Agent/Agency To Whom SHPO Comment Should Be Mailed:

LEAD AGENCY: IDNR - Hal Hassen, PhD., Cultural Resources (Planning and Analysis Section), One Natural Resources Way, Springfield, IL 62702-1271 CLIENT: Williamson Energy, LLC, James Slapak, Williamson Energy, LLC PO Box 300 Johnston City, Illinois 62951

Contact Person: Hal Hassen (IDNR) and Jim Slapak (Williamson Energy, LLC) Phone Number: Hal Hassen - (217) 524-3759; Jim Slapak (618) 231-2640

Reviewers Comments:

11/03/93

Introduction and Project Description

Between March 1 and 3, 2010, Cultural Resource Analysts, Inc. (CRA), personnel conducted a cultural resource survey for the proposed expansion of existing facilities associated with the Pond Creek 1 coal mine (Figures 1–5). The survey was conducted at the request of Jim Slapak of Williamson Energy, LLC. The current Archaeological Survey Short Report (ASSR) summarizes the results of the survey.

The project area consisted of approximately 22.3 ha (55.0 acres), of which approximately 20.2 ha (50.0 acres) were in a bean field. The rest of the project area was primarily in woodland but also in tall grass and weeds. A cinder block lined well, three foundations, and a swimming pool were observed in the project area. No archaeological materials were recovered from shovel tests adjacent to the well, structures, or pool. Although PVC pipe extending from the well suggests that it was connected to a structure at one time, reviewed nineteenth- and twentieth-century maps depicted no structures in the well area. The three foundations, constructed of cement and concrete, and the swimming pool were clustered together and represent a recently abandoned residential property. Based on observations made when these structures were standing in 2008, they were modern (less than 50 years old) (Faberson 2009).

Survey Methods

The current survey was conducted through the use of a variety of field methods, including pedestrian survey and shovel testing.

Pedestrian Survey

Following Illinois Historic Preservation Agency (IHPA) guidelines, pedestrian survey was conducted along transects spaced at 5-m intervals in portions of the project area that had 25 percent or greater ground surface visibility. In the plowed fields, transects were conducted along crop rows to ensure maximum ground visibility.

Shovel Testing

During the current investigations, shovel testing was necessary in portions of the project area where ground surface visibility was either reduced or non-existent. Following IHPA protocol, shovel testing conducted during the current archaeological survey was employed in areas of low ground surface visibility (less than 25 percent). Transects were set at 15-m intervals, with the spacing between transects also set at 15 m. Two negative shovel tests at 5-m intervals were used to define the edges of an archaeological site.

In all cases, shovel tests measured not less than 35 cm in diameter and extended well into subsoil. Shovel tests were excavated in natural levels. The plow zone was removed as one level. After the plow zone was removed, additional levels were excavated based on the local pedon. All fill removed from the shovel tests was screened through .64 cm (.25 in) mesh hardware cloth, and the sidewalls and bottoms were examined for evidence of cultural materials and features. All artifacts recovered from shovel tests were bagged by shovel test number and depth.

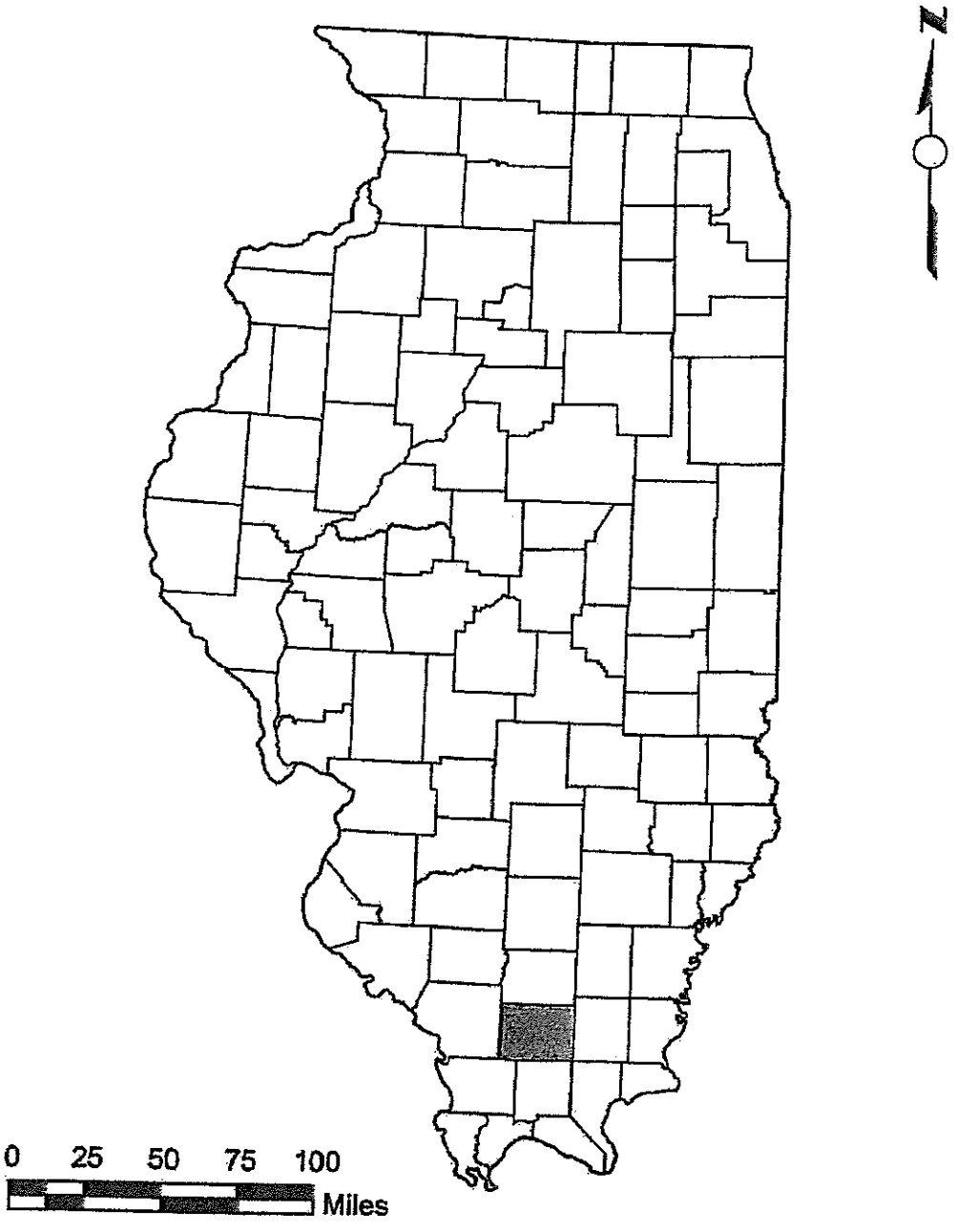


Figure 1. Map of Illinois showing the location of Williamson County.

LIST OF ATTACHMENTS

ATTACHMENT A. PROJECT MAPPING AND OVERVIEW PHOTOGRAPHS A-1
ATTACHMENT B. HISTORIC MAPS A-7
ATTACHMENT C. HISTORIC CONTEXT A-13
ATTACHMENT D. SITE DESCRIPTION A-17
ATTACHMENT E. REFERENCES A-33
ATTACHMENT F. SITE FORM A-39
ATTACHMENT G. HISTORIC ARTIFACT DATABASE A-43
ATTACHMENT H. VITA A-47

LIST OF FIGURES

Figure 1. Map of Illinois showing the location of Williamson County. 2
Figure 2. Location of project area on topographic quadrangle. A-3
Figure 3. Project area plan map showing survey methods and the location of Site 11WM364. ..... A-4
Figure 4. Project overview showing topography and field conditions in the agricultural field. A-5
Figure 5. Project overview showing topography and field conditions in the non-agricultural field. A-5
Figure 6. The 1876 Illinois Atlas showing project area and lack of structures in the project area. A-10
Figure 7. The 1908 Map of Corinth Township showing two structures in the project area. A-11
Figure 8. The 1909 West Frankfort, Illinois, 15-minute topographic quadrangle showing a structure. A-12
Figure 9. Schematic plan map of 11WM364. ..... A-20
Figure 10. Overview of 11WM364 (facing north). A-21
Figure 11. Historic artifacts recovered. A-27

LIST OF TABLES

Table 1. Chain of Ownership of Property Containing Site 11WM364. ..... A-23
Table 2. Historic Artifacts Recovered According to Functional Group. A-24
Table 3. Historic Artifacts Recovered From Site 11WM364. ..... A-30
Table G-1. Historic Materials Recovered. A-45

Attachment A. Project Mapping and Overview Photographs

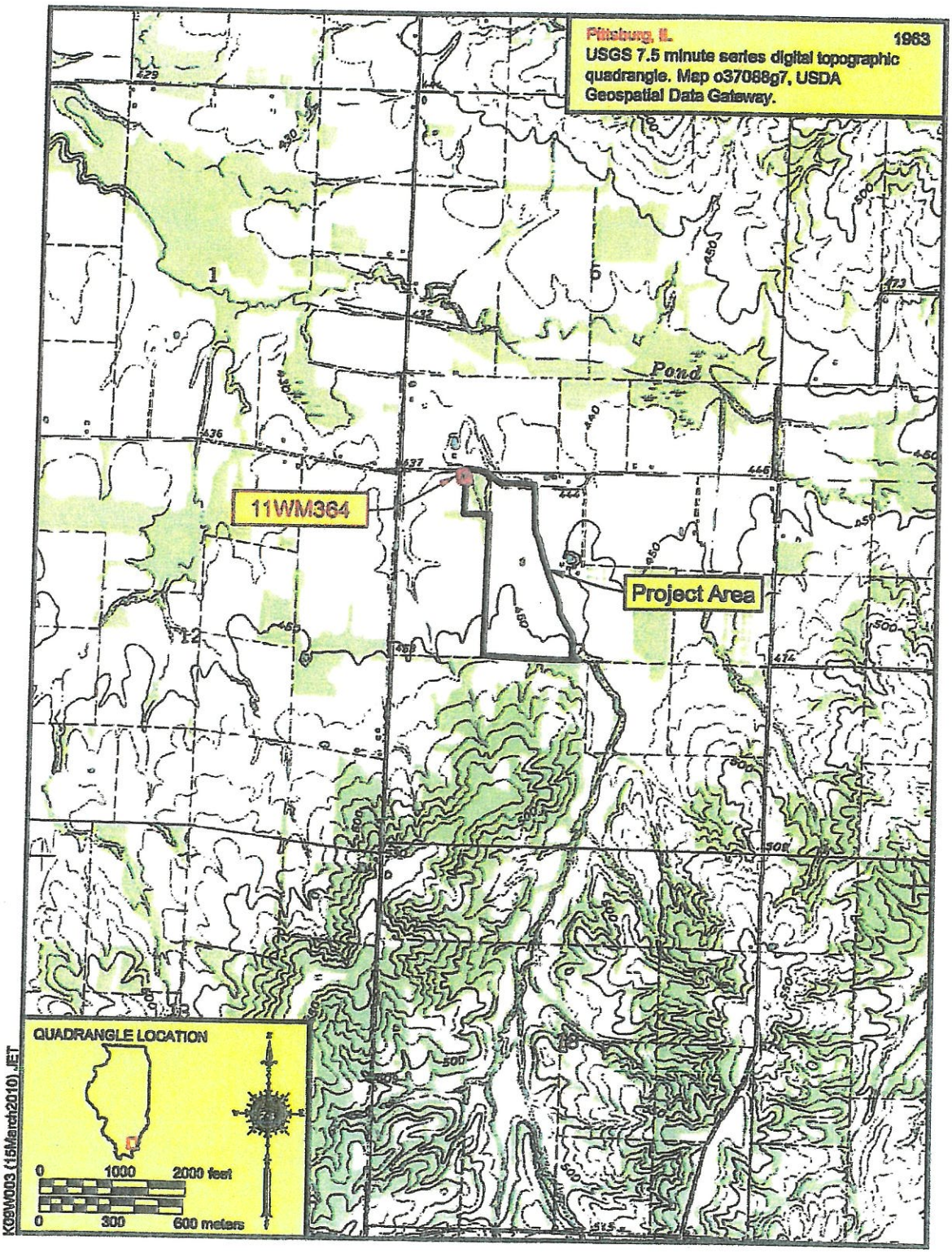


Figure 2. Location of project area on topographic quadrangle.

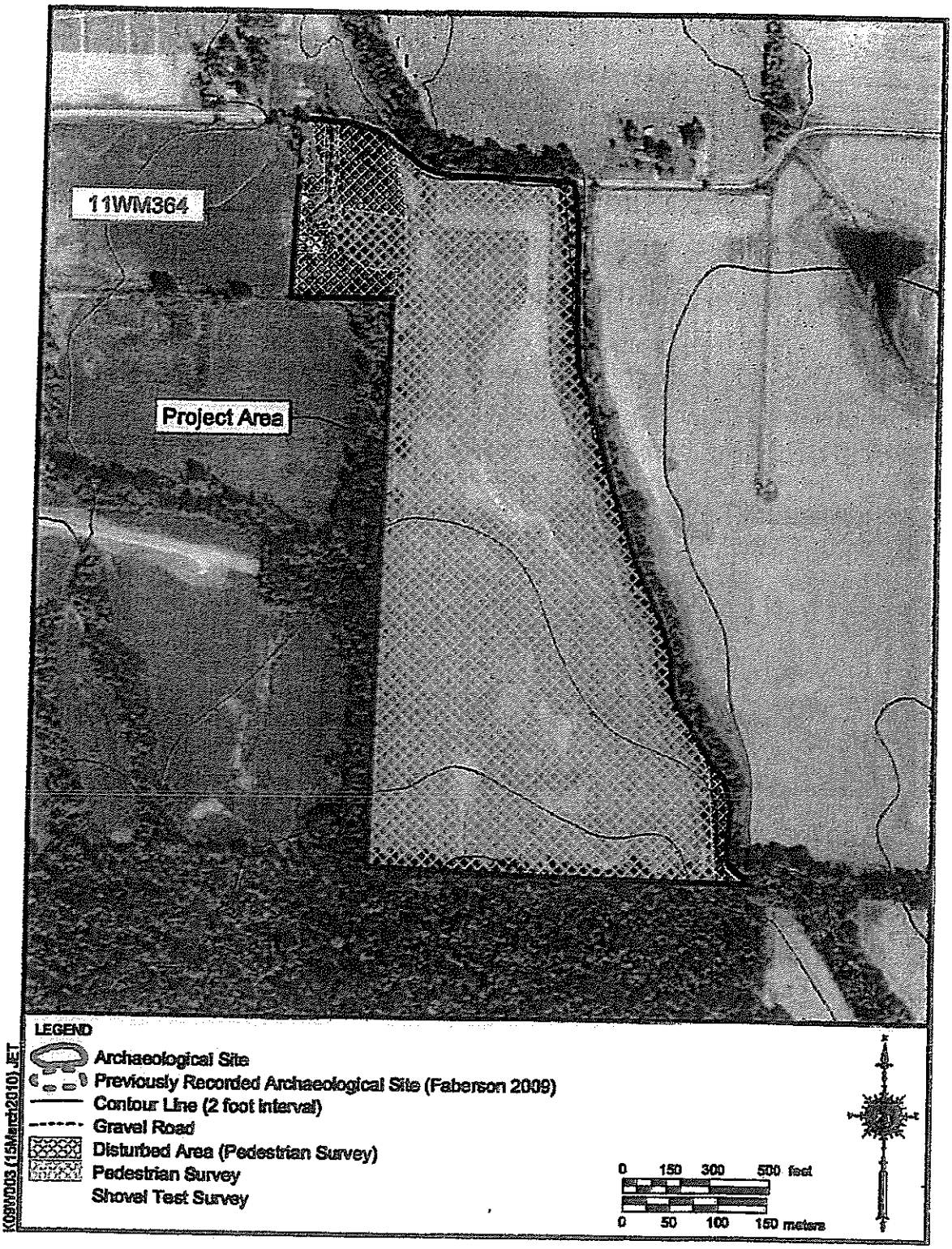


Figure 3. Project area plan map showing survey methods and the location of Site 11WM364.



Figure 4. Project overview showing topography and field conditions in the agricultural field portion of the project area (photo facing south).



Figure 5. Project overview showing topography and field conditions in the non-agricultural field portion of the project area (photo facing south).

Attachment B. Historic Maps

In addition to the site file search, a review of available historic maps was initiated to help identify potential historic sites within the proposed project area (Figures 6–8). As indicated below, the maps range in age from 1807 to 1963 and include:

1807 Government Land Office map (available online at: http://landplats.ilsos.net) (accessed February 25, 2010);

1837 Government Land Office map (available online at: http://landplats.ilsos.net) (accessed February 25, 2010);

1908 Williamson County, Illinois, Including a Plat Book of the Villages, Cities, and Townships of the County (Ogle & Company);

1909 West Frankfort, Illinois, 15-minute series United States Geological Survey (USGS) digital topographic quadrangle (USGS);

1940 Plat Book of Williamson County, Illinois (Marion Daily Republican and Marion Weekly Leader);

1963 Pittsburg, Illinois, 7.5-minute series USGS digital topographic quadrangle (USGS);

1972 [1876] Williamson County Map. Atlas of the State of Illinois (Warner & Beers, Proprietors);

2001 [1920] Williamson County, Illinois Plat Map. (Williamson County Historical Society).

The 1908 Williamson County Plat depicts two structures in the northern end of the project area along Dean Road. The westernmost structure is in the 11WM364 site area. The 1909 West Frankfort, Illinois, 15-minute map also depicts a structure in the 11WM364 site area but not the other one to the east that was on the 1908 map. None of the other maps show structures in or adjacent to the project area.

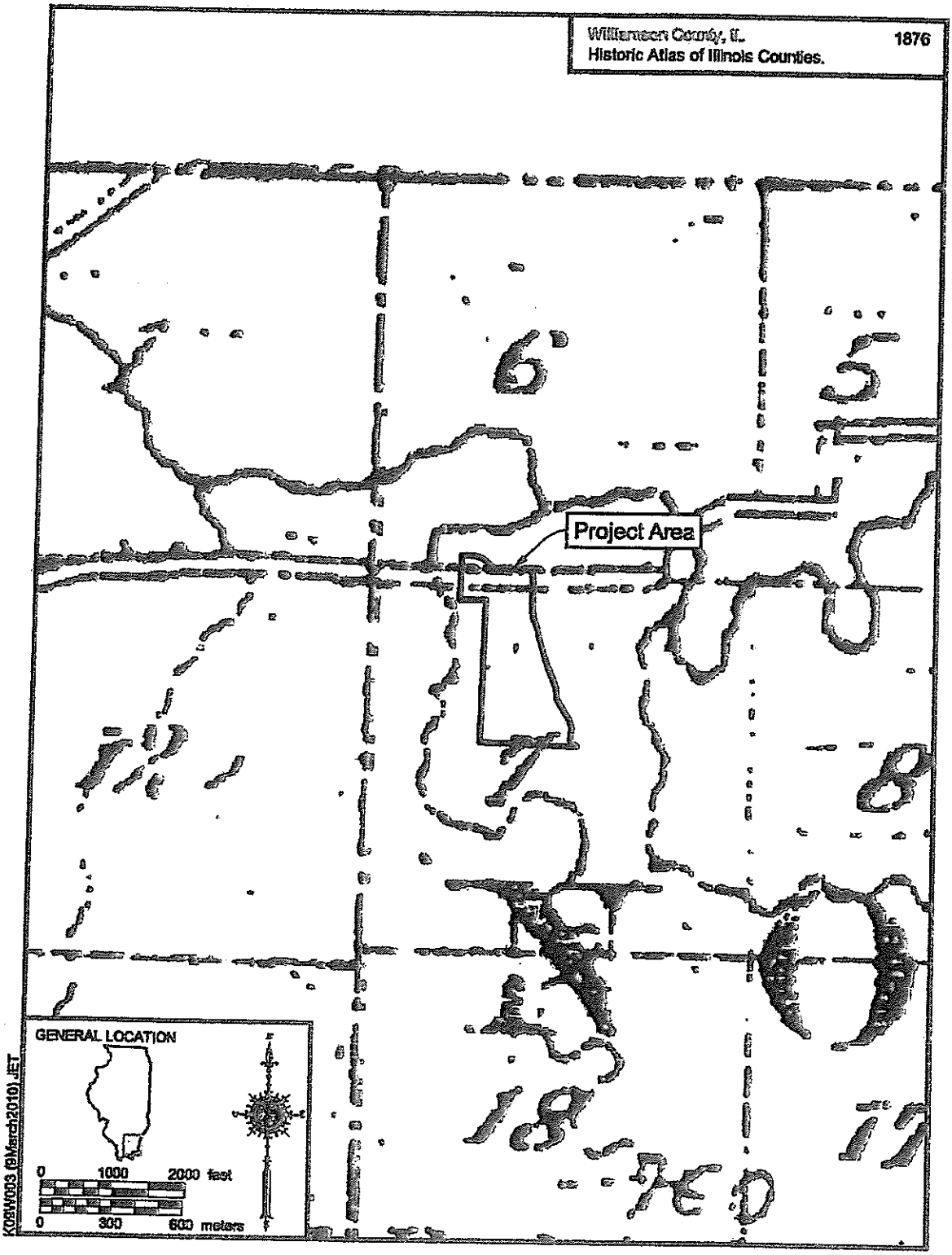


Figure 6. The 1876 Illinois Atlas showing project area and lack of structures in the project area (Warner and Beers 1976).

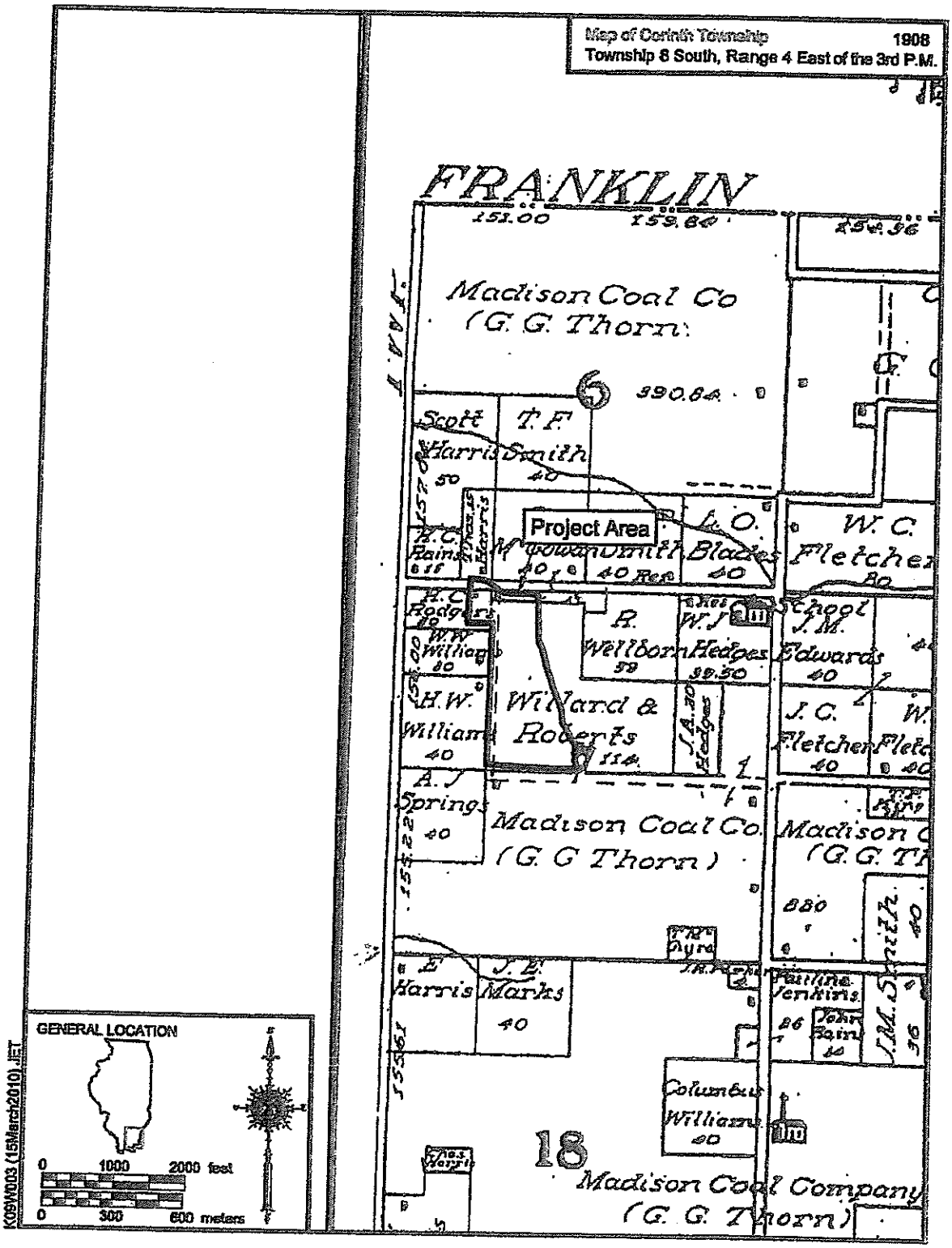


Figure 7. The 1908 Map of Corinth Township showing two structures in the project area (Ogle & Company 1908).

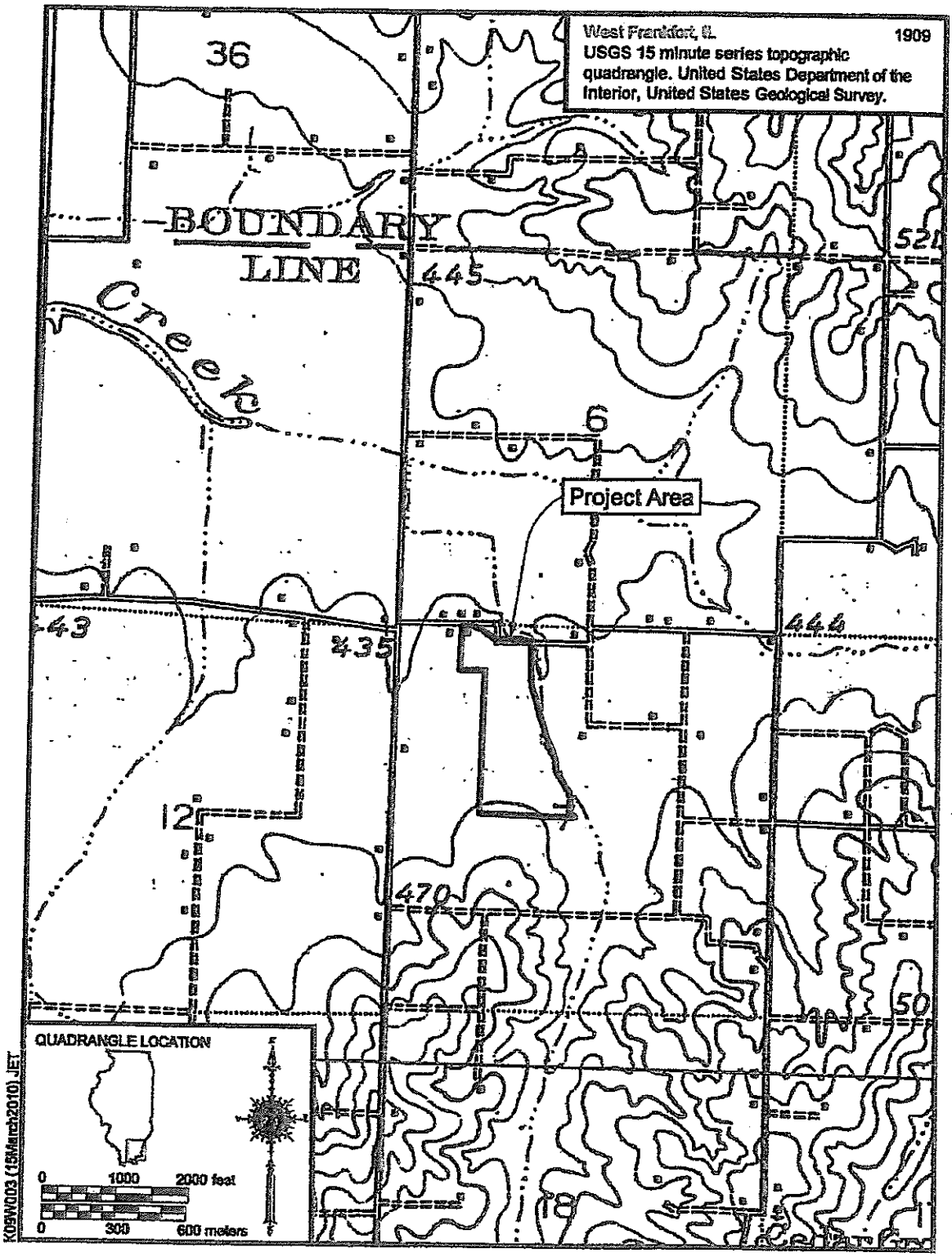


Figure 8. The 1909 West Frankfort, Illinois, 15-minute topographic quadrangle showing a structure in the project area (USGS 1909).

Attachment C. Historic Context

Williamson County has a relatively long history within the state of Illinois. Modern-day Williamson County was originally a portion of Franklin County, which had been created in 1818 at the same time that Illinois was ratified as a state. Williamson County was not created until 1839, when Franklin County was divided by an act of the Illinois Legislature (Erwin 1876). Williamson County was named after Williamson County, Tennessee, and after Hugh Williamson, a physician in the Revolutionary War and a North Carolina delegate to the United States Constitutional Convention. Shortly after Williamson County was established, the town of Marion was named the county seat. During this early time, many of the first European-American settlers in the region were from Kentucky, Tennessee, and the Carolinas. Settlements of free African Americans, such as "Africa," were also present in the county (Musgrave 2004).

In 1852, the Illinois Congress enacted a gradation law to dispose of less desirable land in the state, and this included a large section of southern Illinois. As a result, the land prices dropped from $1.25 to 12.5 cents an acre (the new minimum), and the county began to experience a second wave of land purchase and settlement, especially in the northeast quadrant of the county (Howard 1972:259). By the end of the decade, approximately one-half of all lands in Williamson County had been purchased. This is significant in comparison to the decades prior to the 1850s, when only one-fifth of the county land had been purchased or settled (Goodspeed Publishing Company 1887:442).

Although a large section of southern Illinois was considered undesirable by the State of Illinois, Williamson County was generally considered fertile and productive in the mid-nineteenth century. The county was popularly known as "Egypt," a moniker representative of its agricultural productivity, because the county was recognized for supplying large quantities of food to the northern part of the state (Wilcox 1905:8). Non-food crops, such as tobacco and cotton, were also major sources of agricultural output in the county during the middle of the nineteenth century, and Williamson County produced the highest yield of tobacco of the 16 counties encompassing southern Illinois (Goodspeed Publishing Company 1887).

With the onset of the Civil War, Williamson County farmers prospered because of increasing demands for grains and meat required to support Union troops. The yellowish clay typical of the county was fertile enough to grow corn, wheat, and potatoes, and the pasture land was ample enough to support herds of cattle for meat production (Wilcox 1905:8). New rail lines constructed through southern Illinois facilitated the distribution of grains and beef to the north, and increasing demands for the wool required for military uniforms influenced a boom in the sheep industry in the county (Goodspeed Publishing Company 1887).

In the early years of the war volunteerism ran high in southern Illinois, despite predominating Confederate sympathies (Howard 1972:300). According to Jensen (1978:69), if Missouri or Kentucky had seceded from the Union early on in the war, it is likely that southern Illinois would have made an attempt to break away from the northern half of the state, because many of the residents of the region maintained ties with the Southern states, such as Tennessee, Kentucky, or the Carolinas, where they or their families were from. By the latter half of the war, Confederate sympathies were rampant throughout Williamson and neighboring counties. Confederate-sympathizing guerrilla bands began terrorizing Unionists and discouraging enlistment, and a full-scale riot against Federal troops was even reported to have occurred. Both Union and Confederate supporters engaged in bushwhacking, murder, arson, and pillaging in order to suppress minority opinions throughout the region (Howard 1972:314). It was not until Union troops entered southern Illinois, using brute force and making mass arrests, that southern Illinois's loyalty to the Union was guaranteed (Jensen 1978:69). With the Union occupation of southern Illinois, over 800 deserters were arrested by Federal troops in Perry, Saline, Jackson, and Williamson Counties, 40 percent of the statewide total of arrests for desertion during that time (Goodspeed Publishing Company 1887).

Following the Civil War, an agricultural recession impacted the market prices of tobacco, cotton, grain, and meat, but overall, Williamson County farmers continued to prosper. Increasing regulations on tobacco quickly resulted in a decrease in production, so that by the late nineteenth century it was no longer produced in the county (Wilcox 1905:10). Cotton also ceased to be produced in Williamson County. One unanticipated consequence of the mid- and late-nineteenth-century boom in agricultural production was that the fertile farmlands became exhausted. Lack of proper crop rotation and little or no use of fertilizer led to an overall decrease in the volume of corn and wheat produced in the county. By 1900, many Williamson County farmers had turned to truck farming, producing varieties of berries, fruits, and vegetables (Wilcox 1905:10). By 1930, soybeans had also become one of the county's staple crops (Fehrenbacher and Odell 1959:11).

Industry and railroad building boomed in Williamson County after the Civil War, although some industries, such as coal mining, maintained a continual presence in the county after 1810 (Fehrenbacher and Odell 1959:11). By 1876, at least 10 separate and distinct veins of bituminous coal had been located in the county, and dozens of outcroppings made it easy and inexpensive to mine (Erwin 1876:3). Prior to 1882, coal was mined primarily for household needs. It was not until after this time that Illinois coal began making headway as an energy source for heavy industry (Horsley 1986:107).

In the history of Illinois, Williamson County is second only to Franklin County in the overall production of coal from the nineteenth through the twentieth centuries. With coal mining leading as a major industry in the county for such a long period of time, it is not surprising to find that the majority of the labor pool in the county has been historically comprised of miners. Many of the miners, particularly those that worked for Samuel T. Brush, owner of the St. Louis and Big Muddy Coal Company in the late nineteenth and early twentieth centuries, lived in dilapidated company housing. In addition to the horrible living conditions, most of the miners also worked in unsafe mines, and accidents and deaths were common occurrences (Angle 1952:92–93). As miners in the county moved toward unionization in the late 1890s, tensions increased between union and non-union workers, as well as between European-American and African-American workers, and violence often erupted. Although unionism eventually prevailed throughout the county, antagonism between miners and operators continued throughout the early twentieth century (Angle 1952:92–93).

Williamson County's population has steadily increased from 22,226 in 1890, to 48,621 in 1950, to 61,296 by 2000. In spite of the violence that characterized aspects of Williamson County's history in the nineteenth and early twentieth centuries, industry continues to be attracted to the county's large labor force, good transportation networks, waterways, and coal. Workers have also been attracted to the county's foundry and factories. In addition, agricultural ventures suited to the soils of the county have continued to flourish, typically in the form of grassland farming (Fehrenbacher and Odell 1959:12).

Attachment D. Site Description

11WM364

UTM Coordinates: (NAD 83, Zone 16N) N 4190526.41m; E 340437.86m
Legal Description: NE1/4 NW1/4 NW1/4 Sec 7 T8N R4E (align SE corner)
Elevation: 134 m (440 ft) AMSL
Components: Turn of the twentieth century
Site Type: Historic farm/residence
Size: 1,100 sq m; .11 ha (.27 acres)
Distance/direction to nearest water: Approximately 5 m (16 ft); east
Type and extent of previous disturbance: Agricultural activities (plowing), erosion; 50–75 percent disturbed
Topography: Floodplain
Vegetation: Trees, scrub, grass, and weeds
Soil Series: Bluford silt loam (0–2 percent slope)
Ground surface visibility: Less than 10 percent
Slope direction (Aspect): Flat
Recommended NRHP status: Not eligible

Site Description

Site 11WM364 was previously recorded as a multicomponent site consisting of a turn-of-the-twentieth-century historic farm/residence and a prehistoric open habitation component of unknown age. This site was previously identified by CRA in 2008 during a survey for the Pond Creek No. 1 facilities just west of the current project area (Faberson 2009). The historic component consisted of a moderate to heavy scatter of domestic and architectural artifacts, and the prehistoric component consisted of a single temporally undiagnostic flake. The site had little integrity due to agricultural activities and erosion; therefore, the site within the previous project area was not recommended as eligible for the National Register of Historic Places (NRHP), and no further archaeological investigation was recommended. During the current investigation, the eastern edge of Site 11WM364 was expanded (Figures 9 and 10).

During the current survey, the site area was defined by the presence of cultural material observed in shovel tests. It is located at NE1/4 NW1/4 NW1/4 Sec 7 T8N R4E (align SE corner) (Figures 2 and 3). It was located approximately 290 m (951 ft) east of the intersection of Dean Road and Dwina Road. Site 11WM364 was located on the floodplain of a minor intermittent tributary of Pond Creek. The intermittent stream is approximately 5 m (16 ft) to the east of the site. Note that this stream is not depicted on the 1963 Pittsburg 7.5-minute quadrangle. At the time of the current survey, the vegetation at 11WM364 consisted of secondary growth trees, scrub, grass, and weeds. Visibility was less than 10 percent.

The portion of the site within the current project area was defined by the presence of cultural material in six shovel tests. The site was approximately 50 m (164 ft) north–south and 20 m (66 ft) east–west at its widest extent. The site area was approximately .11 ha (.27 acres) in size.

Investigation Methods

The site was relocated as a result of shovel testing at a 15-m interval, and the site boundaries were delineated using a 5-m grid. Two negative shovel tests at 5-m intervals were used to define the edge of the site. All material from shovel tests was visually inspected and screened through .25-inch mesh. Thirty screened STPs were excavated to delineate the boundaries of the site. Ten shovel tests fall within the indicated site boundary, with six shovel tests (STPs 1–6) yielding cultural material (Figure 9).

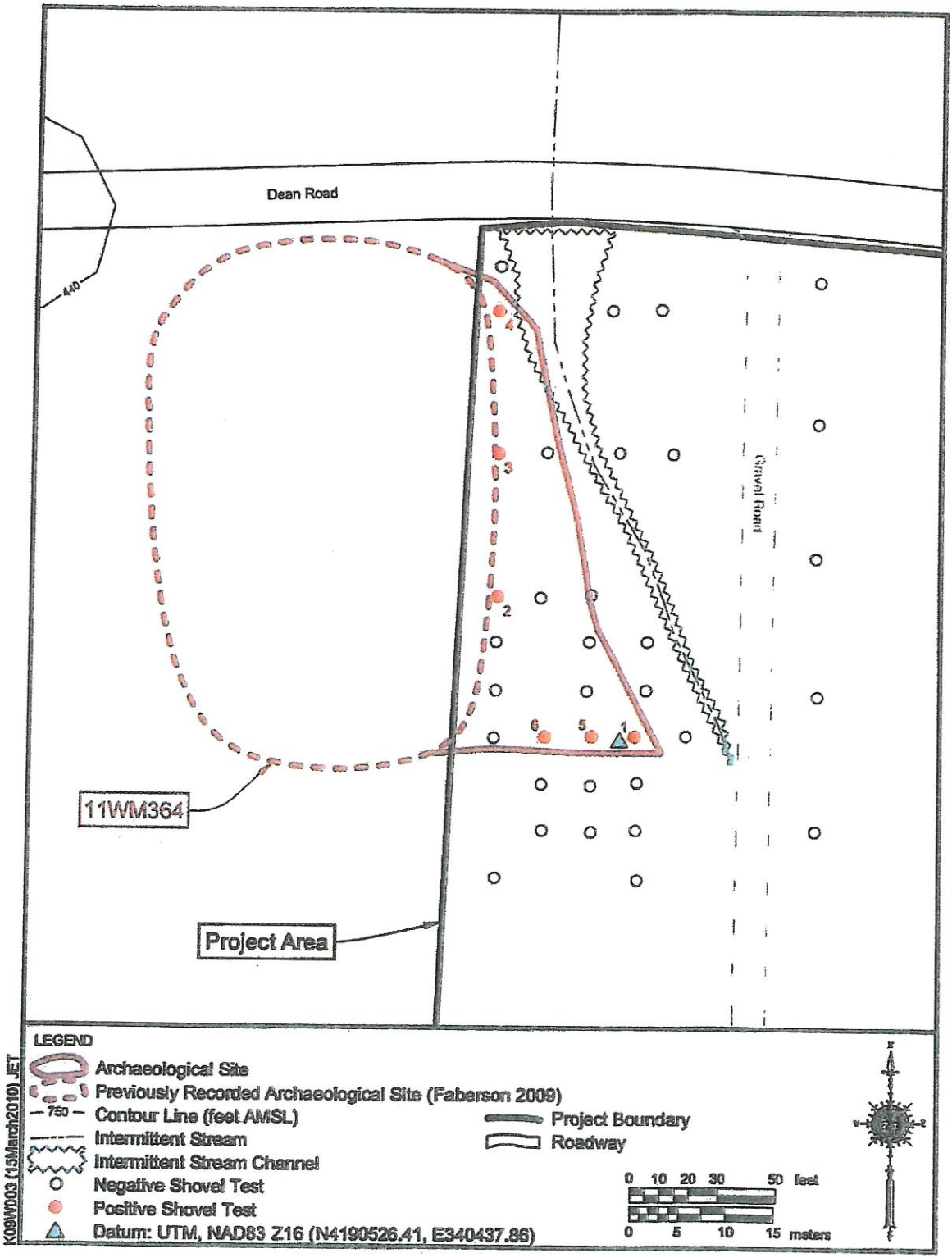


Figure 9. Schematic plan map of 11WM364.



Figure 10. Overview of 11WM364 (facing north).

Data pertaining to the site location was recorded, and the site was indicated on appropriate maps. A site datum was established and its UTM coordinates were recorded using a hand held Magellan MobileMapper GPS unit. A site sketch map was drawn showing the placement of the shovel test positions in relation to physiographic features and the project area boundary. The location of the site was also marked on a copy of the Pittsburg 7.5-minute series quadrangle map (USGS 1963).

Depositional Context

Shovel tests at 11WM364 revealed a shallow plow zone of brown (10YR 5/3) to dark grayish brown (10YR 4/2) silt loam ranging in depth from 10 to 26 cm below ground surface (bgs). The deepest plow zone occurred around STP-2 and STP-3. The plow zone in this area consisted of the darker 10YR 4/2. The subsoil consisted of light yellowish brown (10YR 6/4) to grayish brown (10YR 5/2) silty clay. Manganese concretions were observed in the subsoil. In general, the surface soils observed at 11WM364 appear to have been depleted and disturbed as a result of long-term agricultural activities (plowing).

Site 11WM364 was located on topography mapped as Bluford silt loam (3640A). Bluford series soils are generally characterized by an Ap horizon of brown (10YR 4/3) silt loam from 0 to 17.8 cm bgs underlain by two E horizons of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, 18.0–51.0 cm bgs. A series of Bt horizons underlay the E horizons, and they consist of grayish brown (10YR 5/2) silty clay to gray (10YR 5/1) silty clay loam extending to a depth of more than 1 m bgs (National Resources Conservation Service 2010a, 2010b). Although there was some variation in color, the soils observed at 11WM364 were generally consistent with the Bluford series mapped for this part of the project area. It should be noted, however, that while there was a consistency between the soil profiles observed in the field and the Bluford series, several of the shovel tests were very shallow, suggesting that parts of the site may not only be disturbed due to agricultural activities but erosion as well.

Archival

Tanya Faberson

The earliest known owner of the property containing Site 11WM364 was Cornelius A. Shaw (Table 1). He purchased 28.0 ha (69.3 acres) of land that encompassed the west half of the northwest quadrant of Section 7, Township 8 South, Range 4 East as part of a public domain land tract sale on September 23, 1854 (Williamson County Clerk's Office [WCCO] Deed Book [DB] 112:129). He bought the property for $8.66. In 1850, Cornelius was 24 years old and worked as a mechanic, residing with his widowed mother and his siblings in Williamson County (U.S. Bureau of the Census 1850). Based on the Shaw's neighbors enumerated in the census at that time, such as Samuel Beasley and Thomas Riddle, it appears that the Shaw family resided within the vicinity or near the property in question. Cornelius Shaw was 28 years old when he purchased the 69.3-acre farmstead.

It is not certain when Cornelius sold his property, but it was sometime before 1860. By 1860, he was with his mother and one of his brothers, and they lived in Township 11 Range 4 East (U.S. Bureau of the Census 1860). Between 1854 and 1860, T.F. and Martha A. Clarida acquired 8.1 ha (20 acres) of the original tract. It is unknown whether T.F. and Martha Clarida ever resided on the property. No Claridas could be found in the U.S. Census records in the 1870s, but a number of people with this surname did reside in Township 9 Range 4 East (U.S. Bureau of the Census 1870). On September 5, 1877, T.F. and Martha Clarida sold the 20 acres to Daniel H. Fleming for $150.00 (WCCO DB 8:364).

In 1880, Daniel Fleming, age 33, resided with his wife, Susan C., age 32, and their children Cora and Allie, as well as another child, John Allsup, in the Northern Township of Williamson County. Daniel Fleming worked as a farm hand (U.S. Bureau of the Census 1880). It is unknown exactly where the Flemings resided on their property, but it seems plausible that they resided within the bounds of this 20-acre tract. They resided there for four years, Daniel and Susan C. Fleming selling the 20-acre property to William H. Forbes on September 24, 1881 (WCCO DB 13:22). William Forbes only owned the tract until the following year, when he and his wife, Alsha E. Forbes, sold it to Millard M. Williams on September 1, 1882, for $225 (WCCO DB 18:251). Interestingly, William Forbes and his wife are enumerated in the 1880 census living within the Lake Creek Township (Township 8 South, Range 3 East), but the census taker had crossed out their names after they were listed. It is unknown what the purpose of crossing out their names was. They may have been mistakenly enumerated in that township while living elsewhere, but no further information could be discovered. In 1880 Millard Williams was the 23-year-old son of Terry and Amanda Williams and lived in the Lake Creek Township (U.S. Bureau of the Census 1880). While his father, Terry, was a farmer, Millard was a school teacher at that time. He would have been 25 when he purchased the 20-acre tract in the Northern Township.

Millard Williams owned the property from 1882 until sometime before 1900. The 1900 census indicates that by that year he was residing with his family in the Eagle Creek Township of Gallatin County, Illinois (U.S. Bureau of the Census 1900). In 1901, Millard Williams sold the 20-acre tract to Isam and Annis E. Harris. Isam and Annis Harris appear to never have resided there, living instead in the Barhaus Addition of Johnston City since 1898. On April 12, 1901, the Harrises sold the land to Jasper Williams for $700 (WCCO DB 47:52, 54:211). It is unknown whether Jasper Williams was related to Millard Williams, but he and his family moved to the 20-acre tract at least by 1901 and possibly even earlier. That they moved there is supported by the presence of neighboring community residents who had been there in as early as 1880. In 1900, Jasper was a 56-year-old farmer who resided with his wife, Pattie, age 53, and adult children Millie, age 33, James, age 30, Mallie, age 28, and Walter, age 21 (U.S. Bureau of the Census 1900).

Table 1. Chain of Ownership of Property Containing Site 11WM364.

Date	Quadrant/s	Owner	Acreage	Cost
September 23, 1854	W2NW	Cornelius A. Shaw	69.3	$8.66
Between 1854 and 1860	N2NWNW	T.F. and Martha A. Clarida	20	Unknown
September 5, 1877	N2NWNW	Daniel H. Fleming	20	$150
September 24, 1881	N2NWNW	William H. Forbes	20	$200
September 1, 1882	N2NWNW	Millard M. Williams	20	$225
Between 1882 and 1901	N2NWNW	Isam and Annis E. Harris	20	Unknown
12-Apr-01	N2NWNW	Jasper Williams	20	$700
31-Mar-03	N2NWNW	H.W. Rodgers	20	$750
Between 1908 and 1912	N2NWNW	Henry C. and Janey Rains	20	Unknown
March 9, 1912*	N2NWNW	Jasper and Elizabeth Williams	20	$1,000
July 29, 1913*	N2NWNW	Mary J. Rains	20	$1,000
24-Feb-16	N2NWNW	Gilbert G. Thorne (Madison Coal Company)	20	Unknown

** Excepted were the coal and mineral rights.*

Jasper Williams and his family did not remain on the property long. On March 31, 1903, Jasper and Elizabeth N. Williams sold the property to H.W. Rogers for $750 (WCCO DB 65:443). By that point, the longest ownership/occupation of the land had been by Millard Williams, who may have resided there from 1882 until sometime before 1900. It is not exactly certain whether Millard Williams resided there himself, however. He also owned a 24.3-ha (60-acre) tract just south of this one in the vicinity of 11WM365, and he owned it from 1879 until 1896.

A residence within the bounds of the tract can be seen on the 1908 plat map of Williamson County (Ogle & Co. 1908) and on the 1909 West Frankfort 15-minute quadrangle (USGS 1909) (Figure 7 and 8). It is within the portion of Site 11WM364 adjacent to Dean Road investigated during the current survey. The name on the plat is H.C. Rodgers, and the tract encompassed 4.0 ha (10 acres), not the 20 acres mentioned in the 1903 deed. H.C, or Henry C. Rodgers, whose name is shown as landowner on the 1908 plat map, was the son of James W. Rodgers, a local farmer. James Rodgers and his family were natives of Tennessee, having immigrated to Williamson County, Illinois, sometime between 1880 and 1900 (U.S. Bureau of the Census 1880).

By 1910, the Rodgers family had moved to the Southern Township of Williamson County (U.S. Bureau of the Census 1910). Many of their neighbors had also moved out of the area, their lands having been sold to Samuel T. Brush, owner of the St. Louis and Big Muddy Coal Company (refer to Historic Context section of this report), at the turn of the twentieth century. It is not certain when Rodgers actually sold the tract, but the coal and mineral rights likely had been sold to Samuel T. Brush between 1903 and 1905.

Between 1908 and 1912, Henry C. and Janey Raines acquired the land, probably from the Rodgers family. They owned a 6.1-ha (15-acre) tract directly across Dean Road from the Rodgers tract they purchased. They in turn sold it to Jasper and Elizabeth Williams on March 9, 1912, for $1,000.00 (WCCO DB 108:220). Jasper and Elizabeth Williams had owned the property nearly a decade earlier. It should be noted that the property contained 20 acres, not the 10 acres shown on the 1908 plat. In the sale to Jasper and Elizabeth Williams, excepted in the deed were the coal and mineral rights underlying the land. Just one year later, on July 29, 1913, Jasper and Elizabeth Williams resold the 20-acre tract to Mary J. Raines for $1,000.00 (WCCO DB 124:571). Mary J. Raines was likely the same "Janey Raines" who had owned the property with her husband, Henry C. Raines, between 1908 and 1912. The fact that Jasper and Elizabeth Williams owned the property for only one year and then sold it back to Mary J. Raines suggests that the property remained under the Raines's care and control, since they purchased it sometime between 1908 and 1912. However, it is uncertain whether they ever resided in the same residence as the Rodgers family shown on the 1908 and 1909 maps, because a residence is shown within the bounds of their property across Dean Road.

By 1916, the former Rodgers land was owned by the Madison Coal Company, owned by George G. Thorne (WCCO DB 124:571). However, it appears that Mary J. Raines either utilized the property or resided there until at least 1940. In 1920, she continued to be associated with the Rodgers tract as well as the tract across Dean Road. But on the 1940 plat, her name is exclusively associated with the former Rodgers tract, which suggests that between 1908 and 1940 she may have changed her residence from the tract across Dean Road to the residence in the 11WM364 site area on the former Rodgers tract (Marion Daily Republican and Marion Weekly Leader 1940; Williamson County Historical Society 2001).

Artifacts

Jennifer Faberson

Methods

The following provides a descriptive discussion of the types and age of artifacts recovered from Site 11WM364. The historic assemblage includes artifacts classified and grouped according to a scheme originally developed by Stanley South (1977). South believed that his classification scheme would present patterns in historic site artifact assemblages that would provide cultural insights. Questions of historic site function, the cultural background of a site's occupants, and regional behavior patterns were topics to be addressed using this system.

South's system was widely accepted and adopted by historical archaeologists. However, some have criticized South's model on theoretical and organizational grounds (Orser 1988; Wesler 1984). One criticism is that the organization of artifacts is too simplistic. Swann (2002) observed that South's groups have the potential to be insufficiently detailed. She suggested the use of subgroups to distinguish between, for example, candleholders used for religious purposes and those used for general lighting. Others, such as Sprague (1981), have criticized South's classification scheme for its limited usefulness on late nineteenth- and early twentieth-century sites, sites which include an array of material culture—such as automobile parts—not considered by South. Despite its shortcomings, most archaeologists recognize the usefulness of South's classification system to present data.

Stewart-Abernathy (1986), Orser (1988), and Wagner and McCorvie (1992) have subsequently revised this classification scheme. In this report, artifacts were grouped into the following categories: domestic, architecture, and personal. The artifacts recovered during this project are summarized in Table 2.

Table 2. Historic Artifacts Recovered According to Functional Group.

Group	Total	Percent
Architecture	9	75
Domestic	2	16.7
Personal	1	8.3
Totals	12	100

Grouping artifacts into these specific categories makes it more efficient to associate artifact assemblages with historic activities or site types. One primary change associated with the refinement of these categories is reassigning artifacts associated with the "Miscellaneous and Activities" under South's (1977) original system. Considering the potential variety of historic dwellings and outbuildings within the project area, a refinement of the artifact groupings was considered important to perhaps observe whether the distribution of specific artifact groups would produce interpretable patterns related to activity areas or structure types. Each one of these groups and associated artifacts is discussed in turn.

Information on the age of artifacts as described in the artifact tables is derived from a variety of sources cited in the discussion of the materials recovered. The beginning and ending dates cited need some clarification. Usually, an artifact has specific attributes that represent a technological change, an invention in the manufacturing process, or simple stylistic changes in decoration. These attribute changes usually have associated dates derived from historical and archaeological research. For example, bottles may have seams that indicate a specific manufacturing process patented in a certain year. The bottle then can be assigned a "beginning," or incept, date for the same year of the patent. New technology may eliminate the need for the same patent and the bottle would no longer be produced. The "ending," or terminal, date will be the approximate time when the new technology took hold and the older manufacturing processes are no longer in use.

Specific styles in ceramic decorations are also known to have changed. Archaeological and archival researchers have defined time periods when specific ceramic decorations were manufactured and subsequently went out of favor (e.g., Lofstrom et al. 1982; Majewski and O'Brien 1987). South's (1977) mean ceramic dating technique uses this information. The dates presented here should not be considered absolute but are the best estimates of an artifact's age available at this time. A blank space indicates that the artifact could not be dated, or alternately, that the period of manufacture was so prolonged that the artifact was being manufactured before America was colonized. An open-ended terminal date was assigned for artifacts that may be acquired today. The rationale for presenting dates for the artifacts recovered is to allow a more precise estimate of the time span the site was occupied, rather than the mean occupation date of a site.

A summary of the artifacts recovered follows. A complete inventory of the historic artifacts can be found in Attachment G.

Architecture Group

The architecture group is comprised of artifacts directly related to buildings, as well as those artifacts used to enhance the interior or exterior of buildings. These artifacts primarily consisted of window glass, plate glass, nails, and construction materials, such as brick. The architecture group is discussed below.

Construction Materials

Construction materials refer to all elements of building construction. For this project, the building materials collected included brick and tile fragments. When possible, bricks were separated into hand-made, machine-made, and indeterminate brick fragments. Bricks were further separated based on other diagnostic features such as vitrification, which often occurs on paver bricks. Hand-made or early machine-made bricks often have a glaze resulting from the sand in the clay turning to glass in the kiln. The paste is usually more porous and the shape of the early bricks is more irregular. The later machine-made bricks have a harder, more consistent paste and are uniform in shape. Machine-made bricks will often have marks in the clay related to the machine manufacturing process (Greene 1992; Gurcke 1987). Since no research has been conducted regarding the local history of brick-making facilities near the project area, the brick fragments recovered were not assigned specific dates. However, in Franklin County, Kentucky hand-made bricks were generally produced before 1880 and machine-made bricks were generally produced after 1880 (Hockensmith 1997). It is likely that bricks in Williamson County, Illinois were made around the same time period since many areas in the Ohio Valley region manufactured items during a relatively similar time frame.

Flat Glass

Cylinder glass was developed in the late-eighteenth century to enable the inexpensive production of window glass. With this method, glass was blown into a cylinder and then cut flat (Roenke 1978:7). This method of producing window glass replaced crown glass, which dated back to the

Medieval period, and could only be made into very small, usually diamond shaped, panes (Roenke 1978:5). Cylinder glass was the primary method of window glass production from the late eighteenth century through the early twentieth century, wheat which time cylinder glass windows were slowly replaced by plate glass windows, whose production became mechanized after 1900 but did not become a commercial success in the U.S. until around 1917 (Roenke 1978:11).

Cylinder window glass has been shown to gradually increase in thickness through time and can be a useful tool for dating historic sites. Several dating schemes and formulas have been devised that use average glass thickness to calculate building construction or modification dates. These include Ball (1984), Roenke (1978), and Chance and Chance (1976), to name a few. Like previously derived formulas, Moir (1987) developed a window glass dating formula to estimate the initial construction dates for structures built primarily during the nineteenth century. Although Moir (1987:80) warns that analysis on structures built prior to 1810 or later than 1915 have shown poor results, most research in this area shows the regression line extending back beyond 1810 (Moir 1977; Roenke 1978). Hence, dates calculated back to 1785 were considered plausible. Sample size is also a consideration when using the Moir window glass regression formula. According to Moir (1987:78), sample sizes also need to be "reasonable and not collected from a point or two" in order to accurately date the construction of a building. For the purposes of this investigation, a "reasonable" sample size is considered 25 window glass sherds.

Each fragment of flat glass was measured for thickness and recorded to the nearest hundredth of a millimeter using digital calipers. The differences between cylinder window glass, mirror glass, and plate glass were in part determined by the thickness and wear of each flat glass fragment. Although Moir (1987:80) states that dating window glass after 1915 is not as reliable for dating sites, for our purposes, window glass that measured 2.41 mm (dating to 1916) was included in the calculations; because according to Roenke (1978:11), plate glass does not become widely or successfully produced in the U.S. until 1917.

Nails

There are three stages recognized in the technological chronology of nails: wrought nails, cut nails, and wire-drawn nails.

Wrought nails were handmade and were the primary type of construction fastener in the eighteenth and early-nineteenth centuries. Their use ended around 1810 with the widespread use of square cut or machine cut nails (Nelson 1968:8).

The cut nail, introduced in approximately 1800, originally had a machine-cut body with a hand-made head. Around 1815, crude machine-made heads replaced hand-made heads on cut nails, and overall, cut nails replaced wrought nails in the construction industry. Early fully machine-cut nails exhibit a "rounded shank under the head," and therefore, often appear pinched below the head of the nail (Nelson 1968:8). By the late 1830s, these "early" fully machine-cut nails were replaced with "late" fully, or modern, machine-cut nails.

The first wire-drawn nails were introduced into the United States from Europe by the mid-nineteenth century. These early wire nails were primarily used for box construction and were not well-adapted for the building industry until the 1870s. Although the cut nail can still be purchased today, the wire nail nearly universally replaced it by the turn-of-the-twentieth century (Nelson 1968:8) (Figure 11a). Nails may be useful for suggesting a general date range for individual sites and project areas due to the specific date ranges for each nail type.

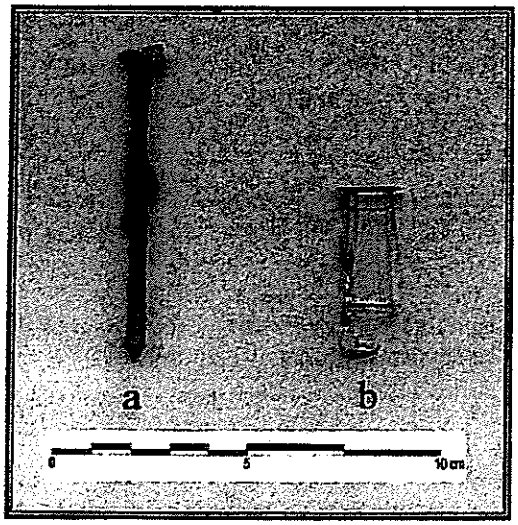


Figure 11. Historic artifacts recovered: (a) wire nail from STP-6; (b) BIM amethyst glass tooled finish lip from STP-4.

Domestic Group

Artifacts included in the domestic group consist of ceramics, container glass, glass tableware, container closures, cookware, utensils, metal food containers, housekeeping items, and undiagnostic container glass. Only two of these classes were represented in the historic assemblage recovered from the current survey.

Container Glass

One container glass fragment was recovered during the current survey. Research by Baugher-Perlin (1982), Jones and Sullivan (1985), and Toulouse (1972) was used to date glass containers. Glass color was the only attribute that could be used for dating those fragments that were not be identifiable as to type of manufacture.

The approximate date of manufacture for bottles and bottle fragments recovered from the project area was established by determining the manufacturing process associated with the bottle (i.e., creation of the base and lip of the container) and using any patent or company manufacturing dates embossed on the bottle.

The lip on a bottle can be informative. A lipping tool, patented in the U.S. in 1856, smoothes and shapes the glass rim into a more uniform edge than a hand-smoothed lip or "laid-on ring." Certain types or styles of lips were associated with specific contents; for example, medicines were often contained in bottles with prescription lips (Jones and Sullivan 1985). A "sheared" or unfinished bottle lip typically dates before 1880.

Lipping tools were used throughout the middle and end of the nineteenth century until the advent of the fully automatic bottle machine (ABM) in 1903. It should be noted, however, that as automated bottle manufacture became available after the turn of the twentieth century (see below), tooled finishes continued to be produced—albeit in steadily decreasing numbers. That is, there is a lag time between tooled finishes and ABM finishes, and although ABM glass is given an incept date of 1903, most tooled-glass vessel sherds will be given a terminal date around the 1920s due to this lag time, unless other diagnostic characteristics are observed, enabling one to give it an earlier terminal date.

The manufacturing process can be roughly divided into three basic groups: free blown, blown in mold (BIM), and machine manufactured (ABM) vessels (Baugher-Perlin 1982:262–265). Only BIM glass was recovered from the current project (Figure 11b).

BLOWN IN MOLD (BIM)

Most molded bottles are constructed in pieces and have distinctive seams. The dip mold was used from the late seventeenth through the mid-nineteenth century (Baugher-Perlin 1982:262). It leaves no seams, unless glass adhered to the edges of the bottle mold as it was attached to the free blown shoulder and bottle neck. The key mold, on the other hand, was a type of two-piece mold that was used from about 1750 to 1880 (Jones and Sullivan 1985:27). Key mold seams cross the base and are concealed in the corners of a flat-sided body.

The turn paste mold was used from about 1870 to the early twentieth century and does not contain seams, because the glass is blown into a container that is spun. The glass conforms to the mold from the centrifugal force produced. Vessels formed from this process usually have faint horizontal lines from the spinning process. The three-part mold has seams running around the shoulder of the vessel and partially up its neck. This style of mold lost popularity around 1870. The blow back mold was another mold type, and this was used in the manufacture of jars such as the distinctive Mason jar, which was patented in 1858.

Embossing on container glass vessels was made possible by engraving the mold the glass was blown into. This was first conducted in the mid-eighteenth century and continued into the twentieth century. The panel bottle came into popular existence around 1860, and the shape of this vessel was useful, because the name of the commodity or the manufacturing company could be changed on the bottle form by substituting a different "slug-plate" into the mold. This process can be identified through the distinctive seams, because they follow the rectangular shape of the nameplate. The date of the manufacturer's patent on the bottle and the name of the company, when present, can often be utilized to determine a date of manufacture for the container.

Jones and Sullivan (1985) observed that chemicals color glass, either as natural inclusions or additions by the manufacturer. According to Munsey (1970:55), amethyst glass began to be manufactured around 1880, when manganese was being added to the glass recipe. Although initially colorless, the glass will turn a distinctive purplish color when exposed to sunlight over time. This glass generally went out of production in 1914 with the beginning of World War I, since the manganese required for amethyst glass had generally been provided by the Germans to American manufacturers in the years preceding the war. Amber glass had a general application in the mid-nineteenth century but was not widely used until after 1860. With the growing public desire to see the contents of the bottles, clear glass came into demand and was popular beginning in the 1860s (Baugher-Perlin 1982:261). However, it should be noted that clear glass was available to a limited degree before this time. Olive, aqua, and light green colored glass were also used for many different containers but cannot be assigned specific dates due to their long periods of use over the last several centuries and continuing popularity.

Glass Tableware

Press molding was first used (although on a very small scale) in England in the late seventeenth century to make small solid glass objects, such as watch faces and imitation precious stones (Buckley 1934). By the end of the eighteenth century, decanter stoppers and glass feet for objects were also being produced (Jones and Sullivan 1985). The production of complete hollowware glass objects did not become possible until there were innovations in press-molded techniques in the United States during the late 1820s (Watkins 1930). Mass production of press-molded glassware was well established by the 1830s (Watkins 1930).

Earlier press-molded glass objects were predominantly made of colorless lead glass (Jones and Sullivan 1985). William Leighton of the Hobbs-Brockunier Glass Works in Wheeling, West Virginia, invented lime glass. This type of glass looked like lead glass, had superior pressing attributes, and was much more inexpensive than lead glass (Revi 1964). Advancements in mold technology in the 1860s and 1870s led to the application of steam-powered mold operation. This in turn led to increased production and reduced costs (Revi 1964). Modern press molding is conducted entirely by machine (Jones and Sullivan 1985).

Press-molded table glass was made by dropping hot pieces of glass into a mold. A plunger was then forced into the mold, pressing the hot glass against it. The outer surface of the glass took on the form of the mold, while the inner surface of the glass was shaped by the plunger. The plunger was withdrawn, and the glass object was removed from the mold. The surface of the glass was often fire polished to restore the brilliance of the glass surface that was disturbed by its contact with the mold (Jones and Sullivan 1985).

Press-molded glass may be recognized by several characteristics. Usually, the glass object must be open topped in order for the plunger to be withdrawn from the mold. Narrow mouthed vessels were produced, but additional manipulation of the glass was necessary after the plunger was removed from the mold. Evidence of this manipulation should be present on the vessel (Jones and Sullivan 1985). There is no relationship between the exterior shape and design of a press-molded vessel to the interior shape and design, because the plunger shapes the interior of the object, most often leaving behind a smooth surface. This differs from earlier glass vessel production techniques like blown glassware, where interior shape was related to the exterior shape and design (Jones and Sullivan 1985).

Another characteristic of press-molded containers was that mold seams were generally present. The seams were sharp and distinct, unless steps had been taken to deliberately remove them. The texture of the glass surface of press-molded glass was disturbed and often disguised by an all-over stipple design. The edges of the designs on press-molded glass had a predisposition toward rounded edges. The bases of press-molded objects were usually polished. The quality of the designs on press-molded glassware was precise and the design motifs were numerous (Jones and Sullivan 1985).

In contrast to press-molded glass, cut glass generally had a polished, smooth, and glossy surface texture. The design edges were sharp and distinct. Cut glass designs consisted mostly of panels, flutes, and miters. The designs were often slightly uneven and asymmetrical. Mold seams were usually absent; they were polished off prior to cutting (Jones and Sullivan 1985). Contact-molded glass also differs from press-molded glass in that the exterior and interior of the vessel will portray parallel patterns. The interior of the vessel is also generally much more diffuse towards the base (see container glass section above for full descriptions of glass colors).

Personal Group

The personal group includes artifacts assumed to have belonged to individuals. This category of artifacts includes health and grooming items, jewelry and beads, coins, music and art items, personal items, toys, and games. Tobacco products are also subsumed into this category. An artifact related to health and grooming was recovered from the project area. This item was an opaque white glass cosmetics jar fragment. Opaque white glass was generally used from the early nineteenth century through the last half of the twentieth century.

Description of Recovered Historic Artifacts

There were 12 historic artifacts recovered from Site 11WM364 during the current phase I survey, including architecture (n = 9), domestic (n = 2), and personal (n = 1) items. The domestic group

consisted of container glass and glass tableware. Note that charcoal flecks and traces of brick were also observed but not collected in STP-3.

One container glass fragment was recovered from this site. This sherd was identified as BIM glass. This sherd was an amethyst glass, tooled, patent finish lip dating from 1870 to 1920 (Lindsey 2008; Rock 1980:9). This item was further identified as an extract bottle fragment. One glass tableware fragment was also recovered. This artifact was a press-molded amethyst glass fragment dating from 1870 to 1920 (Lockhart 2006:54).

Architectural debris included two indeterminate brick fragments, one tile fragment, one window glass sherd, three plate glass sherds, and two wire nails. The brick and tile fragments were not assigned specific dates. The window glass found at this site dated to 1913. Moir's window glass technique, which relies on statistically meaningful samples from discreet contexts for accuracy, was not used to determine the approximate site date, since only one sherd was found. The plate glass dated from 1917 to the present (Roenke 1978:11). The wire nails recovered from this site both dated after 1880 (Nelson 1968).

The personal group item recovered from this site was identified as an opaque white glass cosmetics jar fragment dating from 1830 to 1960 (Fike 1987:13; Husfloen 1992:163; Lindsey 2008).

The artifacts recovered from this site were manufactured beginning in the 1830s. However, all of the artifacts recovered from this site were also manufactured into the twentieth century. The artifacts recovered from the site are indicative of a turn-of-the-twentieth-century residential occupation. The presence of brick, window glass, plate glass, and wire nails supports the presence of a structure during this time period. It is plausible that the scatter observed at 11WM364 during the current survey is a material remnant of the occupation and demolition of the structures observed on the 1908 and 1909 maps. This building was razed sometime in the early to mid-twentieth century, and there are no intact deposits.

Features

No features, prehistoric or historic, were observed during the current investigations of the portions of the site within the limits of the project area. In addition, no fire cracked rock (FCR) or burnt soil was observed that would indicate the presence of a prehistoric component. Charcoal flecks and traces of brick were observed in STP-1, STP-2, and STP-3. These remains may have been associated with a structure depicted on the 1908 and 1909 maps. However, there was no evidence of an intact structure, such as a foundation, observed during the previous (Faberson 2009) or current investigation. All cultural material in this area was recovered from a plow zone context.

Table 3. Historic Artifacts Recovered From Site 11WM364.

STP	Type	Min Date	Max Date	Count
STP-1	Window Glass	1913	1913	1
STP-1	Plate Glass	1917		1
STP-2	Brick, indeterminate			1
STP-4	Container glass, amethyst, BIM	1870	1920	1
STP-4	Brick, indeterminate			1
STP-4	Cosmetic container, opaque white glass	1830	1960	1
STP-5	Nail, wire	1880		1
STP-6	Glass tableware, amethyst, press mold	1870	1920	1
STP-6	Nail, wire	1880		1
STP-6	Tile, ceramic			1
STP-6	Plate Glass	1917		2
Total				12

Summary and National Register Evaluation

Site 11WM364 is located at NE1/4 NW1/4 NW1/4 Sec 7 T8N R4E (align SE corner) of Section 7 Township 8 South Range 4 East. Unless mining activities are altered, the portion of 11WM364 within the bounds of the project area will be impacted by the proposed mining operation. Based on the previous investigation, the site had little integrity due to agricultural activities and erosion. Therefore, the site within the previous project area was not recommended as eligible for the NRHP, and no further archaeological investigation was recommended. The portion of Site 11WM364 investigated during the current survey showed the same lack of integrity. Only a small quantity of artifacts were recovered, and there was no evidence of intact archaeological deposits. Agricultural activities and erosion have severely disturbed this portion of the site. Further research within this portion of the site would likely yield little or no results beyond those recorded during the current survey. Hence, Site 11WM364 is not significant and is not considered eligible for inclusion in the NRHP. As a result of this investigation, no historic properties listed in, or considered eligible for listing in, the NRHP will be affected by the proposed mine operation, and as such, cultural resource clearance is recommended.

Attachment E. References

Angle, Paul M.
1952 *Bloody Williamson: A Chapter in American Lawlessness.* Alfred A. Knopf, New York.

Ball, Donald B.
1984 Historic Artifact Patterning in the Ohio Valley. *Proceedings of the Second Annual Symposium on Ohio Valley Urban and Historic Archaeology* 2:24-36. Indianapolis.

Baugher-Perlin, Sherene
1982 Analyzing Glass Bottles for Chronology, Function, and Trade Networks. In *Archeology of Urban America*, edited by Roy Dickens pp. 250-291. Academic Press, New York.

Buckley, Francis
1934 Old English Glass. The Birmingham Glass Pinchers. *Glass* 11(May):187-188.

Chance, David H. and Jennifer V. Chance
1976 *Kanaka Village, Vancouver Barracks 1974.* Reports in Highway Archaeology, No. 3.

Erwin, Milo
1876 *The History of Williamson County, Illinois, from the Earliest Times Down to the Present.* Williamson County Historical Society, Marion, Illinois.

Faberson, Tanya A.
2009 *A Cultural Resource Survey for a Proposed 183-Acre Williamson Energy Pond Creek 1 Coal Mine Operation in Section 7, Township 8 South, Range 4 East In Williamson County, Illinois (Permit Application Number 375).* Contract Publication Series 08-164. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Fehrenbacher, J. B., and R. T. Odell
1959 *Williamson County Soils.* Soil Report 79. Agricultural Experiment Station, University of Illinois, Urbana, Illinois.

Fike, Richard E.
1987 *The Bottle Book: A Comprehensive Guide to Historic, Embossed Medicine Bottles.* Pergerine Smith Books, Salt Lake City, Utah.

General Land Office
1807 Corinth Township. Electronic document, http://landplats.ilsos.net/, accessed February 25, 2010.

1837 Corinth Township. Electronic document, http://landplats.ilsos.net/, accessed February 25, 2010.

Goodspeed Publishing Company
1887 *History of Gallatin, Saline, Hamilton, Franklin and Williamson Counties.* Goodspeed Publishing Company, Chicago, Illinois.

Greene, Lance K.
1992 The Penfield is Mightier than the Sword: Machine Made Bricks in Knoxville and Knox Co. Tennessee. In *Proceedings of the Tenth Symposium on Ohio Valley Urban and Historic Archaeology*, edited by Amy Young and Charles Faulkner, pp. 74-91. Tennessee Anthropological Association Miscellaneous Paper No. 16.

Gurcke, Karl
1987 *Bricks and Brickmaking, a Handbook for Historical Archeology.* The University of Idaho Press, Moscow.

Hockensmith, Charles D.

1997 A Study of Frankfort Bricks and Brickmaking, Franklin County, Kentucky. *Tennessee Anthropologist* 22(2):121–176.

Horsley, A. Doyne
1986 *Illinois: A Geography*. Westview Press, Boulder, Colorado.

Howard, Robert P.
1972 *Illinois: A History of the Prairie State.* William B. Eerdmans Publishing Company, Grand Rapids, Michigan.

Husfloen, Kyle
1992 *Collector's Guide to American Pressed Glass 1825–1915.* Wallace-Homestead Book Company, Radnor, Pennsylvania.

Jensen, Richard J.
1978 *Illinois: A History*. University of Illinois Press, Urbana, Illinois.

Jones, Olive and Catherine Sullivan
1985 *The Parks Canada Glass Glossary for the Description of Containers, Tableware, Flat Glass, and Closures*. Studies in Archaeology, Architecture and History. National Historic Parks and Sites Branch, Parks Canada.

Lindsey, Bill
2008 Historic Glass Bottle Identification and Information. Electronic document, http://www.sha.org/bottle/index.htm, accessed December 11, 2008.

Lockhart, Bill
2006 The Color Purple: Dating Solarized Amethyst Container Glass. *Historical Archaeology* 40(2):45–56.

Lofstrom, Edward U., Jeffrey P. Tordoff and Douglas C. George
1982 A Seriation of Historic Earthenwares in the Midwest, 1780-1870. *Minnesota Archaeologist* 41(1):3-29.

Majewski, Teresita and Michael J. O'Brien
1987 The Use and Misuse of Nineteenth-Century English and American Ceramics in Archaeological Analysis. In *Advances in Archaeological Method and Theory*, Volume 11, pp 97-209. Edited by Michael J. Shiffer. Academic Press, New York.

Marion Daily Republican and Marion Weekly Leader
1940 *Plat Book of Williamson County, Illinois, 1940*. Marion, Illinois.

Moir, Randall W.
1977 Window Glass: A Statistical Perspective. Manuscript on file, Archaeology Research Program, Southern Methodist University, Dallas, Texas.

1987 Socioeconomic and Chronometric Patterning of Window Glass. In *Historic Buildings, Material Culture, and People of the Prairie Margin*, edited by David H. Jurney and Randall W. Moir pp. 73-81. Richland Creek Technical Series vol. V. Southern Methodist University, Dallas Texas.

Munsey, Cecil
1970 *The Illustrated Guide to Collecting Bottles*. Hawthorn Books, Inc., New York.

Musgrave, Jon
2004 Africa, Illinois. Electronic document, http://www.illinoishistory.com/africa.html, accessed May 25, 2006.

National Resources Conservation Service

2010a Official Soil Series Descriptions (OSD). Electronic document, http://soils.usda.gov/technical/classification/osd/index.html, accessed March 5, 2009.

2010b Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed March 4, 2009.

Nelson, Lee H.
1968 *Nail Chronology as an Aid to Dating Old Buildings.* American Association for State and Local History, Technical Leaflet 15.

Ogle, George A., & Co.
1908 *Williamson County Illinois Including a Plat Book of the Villages, Cities, and Townships of the County.* George A. Ogle & Co., Chicago, Illinois.

Orser, Charles E.
1988 *The Material Basis of the Postbellum Tenant Plantation.* The University of Georgia Press, Athens.

Revi, Albert C.
1964 *American Pressed Glass and Figure Bottles.* Thomas Nelson and Dons, New York.

Rock, James T.
1980 American Bottles: A Few Basics. Manuscript on file at the Klamath National Forest, Region B, United States Department of Agriculture.

Roenke, Karl G.
1978 *Flat Glass, Its Use as a Dating Tool for Nineteenth Century Archeological Sites in the Pacific Northwest and Elsewhere.* Northwest Anthropological Research Notes, Memoir No.4. Moscow, Idaho.

South, Stanley
1977 *Method and Theory in Historical Archaeology.* Academic Press, New York.

Sprague, Roderick
1981 A Functional Classification for Artifacts from 19th and 20th Century Historical Sites. *North American Archaeologist* 2(3):251-261.

Stewart Abernathy, Leslie C.
1986 *The Moser Farmstead, Independent But Not Isolated: The Archeology of a Late Nineteenth Century Ozark Farmstead.* Arkansas Archeological Survey Research Series No. 26, Fayetteville.

Swann, Brenda M.
2002 Material Culture at Presidio Santa Maria de Galve (1698-1722): Combining the Historical and Archaeological Records. *Southeastern Archaeology* 21(1):64-78.

Toulouse, Julian H.
1972 *Bottle Makers and Their Marks.* Thomas Nelson, New York.

United States Geological Survey
1909 West Frankfort, Illinois. 15-minute series topographic quadrangle. United States Geological Survey, Washington, D.C.

1963 Pittsburg, Illinois 7.5-minute series topographic quadrangle. Digital Series map o37088g7, United States Geological Survey, Washington, D.C.

Wagner, Mark and Mary McCorvie

1992 *The Archeology of the Old Landmark. Nineteenth Century Taverns Along the St. Louis Vincennes Trace in Southern Illinois*. Illinois Department of Transportation and the Center for American Archeology, Kampsville.

Warner & Beers, Proprietors
1972 [1876] *Atlas of the State of Illinois to Which are Added Various General Maps and Illustrations*. Union Atlas Company, Chicago, Illinois. Reprinted 1972. Mayhill Publications, Knightstown, Indiana.

Watkins, Lura Woodside
1930 *Cambridge Glass 1818 to 1888: The Story of the New England Glass Company*. Bramhall House, New York.

Wesler, Kit W.
1984 A Spatial Perspective on Artifact Group Patterning Within the Houselot. In *Proceedings of the Symposium on Ohio Valley Urban and Historic Archeology*, vol. II, edited by Donald B. Ball and Phillip J. Diblasi, pp. 37-44. Louisville, Kentucky.

Wilcox, J. F.
1905 *Historical Souvenir of Williamson County, Illinois*. The LeCrone Press, Effingham, Illinois.

Williamson County Historical Society
2001 [1920] Williamson County Illinois Plat Map. Williamson County Historical Society, Marion, Illinois.

Attachment F. Site Form

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson
Field Number: 11Wm364
Quadrangle (7.5'): Pittsburg
Site Name:
Revisit: Y
State Site No.:
Date Recorded:

LEGAL DESCRIPTION (to quarter quarter quarter section)

Align: SE	**1/4s:** NE	NW	NW	**Section:** 7	**Township:** 8	S	**Range:** 4	E
Align:	**1/4s:**			**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**			**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**			**Section:**	**Township:**		**Range:**	

UTM Coordinates (by ISM): **UTM Zone:** **UTM North:** **UTM East:** **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain
Nearest Water Supply: intermittent
Soil Association:
Drainage:
Elevation (in meters): 134
Description: This portion of Site 11Wm364 in on a floodplain setting. It borders an minor intermittant tributary of Pond Creek. The tributary valley is indicated by the 440 ft contour line on the Pittsburg quadrangle. However, the stream is not depicted on the quad.

SURVEY

Project Name: Williamson Energy Phase I
Ground Cover (List up to 3): Weeds Grass Brush
Survey Methods (List up to 2): Shovel Test
Site Type (List up to 2): Habitation
Site Area (square meters):
Visibility (%): 0
Standing Structures: N

SITE CONDITION

Extent of Damage: Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or estimate): 0
Prehistoric Diagnostic Artrifacts: N
Prehistoric Surface Features: N
Number of Historic Artifacts (count or estimate): 12
Historic Diagnostic Artifacts: Y
Historic Surface Features: N
Description: 1 BIM clear container glass frag., 1amethyst glass tableware frag., 2 indeterminate brick frag., 1 tile frag., 1 window glass sherd, 3 plate glass sherds, 2 wire nails, and 1 opaque white glass cosmetics jar frag. Some charcoal and brick flecks observed.

TEMPORAL AFFILIATION (check all that apply)

Prehistoric Unknown:	**Late Archaic:**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian:	**Woodland:**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early Woodland:**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native American:**	**Early Industrial (1871-1900):** Y
Middle Archaic:	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmsteam/residence component dates to the turn of the 20th century based on recovered artifacts. No historic features were observed. House shown on 1908 plat map of Williamson County and on 1909 West Frankfort 15-minute quad.

Surveyor: Jason Anderson
Site Report by: Jason Anderson
IHPA Log No.:
Compliance Status:
Institution: CRA
Institution: CRA
Survey Date: 3/02/2010
Date: 3/11/2010
IHPA First Sur. Doc. No.:
Curation Facility: ISM
NRHP Listing: N

Attachment G. Historic Artifact Database

Table G-1. Historic Materials Recovered.

Bag	Site	Unit #	Dep	Cat #	Group	Class Definition	Type Definition	Combined Attributes	Count	Weight	Diameter	Vessel Part	Vessel Type	Function	MinDate	MaxDate
1	11Wm364	STP 1	0-10 cm bgs	118	A	Flat Glass	Window Glass		1		2.38				1913	1913
1	11Wm364	STP 1	0-10 cm bgs	119	A	Flat Glass	Plate Glass	Flat glass	1						1917	
2	11Wm364	STP 2	0-26 cm bgs	120	A	Construction Material	Brick	Indeterminate brick: non-vitrified	1	2.3						
4	11Wm364	STP 4	0-22 cm bgs	121	D	Container Glass	BIM	Amethyst glass, tooled, patent	1			Lip	Extract	Bottle	1870	1920
4	11Wm364	STP 4	0-22 cm bgs	122	A	Construction Material	Brick	Indeterminate brick: non-vitrified	1	3.3						
4	11Wm364	STP 4	0-22 cm bgs	123	P	Health and Grooming	Cosmetic Container	Opaque white glass	1						1830	1960
5	11Wm364	STP 5	0-10 cm bgs	124	A	Nails	Wire Nail		1						1880	
6	11Wm364	STP 6	0-10 cm bgs	125	D	Glass Tableware	Press mold: unleaded	Amethyst glass	1			Rim			1870	1920
6	11Wm364	STP 6	0-10 cm bgs	126	A	Nails	Wire Nail	16d, Unaltered, Common	1						1880	
6	11Wm364	STP 6	0-10 cm bgs	127	A	Construction Material	Ceramic	Tile	1						1917	
6	11Wm364	STP 6	0-10 cm bgs	128	A	Flat Glass	Plate Glass	Flat glass	2							

R09522

Attachment H. Vita

Jason M. Anderson, MA	Field Supervisor	
Availability: Immediate **Email:** anderson@crai-ky.com	**Specific Duties:** • Supervise fieldwork • Report preparation • GIS specialist • Web-site administration	**Education and Training:** • M.A. anthropology, Ball State University, Muncie, Indiana • B.A. anthropology, Ball State University, Muncie, Indiana

Experience Summary Information		
Field Supervisor Cultural Resource Analysts, Inc. 1999 - present	**Archaeological Field Director** Midwest Environmental Consultants, Inc. 1996 - 1997	**Archaeological Crew Chief and Field Technician** Archeological Resources Management Service, Ball State University 1995 - 1998

Mr. Anderson has been an employee of CRA since 1998. Since 1999, he has served as a Field Supervisor and is responsible for supervising archaeological fieldwork and authoring reports for projects at the survey (phase I) and intensive investigation (phase II) levels. He also assists in fieldwork at the data recovery (phase III) level. Many of Mr. Anderson's other responsibilities are computer-related and include creating customized computer programs and performing GIS analysis. Mr. Anderson is also responsible for maintaining the CRAI webpage and has created a company-wide intranet web server.

Experience and Expertise:

- Prehistoric archaeology
- Computer programming
- Computer Aided Design
- Geographic Information Systems
- Web-site administration and design

Additional Education and Training:

Annual: Occupational First Aid, CPR and Blood-borne Pathogen
2005: Trimble Navigation GPS Mapping Systems: GeoExplorer receivers, Pathfinder Office software (MapSync, instructor)
2003: Section 106: Principles & Practice (2003, Dr. Lynne Sebastian, instructor)
2002: OSHA Competent Person: Excavation, Trenching, and Shoring (8 hrs)
2001: Pathfinder Office GPS/GIS Training
2000: Geoarchaeology Workshop (sponsored by the Council for West Virginia Archeology)
1995: Castell Henllys Archaeological Field School, University of York, England Excavation of an Iron Age hillfort near Fishguard, Wales
Geophysical survey and gravestone study of a medieval monastery at Clonmacnois, Ireland

Archaeological Field and Lab Experience:

Phase III Experience

- Mr. Anderson has participated in several phase III archeological investigations of both prehistoric and historic sites. Examples of this experience include:
- Field Technician for the phase III data recovery of the Village of Monterey. This free black community was established prior to the Civil War and lasted through the Reconstruction Era.
- Field Technician for the phase III data recovery of McConnell Station in Bourbon County, Kentucky.
- Field Technician for the phase III data recovery of a Mississippian site in Rockport, Indiana.
- Field Technician for the phase III data recovery of an Archaic site in Cass County, Indiana.

Phase II Experience

Mr. Anderson has participated in several Phase II National Register evaluations. Examples of this experience include:

- Field Director for the phase II National Register evaluation of a historic mid-nineteenth century residence (15Md434), an Archaic and Middle Woodland habitation on the Otter Creek floodplain (15Md438), and an Early Archaic through Fort Ancient habitation and historic nineteenth century residence on an upland setting (15Md440).
- Field Director for the phase II testing of prehistoric (Late Archaic, Early Woodland, Middle Woodland, Late Woodland, Late Prehistoric) site 15Mm140.
- Field Director for the phase II testing of a multi-component (Early/Late Archaic, Early Woodland), prehistoric site (15Fl104) in Fleming County, Kentucky.
- Field Director for the phase II testing of 2 multi-component prehistoric sites (15Ht73: Late Archaic – Late Woodland, 15Ht74: Paleo-Indian – Late Woodland) in Hart County, Kentucky.
- Field Director for the phase II testing of a Woodland site (15Gd69) in Garrard County, Kentucky.
- Field Technician for the phase II testing of a late eighteenth century log cabin site in Delaware County, Indiana

Phase I Experience

Mr. Anderson has supervised and participated in numerous phase I reconnaissance projects in the eastern United States. Examples of this experience include:

- Field Director for a 10,000 acre phase I survey for the Camp Atterbury military base in Edinburgh, Indiana.
- Crew Chief for a 2,500 acre phase I survey for the Fort Indiantown gap military base in Lebanon, Pennsylvania.
- Field Director for a phase I survey for the proposed Laurel Gorge Trail in Elliott County, Kentucky. The survey was conducted for the U.S. Army Corps of Engineers, Huntington District.

GIS and Miscellaneous Experience

- Developed a site prediction model for Early Medieval sites in the Dingle Peninsula of Ireland.
- Used a magnetometer to investigate Clonmacnois, an Early Medieval monastery in Ireland.

Selected Technical Reports:

(2009) *An Archaeological Survey of the Proposed Sanders Elementary School Safe Routes to School Multi-use Path in Jefferson County, Kentucky*. Report prepared for University of Louisville. Contract Publication Series 09-144. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2009) *Cultural Resource Survey of the Permitted Spurlock Station Landfill in Mason County, Kentucky*. Report prepared for East Kentucky Power Cooperative. Contract Publication Series 09-012. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2008) *An Archaeological Survey of the Proposed Reconstruction of KY 2 in Greenup County, Kentucky (Item No. 9-132.00)*. Report prepared for the Kentucky Transportation Cabinet. Contract Publication Series 08-090. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2008) *Cultural Archaeological Investigations of the Preferred I-66 Alternate in Laurel and Pulaski Counties, Kentucky (Item Number 8-.059.10)*. Report prepared for the Kentucky Transportation Cabinet. Contract Publication Series 07-250. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2007) *An Archaeological Survey Of The Industrial Drive Extension In Lebanon, Marion County, Kentucky (Item No. 4-138.00)*. Report prepared for Third Rock Consultants, LLC. Contract Publication Series 06-202. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2007) *Phase II National Register Evaluation Of Site 15Ma280 Within The Proposed Berea Connector Project In Madison County, Kentucky (Item No. 7-192.00)*. Report prepared for T.H.E. Engineers, Inc. Contract Publication Series 06-140. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2006) *An Archaeological Survey Of The Proposed Reconstruction/Relocation Of Us 27 From KY 34 North Of Lancaster To Us 150 At Stanford In Garrard And Lincoln Counties, Kentucky (Item No. 7-*

196.00). Report prepared for American Consulting Engineers, PLC. Contract Publication Series 06-027. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2006) *A Cultural Resource Survey Of The Proposed Improvement Of River Road In Perry County, Indiana.* Report prepared for Redwing Ecological Services, Inc. Contract Publication Series 06-009. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2005) *An Archaeological Survey of the Proposed KY-313 Realignment and the Phase II National Register Evaluations Of Sites 15Md434, 15Md438, And 15Md440 In Meade County, Kentucky (Item Number 4-297.00).* Report prepared for T.H.E. Engineers Inc. Contract Publication Series 05-025. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2004) *An Archaeological Survey Of The Proposed Champions Baseball Academy At Taylorsville Lake In Spencer County, Kentucky.* Report prepared for Hagerty Engineering, Inc. Contract Publication Series 04-211. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2004) *An Archaeological Survey of the Proposed Construction of I-66 in Laurel and Pulaski Counties, Kentucky (Item Number 8-059.01).* Report prepared for HMB Professional Engineers, Inc. Contract Publication Series 04-118. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2004) *Phase II National Register Evaluation Of Sites 15Mm165, 15Mm166, And 15Mm173 In Montgomery County, Kentucky.* Report prepared for Mt. Sterling-Montgomery County Industrial Authority. Contract Publication Series 04-068. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2003) *A National Register Evaluation Of Site 15Mm140 In Montgomery County, Kentucky (Item Number 7-320.00).* Report prepared for Palmer Engineering. Contract Publication Series 02-238. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2003) *An Archaeological Survey of the Proposed Relocation of US 27 in Garrard County, Kentucky (Item No. 7-26.01).* Report prepared for GRW Engineers, Inc. Contract Publication Series 02-215. Cultural Resource Analysts, Inc., Lexington, Kentucky.

(2002) *A National Register Evaluation of Sites 15Ht73 and 15Ht74 in the Proposed I-65 Rest Area (Item No. 4-11.00), Hart County, Kentucky.* Report prepared for Palmer Engineering.

(2002) *Phase II National Register Evaluation Of Archaeological Site 15Gd69 Within The Proposed KY 52 Upgrade In Garrard County, Kentucky (Item No. 7-302.03).*

(2002) *An Archaeological Survey Of The Proposed Laurel Gorge Trail In Elliott County, Kentucky.* Prepared For the Army Corps of Engineers, Huntington District.

(2002) *An Archaeological Survey Of The Proposed KY 979 Reconstruction In Floyd County, Kentucky (Item No. 12-301.30).*

(2001) *An Archeological Survey For A Proposed Quarry Operation In Harrison County, Indiana. Prepared For Mulzer Crushed Stone, Inc.*

(2001) *An Archaeological Survey Of The Proposed KY11 Up-grade (Item No. 9-174.0) and A Phase II National Register Evaluation Of 15fl104 (Item No. 9-175.0) In Fleming County, Kentucky.* Report prepared for Palmer Engineering.

(2000) *An Archaeological Survey of a Proposed Coal Mine Operation Along Pigeonroost Fork, Hobbs Fork, Johnson Rockhouse Fork, and Maynard fork in Martin County, Kentucky.* Report prepared for Summit, Engineering.

(2000) *An Archaeological Survey of the Proposed Realignment of KY 7, in Elliott County, Kentucky.* Report prepared for Commonwealth Technology, Inc.

(1997) *Archaeological Field Reconnaissance, National Weather Service NEXRAD Radar Facility, Kosciusko County, IN (ARMS # 97FR18).* Prepared for SRI International. Archaeological Resources Management Service. Muncie, Ball State University.

(1997) Archaeological Field Reconnaissance, Medical Clinic, Franklin County, IN (ARMS # 97FR21). Prepared for Beumer and Associates. Archaeological Resources Management Service. Muncie, Ball State University.

(1996) *Archaeological Field Reconnaissance, Harcourt Road Improvement, Steuben County, IN (ARMS # 96FR21).* Prepared for Congdon Engineering Associates, Inc. Archaeological Resources

Management Service. Muncie, Ball State University.

(1996) *Archaeological Field Reconnaissance, US 6 Borrow Pits, DeKalb County, IN (ARMS # 96FR22).* Archaeological Resources Management Service. Muncie, Ball State University.

(1995) *Archaeological Field Reconnaissance, Bridge #61, Hamilton County, IN (ARMS # 95FR86).* Prepared for Beam, Longest and Neff, Inc. Archaeological Resources Management Service. Muncie, Ball State University.

Anderson, J. M. and A. P. Bradbury (1999) *A Phase I Archaeological Survey Of Proposed Wastewater Systems Improvements In Daviess County, Kentucky.* Report prepared for Quest Engineers, Inc.

Anderson, J. M. and T. A. Faberson (2007) *National Register Evaluation Of Sites 15Gd87 And 15Gd89 For The Proposed Relocation Of U.S. 27 In Garrard County, Kentucky (Item No. 7-26.01).* Report prepared for GRW Engineers, Inc.

Clay, R. B., J. M. Anderson, J. T. Kirkwood, and K. Baynard (2001) *Archaeological and Cultural Historic Overview for the Reconstruction of KY 11 in Montgomery County, Kentucky.* Report prepared for Commonwealth Technology, Inc.

Presentations at Professional Meetings:

Bradbury, A. P., J. M. Anderson and M. D. Richmond (2002) An Early Side-Notched Hunting Stand: Excavations at 15FI104, Fleming County, Kentucky. Presented at the 19th annual Kentucky Heritage Council Archaeological Conference, Frankfort, KY.

Affiliations:

- Register of Professional Archaeologists (RPA), 2001 - present
- Archaeological Institute of America (AIA), 2002 - present
- Society for Historical Archaeology (SHA), 2002
- North American Cartographic Information Society (NACIS), 2001-2002

Field and Laboratory Skills:

Mr. Anderson is proficient with field use of total station transits, Global Positioning Systems (GPS), 35mm SLR cameras, and digital cameras. He is responsible for instructing CRA employees in the use of various types of GPS. Mr. Anderson also has experience using geophysical survey equipment, including the resistivity meter and the magnetometer. He has experience monitoring heavy equipment excavation for several sites. Mr. Anderson's laboratory skills include washing, sorting, cataloging, classifying, and photographing artifacts and processing and sorting flotation samples.

Computer Skills:

Mr. Anderson's training and experience in computer technology is extensive. He has proficient knowledge of the Windows, Linux, and Unix operating systems. He has extensive training and experience in the use of Geographic Information Systems (GIS) software, including ArcView 3.x and ArcGIS 9.x. This experience includes cartographic design, data conversion, and designing customized programs and user interfaces using Visual Basic, Python, and Avenue. He has extensive experience in computer-aided design (CAD) and is proficient with AutoCAD. Mr. Anderson uses Perl, PHP, and Visual Basic to design programs to automate common tasks, such as code conversion and statistics generation. He is also experienced in a variety of other software types including database (mySQL, Access), spreadsheet (Excel), word processing and publishing (Word, Acrobat), graphics (Illustrator, Photoshop), and webpage administration/design (Apache Web Server, Dreamweaver, Joomla). Mr. Anderson is responsible for designing and maintaining the CRAI webpage and has created a corporate intranet web page.

Contract Publication Series 08-164

R09528

A CULTURAL RESOURCE SURVEY FOR A PROPOSED 183-ACRE WILLIAMSON ENERGY POND CREEK 1 COAL MINE OPERATION IN SECTION 7, TOWNSHIP 8 SOUTH, RANGE 4 EAST IN WILLIAMSON COUNTY, ILLINOIS (PERMIT APPLICATION NUMBER 375)





by
Tanya A. Faberson, Ph.D., RPA

Prepared for

Williamson Energy, LLC

Prepared by

Cultural Resource Analysts Inc.
www.crai-ky.com

Contract Publication Series 08-164

A CULTURAL RESOURCE SURVEY FOR A PROPOSED 183-ACRE WILLIAMSON ENERGY POND CREEK 1 COAL MINE OPERATION IN SECTION 7, TOWNSHIP 8 SOUTH, RANGE 4 EAST IN WILLIAMSON COUNTY, ILLINOIS (PERMIT APPLICATION NUMBER 375)

by

Tanya A. Faberson, Ph.D., RPA

With contributions by Brian G. DelCastello and Jennifer M. Faberson

Prepared for

James Plumley
Williamson Energy, LLC
P.O. Box 99
Johnston City, Illinois 62951
Phone: (618) 694-3739

Prepared by

Cultural Resource Analysts, Inc.
151 Walton Avenue
Lexington, Kentucky 40508
Phone: (859) 252-4737
Fax: (859) 254-3747
E-mail: cmniquette@crai-ky.com
CRAI Project No.: K08W002

Charles M. Niquette, RPA
Co-Principal Investigator

Richard L. Herndon, RPA
Co-Principal Investigator

March 30, 2009

Lead Agency: Illinois Department of Natural Resources, Division of Mine Permits
Williamson Energy, LLC, Permit Application Number: 375

ABSTRACT

Between November 5 and 9, 2008, Cultural Resource Analysts, Inc., personnel conducted a cultural resource survey for the proposed expansion of existing facilities associated with the Pond Creek 1 coal mine. The survey was conducted at the request of James Plumley of Williamson Energy, LLC (Permit Application Number 375). It was carried out in order to comply with 62 Illinois Administrative Code 1783.12a General Environmental Resources Information. The project area consisted of floodplains and dissected upland ridges, and it encompassed 74.2 ha (183.3 acres), all of which were surveyed via systematic shovel testing. Disturbances identified in the project area consisted of agricultural use, logging, and erosion.

Prior to the initiation of fieldwork, a site file search was conducted at the Illinois State Museum in Springfield, Illinois. This search indicated that approximately 80 percent of the project area had been surveyed in 1981, and that two previously recorded historic archaeological sites (11WM121 and 11WM123) and one prehistoric site (11WM122), known as Vance's Hoe, were located within the confines of the project area. Sites 11WM121 and 11WM122 could not be relocated during the survey. This was probably due to disturbance created by long term agricultural use and logging in these locales.

Site 11WM123 was rediscovered during the current work. This historic farm/residence site consisted of a moderate scatter of domestic and architectural artifacts, generally dating from the mid- to late nineteenth century to the early twentieth century. The site was discovered on a wooded ridgetop with a dense understory of briars, shrubs, and immature trees. The archaeological deposits were very disturbed, most likely as a result of repeated logging activities and subsequent erosion. No structures within the vicinity of the site were observed on available historic maps.

Two previously unrecorded sites (11WM364 and 11WM365) were also discovered during the current survey. Site 11WM364 was identified as a multicomponent site consisting of a turn-of-the-twentieth-century historic farm/residence and a temporally undiagnostic prehistoric open habitation component. The historic component consisted of a moderate to heavy scatter of domestic and architectural artifacts, and the prehistoric component consisted of a single temporally undiagnostic flake. This site was discovered in a pasture setting that had been significantly disturbed by previous agricultural activities. It appears to have been associated with a historic residence shown on the 1908 plat map of Williamson County that would have been located adjacent to, and east of, 11WM364 just outside of the project area boundary. While the portion of 11WM364 that was surveyed during the current work was heavily disturbed and lacked archaeological integrity, it should be noted that the eastern boundary of the historic component of the site likely extends east to an unknown distance beyond the current project limits onto private property. It is not anticipated that the prehistoric component extends beyond the current project boundary due to the paucity of remains and the nature of the deposits. Site 11WM365 was a historic farm/residence that consisted of a moderate scatter of turn-of-the-twentieth-century domestic and architectural material culture. This site was also discovered in a pasture setting that had been negatively impacted by agricultural activities and erosion. No structures were observed near the site on available historic maps.

Based on these results, 11WM123, the portion of 11WM364 within the limits of the project area, and 11WM365 contain little potential to yield information beyond that recorded during the current survey and are not considered eligible for inclusion in the National Register of Historic Places. If, at any time, the portion of 11WM364 outside of the project boundary would be impacted by the proposed construction, then it is recommended that the area be archaeologically surveyed to determine the eastern limits of the site and evaluate its significance.

TABLE OF CONTENTS

ABSTRACT i
LIST OF FIGURES iii
LIST OF TABLES iv
CHAPTER 1. INTRODUCTION 1
CHAPTER 2. ENVIRONMENTAL SETTING 7
CHAPTER 3. PREVIOUS RESEARCH, MAP REVIEW, AND CULTURAL OVERVIEW 15
CHAPTER 4. METHODS 31
CHAPTER 5. RESULTS 49
CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS 73
REFERENCES 75
APPENDIX A. SCOPE OF WORK A-1
APPENDIX B. VITA B-1
APPENDIX C. HISTORIC MATERIALS RECOVERED C-1
APPENDIX D. SITE FORMS D-1
APPENDIX E. ARCHAEOLOGICAL SHORT SURVEY REPORT (ASSR) E-1

LIST OF FIGURES

Figure 1. Map of Illinois showing the location of Williamson County. 1
Figure 2. Location of project area on topographic quadrangle. 3
Figure 3. Project Area plan map with site locations and field methods employed. 4
Figure 4. Project area overview showing grassy pasture, facing southwest. 11
Figure 5. Project area overview showing forested area with dense underbrush, facing south. 12
Figure 6. Methane gas pipeline cross-cutting project area east–west. 12
Figure 7. Railroad track bounding southern end of project area. 13
Figure 8. The 1908 Williamson County plat map showing property ownership and structures in project area 22
Figure 9. 1920 plat map of Williamson County Illinois showing properties within the project area. 23
Figure 10. 1940 plat map of Williamson County Illinois showing properties within the project area. 24
Figure 11. .22 rimfire cartridge recovered from 11WM364, STP10 35
Figure 12. Ceramics recovered 40
Figure 13. Container glass and toy artifacts 43
Figure 14. Overview of 11WM123, facing west. 50
Figure 15. Site 11WM123 site schematic 51
Figure 16. Site 11WM123 soil profiles 52
Figure 17. Overview of 11WM364, facing northeast. 56
Figure 18. Site 11WM364 site schematic 57
Figure 19. Site 11WM364 soil profiles 58
Figure 20. Overview of 11WM365, facing east 65
Figure 21. Site 11WM365 site schematic 66
Figure 22. Site 11WM365 soil profiles 67

LIST OF TABLES

Table 1. Chain of Ownership of Property Containing Site 11WM123. 52
Table 2. Summary of Artifacts Recovered from 11WM123 53
Table 3. Chain of Ownership of Property Containing Site 11WM364. 59
Table 4. Summary of Artifacts Recovered from 11WM364 61
Table 5. Chain of Ownership of Property Containing Site 11WM365. 68
Table 6. Summary of Artifacts Recovered from 11WM365 69
Table C-1. Historic Materials Database. C-3

Chapter 1. Introduction

Between November 5 and 9, 2008, Cultural Resource Analysts, Inc., (CRAI), personnel conducted a cultural resource survey for the proposed expansion of existing facilities associated with the Pond Creek 1 coal mine. The survey area was located in Section 7, Township 8 South, Range 4 East of Williamson County, Illinois (Figure 1). The survey was conducted at the request of James Plumley of Williamson Energy, LLC (Permit Application Number 375) (Appendix A). The project area encompassed approximately 74.2 ha (183.3 acres), all of which were surveyed via systematic shovel testing. The cultural resource survey was conducted by Christopher Cartellone, Tanya Faberson, Tracy Linville, Rachel McAllister, Thomas McAlpine, and Julie Senger, and took approximately 240 person hours to complete. A vita is provided for the field supervisor/author in Appendix B.

Purpose of Study

The survey was conducted to comply with the Illinois Historic Preservation Agency (IHPA) guidelines (available online at: http://virtual.parkland.edu/IAS/professional_resources/guidelines.html) (accessed on August, 22, 2007) and with the 62 Illinois Administrative Code 1783.12a General Environmental Resources Information (effective January 1, 1991) for underground mining permit applications. The methodology and subsequent report also conform to the procedures outlined in the Scope of Services submitted to Williamson Energy, LLC, prior to the initiation of the current fieldwork. The purpose of this assessment was to locate, describe, evaluate, and make appropriate recommendations for the future treatment of any archaeological sites or historic properties that may be threatened by the proposed mining-related activities.

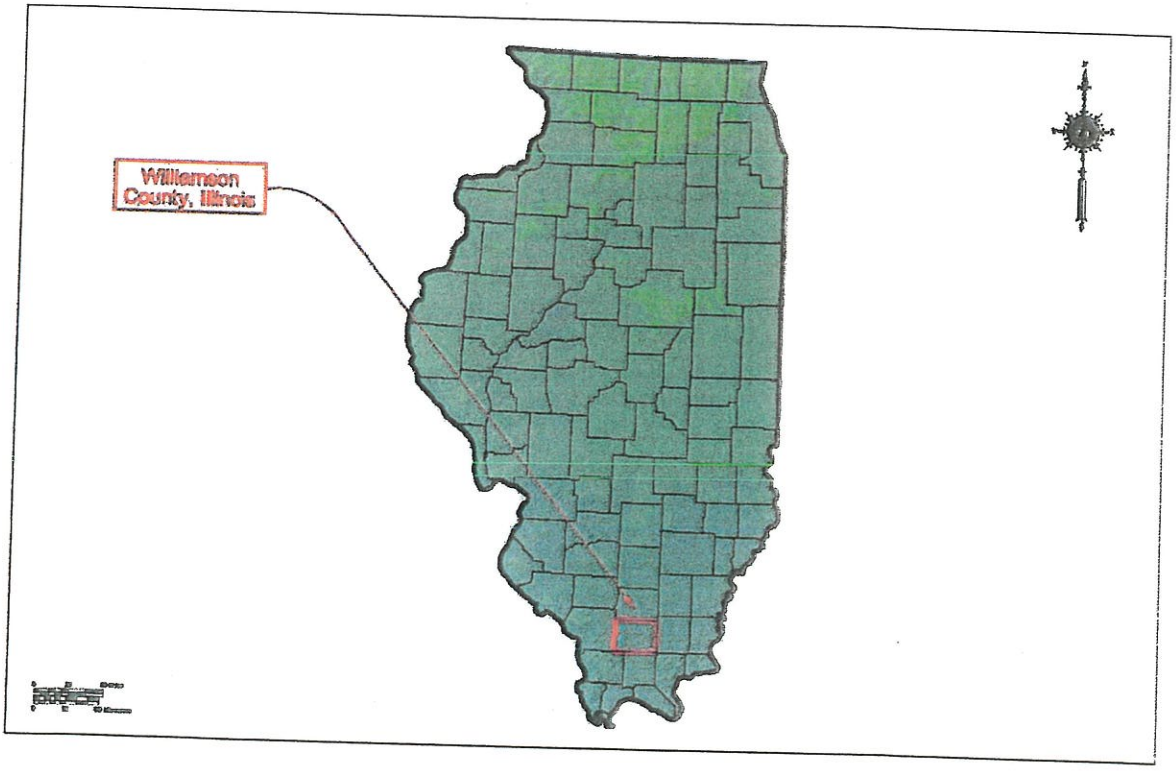


Figure 1. Map of Illinois showing the location of Williamson County.

For the purposes of this assessment, the definition of an archaeological site follows that provided in the National Register Bulletin 36. An archaeological site is "the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains" (Guidelines for Evaluating and Registering Historical Archeological Sites and Districts, 1993, p. 2). In addition, these properties may also meet the criteria used for their inclusion in the National Register of Historic Places (NRHP), since they may yield information important to prehistory or history and are older than 50 years of age (National Register Criteria for Evaluation, 36 CFR 60.4).

Furthermore, following the guidelines discussed during a recent workshop concerning Illinois archaeology (available online at: http://virtual.parkland.edu/IAS/member_com/guidelines_workshop.htm) (accessed on April 8, 2008), an archaeological site was further defined as three artifacts recovered within 15 m (49.2 ft) of each other. Cultural deposits less than 50 years of age were not considered sites, in accordance with "Archeology and Historic Preservation: the Secretary of the Interior's Standards and Guidelines" (National Park Service 1983).

Project Description

Williamson Energy, LLC, is proposing to expand existing facilities associated with the Pond Creek 1 coal mine (Permit Application Number 375). The mine is located approximately 12.9 km (8 mi) east of Johnston City adjacent to Dwina Road in Section 7, Township 8 South, Range 4 East in Williamson County, Illinois (Figures 2 and 3). The 74.2-ha (183.3-acre) permit area is situated in the Big Muddy drainage system and approximately 80 percent was previously surveyed in 1981 for a former mining permit for the Zeigler Number 6 mine operated by the Peabody Coal Company (Vander Leest 1981).

Summary of Findings

One previously recorded site (11WM123) and two previously unrecorded archaeological sites (11WM364 and 11WM365) were documented during the current survey. Two previously documented sites (11WM121 and 11WM122) could not be relocated but are shown on Figures 2 and 3. Site 11WM121 was a late nineteenth- to early twentieth-century historic farmstead that consisted of a light scatter of domestic and architectural artifacts. Site 11WM122, Vance's Hoe, was a Late Woodland/Mississippian site that consisted of a light scatter of flakes, shatter, and hematite in addition to a complete hoe of Mill Creek chert (Vander Leest 1981). Three non-extant structures within the limits of the project area shown on the 1908 plat map of Williamson County also could not be found (see Chapters 3 and 5). That the remains of these structures and archaeological sites could not be rediscovered is likely due to their locations having been disturbed by agricultural and logging activities.

Site 11WM123 was a mid-to-late nineteenth century to early twentieth-century historic farm/residence located near the southern boundary of the project area in a wooded section that had been very disturbed by past logging activities and erosion. It was situated on a generally southwest to northeast trending, broad dissected upland ridge approximately 300 m (984.2 ft) west of an unnamed intermittent tributary of Pond Creek. The elevation of the site was 158.5 m (520.0 ft) above mean sea level (AMSL). A moderate density of historic domestic, architectural, clothing, and furniture artifacts generally dating from the mid- to late nineteenth century to the early twentieth century was recovered. No structures within the vicinity of the site were observed on available historic maps. Due to disturbance created by logging and erosion, Site 11WM123 lacks archaeological integrity, and further research would likely yield little or no results beyond those recorded during the current survey; therefore, the site is not significant and is considered not eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation.

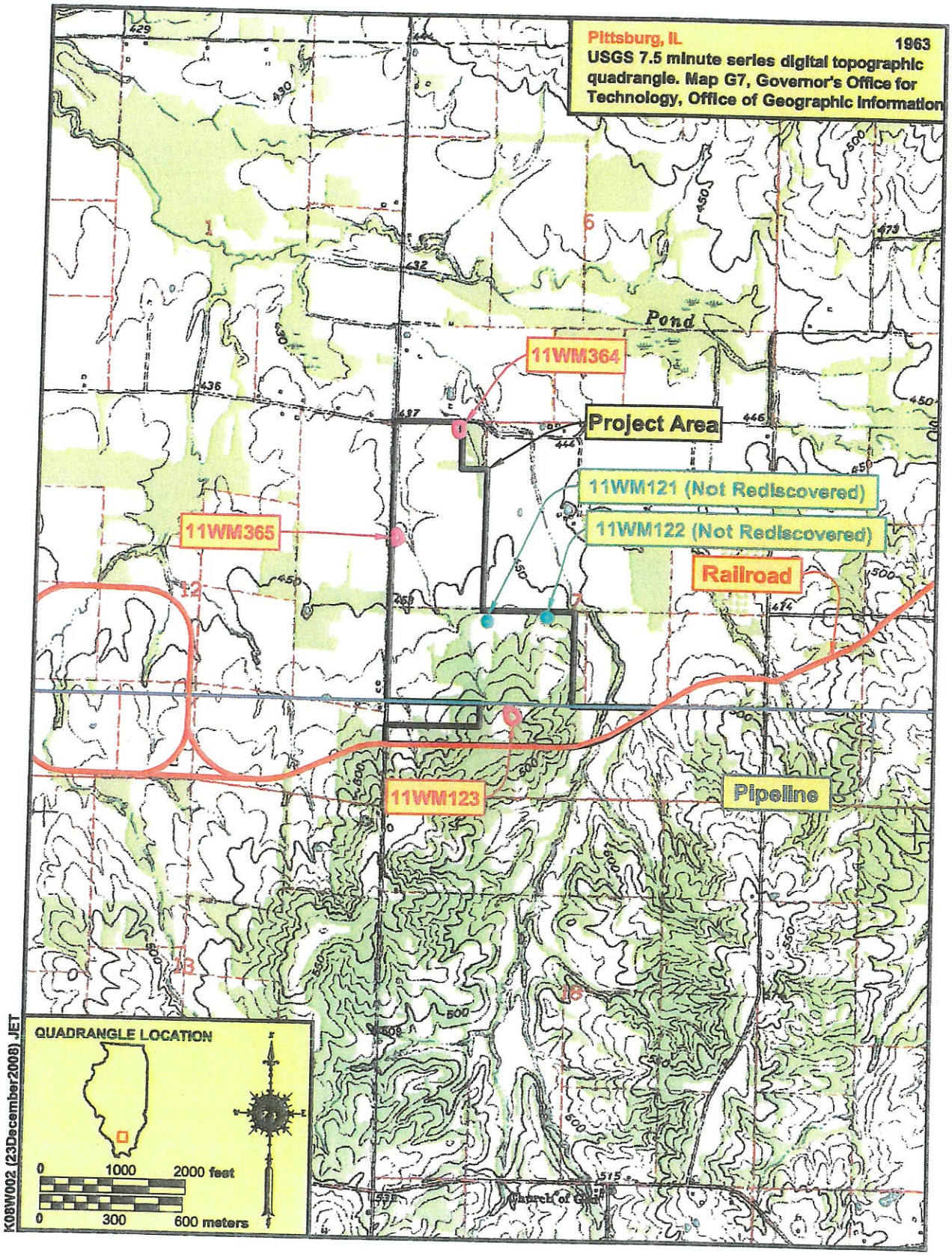


Figure 2. Location of project area on topographic quadrangle.

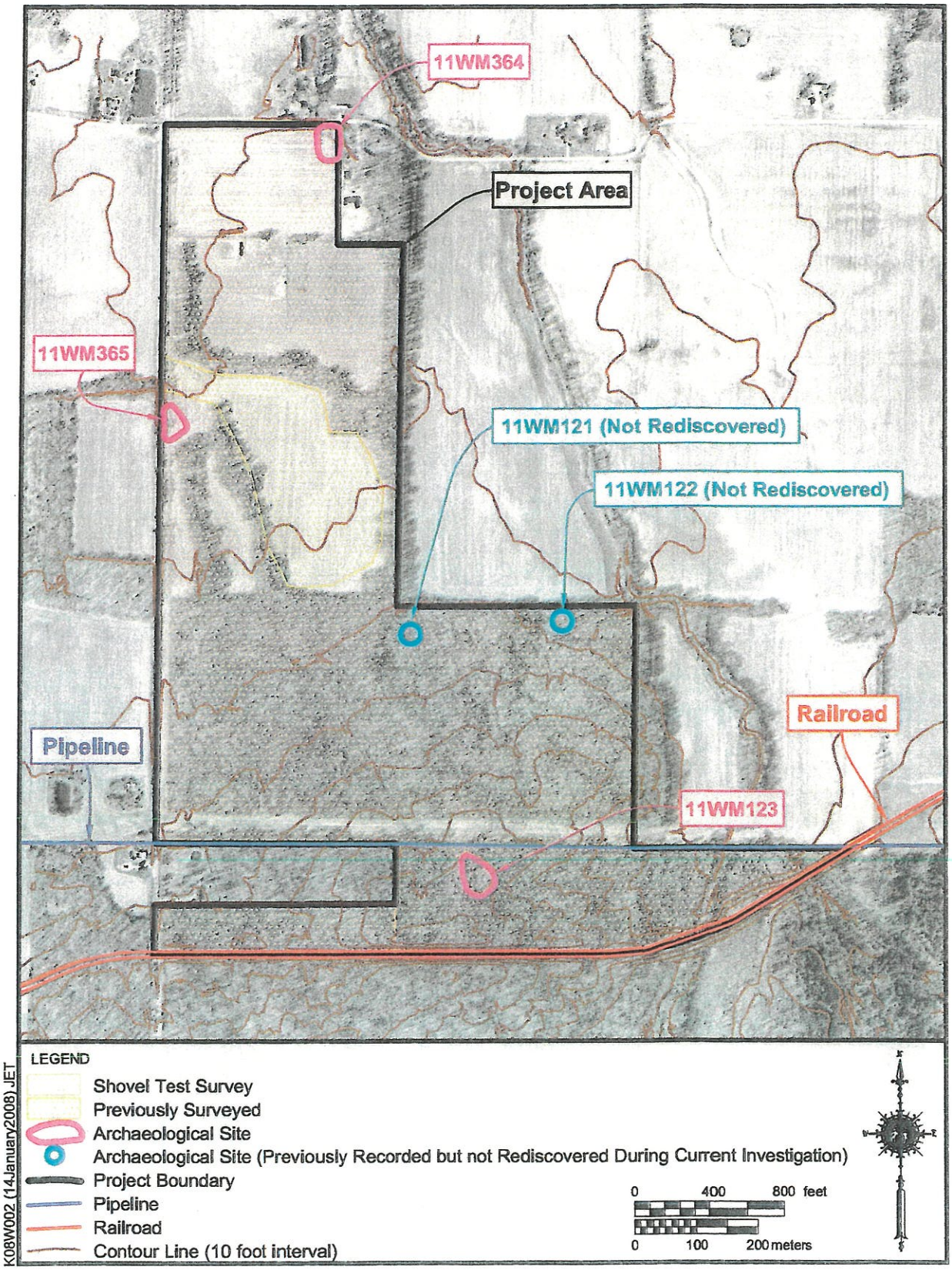


Figure 3. Project Area plan map with site locations and field methods employed.

Site 11WM364 was identified as a multicomponent site consisting of a turn-of-the-twentieth-century historic farm/residence and a prehistoric open habitation component. It was located at the northeast corner of the project area adjacent to Dean Road in a pasture that had been significantly disturbed by previous agricultural activities. It was situated in a floodplain setting, approximately 150 m (492.1 ft) southwest of an unnamed intermittent tributary of Pond Creek. The elevation of the site was 140.1 m (459.6 ft) AMSL. A moderate to heavy density of historic arms, domestic, architectural, furnishing, and maintenance and subsistence artifacts dating to the turn-of-the-twentieth century, as well as one temporally undiagnostic prehistoric flake, were recovered from the site during the current survey. The site appears to have been associated with a historic residence shown on the 1908 plat map of Williamson County that would have been located adjacent to, and east of, 11WM364 just outside of the project area boundary (Ogle & Co. 1908). While the portion of 11WM364 that was surveyed during the current work was heavily disturbed and lacked archaeological integrity, it should be noted that the eastern boundary of the historic component of the site extends east to an unknown distance beyond the current project limits onto private property. It is not likely that the prehistoric component extends beyond the current project boundary due to the paucity of remains. Due to disturbance created by agricultural activities and erosion, the portion of Site 11WM364 within the limits of the project area lacks archaeological integrity. Further research would likely yield little or no results beyond those recorded during the current survey; therefore, it is not significant and is considered not eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation for the portion of the site within the current project boundary. If at any time the portion of 11WM364 outside of the project boundary would be impacted by the proposed construction, then it is recommended that the area be archaeologically surveyed to determine the eastern limits of the site and evaluate its significance.

Site 11WM365 was a turn-of-the-twentieth-century historic farm/residence located in the northwest section of the project area. It was discovered in a pasture adjacent to Dwina Road that had been significantly disturbed by agricultural activities and erosion. It was situated in a floodplain setting, roughly 50 m (164.0 ft) west of an unnamed intermittent tributary of Pond Creek, and the elevation was 139.6 m (458.0 ft) AMSL. Site 11WM365 consisted of a moderate scatter of turn-of-the-twentieth-century domestic, architectural, and maintenance and subsistence material culture. No structures were observed near the site on available historic maps, but one structure is shown approximately 400 m east if the site within the same property boundaries on the 1908 plat map (see Chapters 3 and 5). The site was heavily disturbed by agricultural activities and subsequent erosion, and, therefore, it lacks archaeological integrity. Further research would likely yield little or no results beyond those recorded during the current survey; therefore, the site is not significant and is considered not eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation.

Chapter 2. Environmental Setting

Brian DelCastello and Tanya Faberson

The project area is located in the Southern Till Plain Division of the Central Lowland Province (Leighton et al. 1948; Schwegman et al. 1986). The Southern Till Plain encompasses a broad expanse of dissected Illinoisan till plains south of the Shelbyville Moraine and the Sangamon River (Lopinot et al. 1982:15). This portion of southern Illinois is characterized as having a flat to rolling topography with broad uplands and wide alluvial valleys, reflecting the underlying bedrock topography. A thin veneer of loess, glacially derived diamictons, and lacustrine deposits overlies much of the Pennsylvanian bedrock in this region. More specifically, the project area is situated within the southern Mt. Vernon Hill Country Section, an area adjacent to the more northern Effingham Plain Section (Schwegman et al. 1986). This latter physiographic section is characterized as a relatively flat till plain dissected by broad floodplains. During pre-Contact times, this section was mostly prairie (Schwegman et al. 1986).

In contrast to the nearly flat topography of the Effingham Plain Section, the Mt. Vernon Hill Country Section is distinguished by its rolling, hilly topography. The broad floodplains that drain the eastern portion of this section are typically considered part of the adjoining Wabash Border Division (Schwegman et al. 1986:32). During pre-Contact times, this section had been a mosaic of prairie and forest. Upland forests once dominated this region during initial European contact (Schwegman et al. 1986). MacClintock (1929:7) provides a general description of this region:

> The area consists partly of a plain and partly of gently rolling hills 50 to 60 feet high, though few are as much as 100 to 125 feet in height... the whole area is mantled with drift, and much of it with loess as well, outcrops of bedrock are rare and, where found, are commonly... low in valley walls....

Specific to the current phase I work, the project area consists of floodplains and an upland landform 150 m (492.1 ft) northeast of an intermittent tributary of Pond Creek in the Big Muddy River drainage system, whose headwaters are located at the northern border of Jefferson County and mouth is on the Mississippi River just south of Grand Tower in Union County. This basin drains all or portions of seven counties: Franklin, Jackson, Jefferson, Perry, Union, Washington, and Williamson (Sant et al. 1987:353). Elevations within the project area range between 133 and 135 m (436 and 443 ft) AMSL. The soils in the project area are very fine-textured and have very slowly permeable subsoils. Unless carefully managed, they are relatively unproductive, being generally deficient in lime, nitrogen, phosphorus, and potassium (University of Illinois Department of Agronomy 1949:8).

Soils

Because the project area is located in the Southern Till Plains, the majority of the soils found throughout the region derive from glacial deposits. While locally the parent material for these soils can vary, the majority of the soils were formed in Illinoisan glacial deposits, recent alluvium, and Wisconsin-age water deposited sediments.

Soil Series

A total of 11 soil series are located within the project area based on the current soil survey data available online at the online Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/) for Williamson County. The following soil series descriptions have been taken from the online database available at the Natural Resource Conservation Service (NRCS) (http://soils.usda.gov/technical/classification/osd/index.html). The soil series descriptions for each series or complex include the location within the project area in which the series or

complex was mapped, a general discussion of the series or complex, and a typical profile to a depth of 1 m (3.28 ft) below ground surface (bgs).

Ava silt loam (14B and 14C2)

Ava series soils are mapped in the southern portion of the project area (NRCS 2007b). This series consists of moderately well-drained soils on ridges and sideslopes of drainageways. They are formed in loess and the underlying silty or loamy deposits that overly a strongly developed paleosol. These soils have been classified as fine-silty, mixed, active, mesic Oxyaquic Fragiudalfs (NRCS 2007a).

Ava series soils have an Ap horizon of dark grayish brown (10YR 4/2) silt loam that extends from the ground surface to 15.2 cm (6 in) bgs. Underlying the Ap horizon is an E horizon hat consists of brown (10YR 4/3) silt loam, 15.2–25.4 cm (6–10 in) bgs. The yellowish brown (10YR 5/6) silt loam BE horizon underlies the E horizon from 25.4 to 35.6 cm (10 to 14 in) bgs. Beneath the BE horizon is a series of Bt horizons composed of yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) silty clay loam to a depth of 86.36 cm (34 in) bgs, and grayish brown (10YR 5/2) to brown (10YR5/3) loam to a depth of more than 1 m bgs (NRCS 2007a).

Belknap silt loam (3382A)

Belknap silt loam is mapped in the central portion, as well as the southeast corner of the project area (NRCS 2007b). This soil series consists of very deep, somewhat poorly drained soils formed in acid, silty alluvium on floodplains. The soils have been classified as coarse-silty, mixed, active, acid, mesic Fluvaquentic Endoaquepts (NRCS 2007a).

Belknap soils have an Ap and an A horizon of dark grayish brown (10YR 4/2) silt loam from 0 to 33.0 cm (0 to 13 in) bgs. The Ap and A horizons are underlain by a Bg horizon of dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam, 33.0–68.6 cm (13–27 in) bgs. Two Cg horizons underlay the Bg horizon, and consist of light grayish brown (10YR 6/2) to dark gray (10YR 4/1) silt loam to greater than 1 m bgs (NRCS 2007a).

Bluford silt loam (13A and 13B2) and Bluford silt loam benches (640A and 640B2)

Bluford series soils are mapped in the central portion of the project area (NRCS 2007b). This series consists of very deep, somewhat poorly drained soils on broad summits of hillslopes and knolls. They are formed in loess and the underlying silty or loamy sediments. They are classified as fine, smectitic, mesic Aeric Fragic Epiaqualfs (NRCS 2007a).

This soil series generally has an Ap horizon of brown (10YR 4/3) silt loam from 0 to 17.8 cm (0 to 7 in) bgs. This is underlain by two E horizons of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, 18.0–51.0 cm (7–20 in) bgs. A series of Bt horizons underlay the E horizons consisting of grayish brown (10YR 5/2) silty clay to gray (10YR 5/1) silty clay loam extending to a depth of more than 1 m bgs (NRCS 2007a).

Grantsburg silt loam (301B)

Grantsburg silt loam is mapped to a minor extent in the southern portion of the project area (NRCS 2007b). This soil series consists of moderately well drained soils formed in loess on uplands. The soils have been classified as fine-silty, mixed, active, mesic Oxyaquic Fragidualfs (NRCS 2007a).

Very dark grayish brown (10YR 3/2) silt loam, 5.1 cm (0–2 in) bgs, comprises the A horizon. The A horizon is underlain by an E horizon consisting of brown (10YR 5/3) silt loam, 5.1–17.8 cm (2–7 in) bgs. The BE horizon consists of strong brown (7.5YR 5/6) silt loam from 17.8 to 30.5 cm (7 to 12 in) bgs. This horizon is underlain by several Bt horizons, ranging from strong brown (7.5YR 5/6) silt loam to yellowish brown (10YR 5/4) silt loam to a depth of more than 1 m bgs (NRCS 2007a).

Hickory-Kell clay loams (908D3)

Hickory-Kell clay loam is mapped near the southeast corner of the project area (NRCS 2007b). These soils consist of moderately to very deep, well-drained soils formed in loamy drift and found on dissected till plains. They formed in till that can be capped with up to 50.8 cm (20 in) of loess. Hickory soils are classified as fine-loamy, mixed, active, mesic Typic Hapludalfs, and Kell soils are classified as fine-loamy, mixed, active, mesic Ultic Hapludalfs (NRCS 2007a).

Hickory soils have an A horizon of dark grayish brown (10YR 4/2) silt loam, 0–10 cm (0–4 in) bgs. This is underlain by an E horizon of light yellowish brown (10YR 6/4) silt loam from 10 to 30 cm (4 to 12 in) bgs. Several Bt horizons underlay the E horizon and consist of yellowish brown (10YR 5/6) to yellowish brown (10YR 5/4) clay loam to a depth of more than 1 m bgs (NRCS 2007a).

Kell soils have an A horizon of very dark grayish brown (10YR 3/2) silt loam from 0 to 7.6 cm (0 to 3 in) bgs. This is underlain by an E horizon of 60 percent dark grayish brown (10YR 4/2) and 40 percent dark yellowish brown (10YR 4/4) silt loam, 7.6–17.8 cm (3–7 in) bgs. This is followed by several Bt horizons ranging from yellowish brown (10YR 5/4) silt loam to yellowish brown (10YR 5/6) silty clay loam from 17.8 to 63.5 cm (7 to 25 in) bgs. The Bt horizons are underlain by a BC horizon consisting of 50 percent yellowish brown (10YR 5/4) and 50 percent light brownish gray (2.5Y 6/2) very channery silty clay loam, 63.5–88.9 cm (25–35 in) bgs. The C horizon is identified as 50 percent yellowish brown (10YR5/4) and 50 percent light brownish gray (2.5Y 6/2) silty clay (NRCS 2007a).

Rend silty clay loam (518C3)

Rend silty clay loam is mapped in the eastern portion of the project area (NRCS 2007b). This soil series consists of very deep, moderately well-drained soils on convex shoulders and back slopes that formed in loess and other silty deposit with overlay silty or loamy valley materials. They are classified as fine-silty, mixed, active, mesic Fragic Oxyaquic Hapludalfs (NRCS 2007a).

The Ap horizon is mapped as dark brown (10YR 4/3) silt loam from the ground surface to a depth of 12.7 cm (5 in) bgs. This is underlain by several Bt horizons ranging from yellowish brown (10YR 5/4) silty clay loam to silt loam of the same color from 12.7 cm to a depth of more than 1 m bgs.

Sharon silt loam (3072A)

Sharon silt loam is mapped to a limited degree in the eastern portion of the project area (NRCS 2007b). This soil series consists of deep, moderately well permeable soils formed in acid silty alluvium on flood plains. It is classified as coarse-silty, mixed, active, acid, mesic Oxyaquic Udifluvents (NRCS 2007a).

The Ap horizon for this soil series consists of brown (10YR 4/3) silt loam, 0–17.8 cm (0–7 in) bgs. The Ap horizon is underlain by two A horizons of brown (10YR 4/3) silt loam from 17.8 to 63.5 cm (7 to 25 in) bgs. No B horizon is present in this series. Instead, the A horizons are underlain by several C horizons, ranging from brown (10YR 4/3) silt loam with common medium faint pale brown (10YR 6/3) mottles to mixed brown (10YR 5/3), light brownish gray (10YR 6/2), light gray (10YR 7/2), and yellowish brown (10YR 5/6) silt loam to a depth of more than 1 m bgs (NRCS 2007a).

Vegetation

The Mt. Vernon Hill Country Section of the Southern Till Plains is located within the Prairie Peninsula Section of the Northern Division within the Oak-Hickory Forest Region (Braun 2001:185–191). As defined by Braun (2001:185), the Prairie Peninsula Section is somewhat more extensive than what is typically considered the Prairie Peninsula proper. The major vegetation types in this glaciated region form a complex mosaic strongly influenced by underlying geological strata.

The transition from extensive, Mixed Mesophytic communities in the far eastern

part of Illinois to extensive oak and oak-hickory communities in central and western Kentucky is well marked despite the more generalized mosaic pattern and the presence of large prairie areas (Braun 2001:123). There are no extensive areas of original vegetation outside of the lesser farmed river valleys throughout the region, and it would be nearly impossible to accurately reconstruct a picture of the original forest conditions within this region of southern Illinois.

The forests in the Mt. Vernon Hill Country Section are generally sparser and less luxuriant than those of the Western Mesophytic Forest. The Oak-Hickory forests in the region are generally limited to "slopes of shallow and ill-defined ravines or of low morainal ridges" (Braun 2001:187). The transition from extensive Mixed Mesophytic communities in extreme southern Illinois through the Shawnee Hills to the sparse oak-hickory communities of the Southern Till Plains is well marked.

Within this region, local factors dictate the composition of the forest types (Braun 2001:189). Of the local factors, soil conditions play an important role in the determination of local forest communities. Oak-hickory or mixed hardwood communities typically occupy slopes and ridgetops in areas where local streams are cut into the landscape (Braun 2001; Schwegman et al. 1986). In these expanses, the forests are dominated by oaks, particularly white, shingle, and black oaks, on the drier southern and western exposures; while on the more mesic exposures, a variety of hardwoods including hickories, white ash, basswood, sugar maple, wild black cherry, slippery elm, and black walnut, along with several oaks, tend to dominate (Schwegman et al. 1986:31). In areas where poor drainage and flooding is frequent, swamp species tend to dominate the local flora.

At the time of European contact, the prairies in the region were characterized as the mesic tall-grass type (Schwegman et al. 1986:31). These mesic prairies appeared to have been more common throughout the western portion of the Southern Till Plains. Wet prairies were fairly uncommon, although some existed to the west along the Kaskaskia River Valley.

Climate

Prehistoric Climate

Climatic conditions during pre-Contact times appear to have been different than those of the present day. As discussed by various researchers (Denton and Karlen 1973; Fritts et al. 1979; Warren and O'Brien 1982), climatic conditions during the Holocene Age represent a series of transitions in temperature, rainfall, and seasonal patterns. These transitions created a seemingly infinite range of ecological variation across time and space. These variations both limited and expanded the various survival strategies of human populations throughout the region.

Studies of historic weather patterns and tree-ring data by Fritts et al. (1979) have indicated that current climatological averages are "unusually mild" when compared to seventeenth- to nineteenth-century trends (Fritts et al. 1979:18). The study suggests that winters were generally colder, weather anomalies were more common, and unusually severe winters were more frequent between A.D. 1602 and A.D. 1899 than after A.D. 1900. Cooler, moister conditions are associated with the Neo-Boreal episode, which began around 700 B.P. and coincided with minor glacial advances in the northwest and Europe (Denton and Karlen 1973; Warren and O'Brien 1982:73). This episode is viewed by Warren and O'Brien (1982:74–76) as a causal factor in vegetation pattern shifts in northeast Missouri. Fluctuations in the Neo-Boreal episode appear to have varied locally (Baerreis et al. 1976:50–52; Warren and O'Brien 1982:73).

The effects of the Neo-Boreal episode, which ended during the mid- to late nineteenth century, have not been studied in detail for this region. It appears that the area experienced less radical temperature decreases during the Late Neo-Boreal than did the upper Midwest and northern Plains (Fritts et al. 1979);

therefore, related changes in extant vegetation would be more difficult to detect. It is probably safe to assume that average temperatures were at least a few degrees cooler during the late Prehistoric and early Historic periods. The frequency of severe winters and average winter precipitation were probably greater as well. Several scholars (Anderson 2001; Griffin 1961; Grove 1988) have observed that the beginning of what became known as the "Little Ice Age" disrupted prehistoric cultures throughout the Eastern Woodlands.

Present Day Climate

The climate in Illinois is typically continental in character, meaning that temperature and precipitation levels fluctuate widely throughout the year, with cold winters, warm summers, and frequent fluctuations in temperature, humidity, cloudiness, and wind direction (Illinois State Climatologist Office 2003). Most of the winds are westerly; therefore most storms cross the state in a west to east pattern.

According to Fehrenbach and Odell (1959:10), the Carbondale station a few miles west of Williamson County had a mean July temperature of 79.8 degrees Fahrenheit during the period from 1910 to 1946, while the average maximum daily temperature in January was 34.9 degrees Fahrenheit. The average annual rainfall during that time was 113.5 cm (44.7 in), and the average annual snowfall was 34.5 cm (13.6 in). The average growing season in Williamson County is 193 days (Fehrenbach and Odell 1959:10).

Description of the Project Area

The project area is located approximately 12.9 km (8 mi) east of Johnston City adjacent to Dwina Road in Section 7, Township 8 South, Range 4 East in Williamson County, Illinois (see Figure 2). The 74.2-ha (183.3-acre) project area is situated in floodplain and dissected upland ridge settings in the Big Muddy drainage system. Vegetation consisted of grassy pastures and forested ridge slopes and drainages (Figures 4–5). The forested areas contained a dense understory of shrubs, small trees, and briars, and evidence of former logging activities was abundant. In addition, the project area was cross-cut by a methane gas pipeline running east–west, and a railroad track bounded the southern end (Figures 6–7). The elevations ranged between 139.6 m (458.0 ft) and 158.5 m (520.0 ft) AMSL.



Figure 4. Project area overview showing grassy pasture, facing southwest.



Figure 5. Project area overview showing forested area with dense underbrush, facing south.



Figure 6. Methane gas pipeline cross-cutting project area east–west.

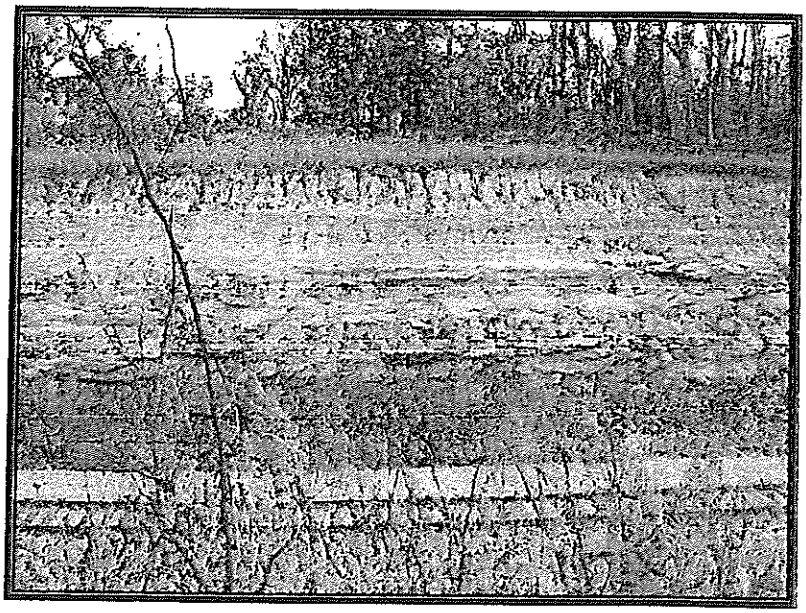


Figure 7. Railroad track bounding southern end of project area.

Surface disturbances noted in the project area included agricultural use (plowing), logging, and erosion. Ground surface visibility in the pastures and forested areas was poor. The sections with extant forests had been obviously subject to logging at one time, because as seen on Figure 5, treetops were scattered throughout the woods. No geologic overhangs were observed, and no caves were discovered.

Soil profiles observed the portions of the project area in pasture were for the most part shallow and consisted of brown (10YR 5/4) silt loam with manganese concretions extending to approximately 25 cm (9.4 in) bgs. The underlying subsoil consisted of light gray (10YR 7/1) silt loam with manganese concretions extending to approximately 35 cm (13.8 in) bgs. In the forested areas, the soils were also shallow and generally consisted of dark grayish brown (10YR4/2) silt loam to roughly 25 cm (9.4 in) bgs underlain by yellowish brown (10YR 5/4) silt loam subsoil to 35 cm (13.8 in) bgs.

A comparable soil profile for the pasture areas in the project area is provided by the NRCS (2007a and 2007b) wherein these areas are for the most part mapped as either Belknap series soils or Bluford series soils. As noted previously, Belknap series soils are characterized by an A horizon of dark grayish brown (10YR 4/2) silt loam from 0 to 33.0 cm (0 to 13 in) bgs and a Bg horizon of dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam, 33.0–68.6 cm (13–27 in) bgs. Bluford series soils are characterized by an Ap horizon of brown (10YR 4/3) silt loam from 0 to 17.8 cm (0 to 7 in) bgs underlain by two E horizons of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, 18.0–51.0 cm (7–20 in) bgs. A series of Bt horizons underlay the E horizons consisting of grayish brown (10YR 5/2) silty clay to gray (10YR 5/1) silty clay loam extending to a depth of more than 1 m bgs (NRCS 2007a). The soils observed in pasture were by and large consistent with the Belknap and Bluford series; however, in some sections, the surface soils were generally shallow due to agricultural depletion and erosion.

The forested sections of the project area were in general mapped as Bluford series soils, as described above. However, the soils differed somewhat in the observed subsoil, which was yellowish brown silt loam rather than grayish brown silty clay. This may be due to disturbances created by repeated logging activities and erosion.

Chapter 3. Previous Research, Map Review, and Cultural Overview

This chapter provides a summary of the previous research specific to the project area, a review of historic maps, and a cultural background. The previous research discussion is focused on archaeological fieldwork and cultural resources located within a 1.6-km (1-mi) radius of the current project area. A review of historic maps reveals property ownership data and the location of mapped historic structures. The prehistoric and historic cultural overview provides a generally accepted, broad context within which the prehistoric and historic components identified in the project area can be better understood.

Previous Research

Prior to initiating fieldwork, a search of records maintained by the NRHP (available online at: http://www.nr.nps.gov/nrloc1.htm) and the site files at the Illinois State Museum (ISM) in Springfield, Illinois, was conducted. The ISM records search, conducted by their staff, indicated the presence of six professional archaeological projects (ISM Survey Report Numbers 669, 5025, 11295, 14961, 90345, and 90352) and 33 sites (11WM113, 11WM114, 11WM120, 11WM121, 11WM122, 11WM123, 11WM124, 11WM125, 11WM126, 11WM127, 11WM128, 11WM130, 11WM131, 11WM132, 11WM133, 11WM134, 11WM135, 11WM136, 11WM137, 11WM138, 11WM139, 11WM140, 11WM141, 11WM142, 11WM143, 11WM144, 11WM148, 11WM153, 11WM334, 11WM337, 11WM339, 11WM349, and 11WM350) within a 1.6 km radius of the current project on the Pittsburg 7.5-minute topographic quadrangle map (United States Geological survey [USGS] 1963). One additional survey was also completed by CRAI in 2006, but this survey was not given a survey report number by ISM.

ISM 669

ISM 669 was a 457.3-ha (1,130-acre) phase I archaeological survey consisting of shovel testing at 15-m intervals conducted by Espey, Huston, & Associates (EHA) of Austin, Texas, in April 1981 on behalf of the Zeigler Coal Company for the proposed Zeigler Number 6 Mine in Williamson County, Illinois (Vander Leest 1981). This survey identified 42 prehistoric and historic sites, 25 of which were within 1 mile of the project area (11WM113, 11WM114, 11WM120, 11WM124, 11WM125, 11WM126, 11WM127, 11WM128, 11WM130, 11WM131, 11WM132, 11WM133, 11WM134, 11WM135, 11WM136, 11WM137, 11WM138, 11WM139, 11WM140, 11WM141, 11WM142, 11WM143, 11WM144, 11WM148, and 11WM153), and 3 of which were within the current project area boundary (11WM121, 11WM122, and 11WM123).

Historic sites recorded during this 457.3-ha survey included 11WM113, 11WM120, 11WM121, 11WM123, 11WM124, 11WM125, 11WM127, 11WM128, 11WM137, 11WM138, 11WM142, and 11WM148. Site 11WM113, the Williams House site, was a historic farmstead that dated from the mid-nineteenth to the mid-twentieth century and consisted of a light scatter of domestic and architectural artifacts. No foundations were observed (Vander Leest 1981). National Register eligibility recommendations were not made at that time. This site was revisited in by American Resources Group, Ltd. (ARG) in July 2004, and they recovered material culture consistent with those recovered in 1981. Due to extensive disturbance created by agricultural activities, the site was determined to be not eligible for inclusion in the NRHP (Ensor et al. 2005).

Site 11WM120, the Hedges House site, was a historic farmstead that dated from the mid-nineteenth to the mid-twentieth century. Domestic and furniture items were recovered, as well as coal fragments and limestone (Vander Leest 1981). No recommendations were made regarding the site's National Register eligibility. This site was revisited by ARG in June 2004, and their observations were consistent with the findings of the 1981 survey. Due to extensive agricultural disturbance, the site was determined to be ineligible for inclusion in the NRHP (Ensor et al. 2005).

Site 11WM121 was a late nineteenth- to early twentieth-century historic farmstead that consisted of a light scatter of domestic and architectural artifacts (Vander Leest 1981). NRHP eligibility was not determined based on the phase I results. This site was situated within the current project boundary, and the area was resurveyed by CRAI, but it could not be relocated (see Chapter 5).

Site 11WM123 was documented as a nineteenth to twentieth-century historic cabin or farmstead site that consisted of a moderate density of domestic and architectural materials. National Register eligibility was not addressed during the 1981 survey (Vander Leest 1981). This site was situated within the current project boundary and was relocated with systematic shovel testing. The results of the current site survey are presented in Chapter 5.

Site 11WM124 was recorded as a historic farmstead that consisted of four brick fragments. These items were not given a manufacture date, and no recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM125 was a historic farmstead that consisted of a small scatter of turn-of-the-twentieth-century domestic and architectural artifacts. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM127 was recorded as a historic farmstead site that consisted of a small to moderate scatter of turn-of-the-twentieth-century domestic and architectural artifacts. Vander Leest (1981) noted that 11WM127 and 11WM125 may have been part of the same farmstead complex at one time. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM128 was a late nineteenth-century historic farmstead that consisted of a very small scatter of domestic and architectural artifacts. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM137 was a historic farmstead site that dated to the mid- to late nineteenth century and consisted of a moderate scatter of domestic and architectural artifacts. No recommendations were made regarding the National Register eligibility of the site at that time (Vander Leest 1981). In 2004, ARG resurveyed the area and re-recorded the site. However, in a comparison of the site file data provided by ISM with the ARG report (Ensor et al. 2005), ARG denoted the site mistakenly as 11WM136. They recommended the site as not eligible for inclusion in the NRHP.

Site 11WM138 was characterized as a historic farmstead site, possibly dating to the late nineteenth or early to mid-twentieth century. A very small scatter of container glass, bricks, and coal were observed but not collected. The presence of a well was also recorded. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM142 was a possible nineteenth-century historic residential site. One "square nail" was recovered, and what were considered undiagnostic ceramics, container glass, and bricks were observed but not collected. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM148 was identified as the turn-of-the-twentieth-century Alsup cemetery near two cedar trees within a proposed railroad right-of-way. The graves were unmarked. No

recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981). The site was resurveyed by ARG in 2004 and it was noted that while the cemetery was not observed on any available historic maps, its presence was confirmed by a local informant (Ensor et al. 2005:91).

Prehistoric sites recorded during this survey included 11WM114, 11WM122, 11WM126, 11WM130, 11WM131, 11WM133, 11WM134, 11WM135, 11WM136, 11WM141, 11WM143, and 11WM153. Site 11WM114 was a prehistoric site of unknown cultural affiliation (Vander Leest 1981). Cultural materials recovered included a Burlington chert projectile point and a side scraper made of Cobden chert. This site was revisited by ARG in 2004; however, no other remains were recovered. While no National Register eligibility recommendations were made during the original survey, following the 2004 survey the site was determined to be not eligible for inclusion in the NRHP (Ensor et al. 2005).

Site 11WM122, the Vance's Hoe site, was a Late Woodland/Mississippian site that consisted of a light scatter of flakes, shatter, and hematite in addition to a complete hoe of Mill Creek chert (Vander Leest 1981). No National Register eligibility recommendations were made during following the 1981 survey. This site was situated within the current project boundary. The area was resurveyed but could not be relocated (see Chapter 5).

Site 11WM126, the Pegi Jodry site, was recorded as a Late Woodland prehistoric site that consisted of a small scatter of flakes, shatter, and a Cypress Stemmed projectile point. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM130 consisted of a temporally undiagnostic prehistoric site. Artifacts recovered included a Cobden chert core and a turtle shell fragment. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981). This area was resurveyed in the summer of 2004 by ARG; however, remaining evidence of the site could not be found (Ensor et al. 2005).

Site 11WM131 was recorded as a temporally undiagnostic prehistoric site that consisted of a light scatter of flakes, shatter, and an undiagnostic projectile point missing its base. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981). ARG conducted a phase I survey of the area in 2004, but the site is not listed with the sites they encountered during the survey (Ensor et al. 2005).

Site 11WM133, the Prairie Lookout site, was a temporally undiagnostic prehistoric site consisting of a light scatter of flakes, a core, a utilized flake, and a finely-made knife base. Fire-cracked rock (FCR) and handstones were also observed (Vander Leest 1981). The site was recommended for phase II testing, but it is unknown whether this has ever been conducted. ARG conducted a phase I survey of the area in 2004, but the site is not listed with the sites they encountered during the survey (Ensor et al. 2005).

Site 11WM134 consisted of a temporally undiagnostic prehistoric site with a light lithic scatter. Artifacts recovered from the site included flakes and a large core utilized as a chopper. No recommendations were made regarding the National Register eligibility of the site at that time (Vander Leest 1981). This area was resurveyed in the summer of 2004 by ARG; however, remaining evidence of the site could not be found (Ensor et al. 2005).

Site 11WM135 consisted of a possible Late Woodland site consisting of a light scatter of flakes, shatter, a hammerstone, and a projectile point stem that could have come from a Cypress Stemmed point. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981). This area was resurveyed in the summer of 2004 by ARG; however, remaining evidence of the site could not be found (Ensor et al. 2005).

Site 11WM136 was characterized as an Early Archaic site consisting of a large lithic scatter of flakes, shatter, Mill Creek chert, end scrapers, projectile point fragments, a large side-notched point, a side-notched, beveled Early Archaic point, a nutting stone, a hammerstone, and a celt fragment (Vander Leest 1981). No recommendations were made regarding the National Register eligibility of the site. No mention of the site was made by Ensor et al. (2005) following their survey in the vicinity of 11WM136.

Site 11WM141 was identified as a temporally undiagnostic prehistoric site. The site consisted of a small lithic scatter of flakes, shatter, and a possible hammerstone. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM143 was a temporally undiagnostic prehistoric site that consisted of a very small scatter of two flakes. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Site 11WM153 was identified as a Late Woodland site that consisted of flakes, a biface fragment, a nutting stone, a small grit-tempered cordmarked pottery sherd, and a bird bone. No recommendations were made regarding the National Register eligibility of the site (Vander Leest 1981).

Multicomponent sites recorded by EHA included 11WM132, 11WM139, 11WM140, and 11WM144. Site 11WM132 consisted of a turn-of-the-twentieth-century historic component and a temporally undiagnostic prehistoric component (Vander Leest 1981). The historic artifacts consisted of a light scatter of domestic artifacts, such as ceramics and container glass. The prehistoric component consisted of three flakes and one core. No recommendations were made regarding the National Register eligibility of the site in 1981 (Vander Leest 1981). This area was resurveyed in the summer of 2004 by ARG; however, remaining evidence of the site could not be found (Ensor et al. 2005).

Site 11WM139, Dan's Metate Site, consisted of a temporally undiagnostic historic component (only three pieces of brown bottle glass recovered) and a Middle Archaic prehistoric component (Vander Leest 1981). The prehistoric artifacts consisted of flakes, a core, and a large metate, which was observed but not collected. No recommendations were made regarding the National Register eligibility of the site in 1981 (Vander Leest 1981).

Site 11WM140 was a multicomponent site consisting of a turn-of-the-twentieth-century farmstead component and a Middle Archaic prehistoric component. Historic artifacts recovered from the site included domestic and architectural items. Prehistoric cultural materials consisted of flakes, hammerstones, sandstone fragments, and a mano. It was noted that 11WM140 probably was associated with the occupation of neighboring 11WM139, which contained a metate. No recommendations were made regarding the National Register eligibility of the site in 1981 (Vander Leest 1981).

Site 11WM144 consisted of a mid-to-late nineteenth-century historic farmstead component, as well as a temporally undiagnostic prehistoric flake. The historic artifacts included items classified as domestic and architectural artifacts. No recommendations were made regarding the National Register eligibility of the site in 1981 (Vander Leest 1981).

ISM 5025

ISM 5025 was a 16.2-ha (40-acre) phase I archaeological survey consisting of pedestrian survey and shovel testing at a 30-m interval conducted by ARG in April of 1993 on behalf of the Corinth Water District for a proposed new water distribution system. This survey identified two sites (11WM384 and 11WM385), one isolated find, and one historic cistern. The ISM site files did not provide a report reference for this project. None of these identified resources is located within a 1-mi radius of the current project area.

ISM 11295

ISM 11295 was a 30.4-ha (75-acre) pedestrian and shovel test survey conducted in February of 2001 by ARG for a proposed gas gathering pipeline and gas plant location conducted on behalf of Illinois Methane, LLC. Five sites (11WM150, 11WM313, 11FK200, 11FK201, and 11FK202) were located as a result of this survey, none of which were located within a 1-mi radius of the current project area (Shah 2001).

ISM 14961

ISM 14961 was a 310.9-ha (768.2-acre) cultural resource survey conducted by ARG in the summer of 2004 on behalf of the Steelhead Development Corporation, LLC, Beckley, West Virginia. Field methods included shovel testing on a 15-m grid and pedestrian survey (Ensor et al. 2005). During this survey, ARG recorded 22 sites, 15 of which were within 1 mile of the current project area (11WM113, 11WM114, 11WM120, 11WM130, 11WM131, 11WM132, 11WM133, 11WM134, 11WM135, 11WM136, 11WM137 [136], 11WM148, 11WM334, 11WM337, and 11WM339).

As noted previously (see ISM 669), Sites 11WM113, 11WM114, 11WM120, 11WM137 (incorrectly denoted as 11WM136 in the report), and 11WM148 were originally recorded as historic sites by EHA in 1981. Following ARG's revisit to the sites in 2004, 11WM113, 11WM120, and 11WM137 were determined to be ineligible for inclusion in the NRHP. Site 11WM148 was a historic cemetery that was protected under Illinois cemetery laws. Site 11WM114 was a prehistoric site also originally recorded by EHA in 1981. Following ARG's revisit in 2004, the site was determined to be ineligible for inclusion in the NRHP (Ensor et al. 2005).

Several sites previously recorded by EHA in 1981 were not relocated during ARG's 30.4-ha survey, such as prehistoric Sites 11WM130, 11WM131, 11WM133, 11WM134, 11WM135, and 11WM136, as well as multicomponent Site 11WM132. These sites are described in the ISM 669 section discussed previously in this chapter.

Three previously unrecorded sites (11WM334, 11WM337, and 11WM339) were also documented. Site 11WM337 and 11WM339 were historic sites and Site 11WM334 was documented as multicomponent. Site 11WM337 was a historic residential site dating from the 1870s to the post World War II era. A high density of artifacts was recovered and included domestic, architectural, transportation, furnishing, arms, and maintenance and subsistence items (Ensor et al. 2005). This site was recommended as not eligible for inclusion in the NRHP.

Site 11WM339 was a historic site dating from the mid-nineteenth to the mid-twentieth century. A small to moderate density of artifacts was recovered, including domestic, architectural, and maintenance and subsistence items (Ensor et al. 2005). This site was determined to be not eligible for inclusion in the NRHP.

Site 11WM334 was originally surveyed as a historic site dating to the early to mid-nineteenth century. A small to moderate density of historic artifacts was recovered including domestic, personal, and clothing items. Following the survey, phase II testing was recommended at the site to determine its National Register eligibility (Ensor et al. 2005).

Phase II testing at 11WM334 was conducted by ARG in April 2005, wherein two test units were excavated, as well as six excavation blocks totaling 400 sq m (4,305.6 sq ft). Twelve features and nine post holes were documented. According to Aberle et al. (2006), the testing of 11WM334 revealed that it was a mid-nineteenth-century farmstead site occupied by the Alonzo Rees family from 1861 to 1868. This assessment was based on the recovered material culture (domestic, architectural, personal, and transportation items) in addition to archival data. Archaic-period prehistoric lithics were also recovered. Following the phase II testing, the historic component of 11WM334 was determined to be eligible for inclusion in the National Register, and phase III data recovery was recommended (Aberle et al.

2006). The prehistoric component was determined to be ineligible.

In April 2006, CRAI conducted phase III data recovery investigations at 11WM334. The project area totaled approximately 2.03 acres (.82 ha), of which 2,067 sq m (22,249 sq ft) was mechanically stripped. All features and post holes previously identified by ARG during the phase II investigations in 2005 were relocated, and seven additional features were found, three of which were cultural. Artifacts recovered from the site generally dated to the mid- to late nineteenth century. Data recovery revealed that the site was significantly disturbed by previous historic and modern clearing activities, cultivation, and erosion. Nearly all of the subsurface features demonstrated poor integrity, and no primary deposits were discovered in any of the features. All post holes identified during the previous investigation were examined and determined to be tree root stains, and all of the material culture collected during the mitigation was recovered from secondary deposits. A re-examination of the archival records revealed that Alonzo Rees never resided at the site and that the features and material culture were associated with the Rector family, who were either tenants or squatters at the site (Faberson 2006).

ISM 90345

ISM 90345 was a phase I pedestrian and shovel test survey of the Steelhead Railroad Spur conducted in September 2005. The report of findings for ISM 90345 was not available at the time of the records search, as this project was still being reviewed by the IHPA. However, the records search did indicate two sites (11WM349 and 11WM350) were located within a 1-mi radius of the current project area.

Site 11WM349 consisted of a multicomponent site with a temporally undiagnostic prehistoric component and a turn-of-the-twentieth-century component. Prehistoric artifacts consisted of three pieces of debitage, and a moderate historic scatter of domestic, architectural, arms, and personal items. ARG only investigated part of the site and determined that the portion of 11WM349 that they surveyed was not eligible for inclusion in the NRHP.

Site 11WM350 consisted of a post-World War II historic site with a scatter of modern trash and architectural items. None of these items were collected and the site had been vandalized. While the site file did not indicate whether the National Register eligibility of the site had been determined, based on the findings, it is very likely that the site was not determined to be eligible for inclusion in the NRHP.

ISM 90352

ISM 90352 was a phase I archaeological survey of approximately 68.8 ha (170.0 acres) conducted by CRAI for the proposed Locust Grove coal mine operation in Corinth Township, Williamson County, Illinois. Three sites were recorded during this survey, one of which (11WM349) was within a 1 mile radius of the current project area (Bundy 2007).

As noted above, 11WM349 was previously investigated by ARG in September 2005 for the Steelhead Railroad Spur (report reference not provided by ISM). It was a multicomponent site with a temporally undiagnostic prehistoric component and a turn-of-the-twentieth-century historic component. The portion of 11WM349 that ARG investigated was determined not eligible for inclusion in the NRHP.

In 2006, CRAI documented the portion of the site not surveyed by ARG in 2005. By that time, the portion of the site ARG had surveyed had been destroyed by the construction of the railroad spur. The results of CRAI's survey of the remaining portion indicated that no intact deposits remained due to disturbance created by the construction of the rail line. The portion of the site investigated by CRAI was determined not eligible for inclusion in the NRHP (Bundy 2007).

Additional Survey (ISM Number Not Assigned)

In April 2006, CRAI conducted a 7.1-ha (17.6-acre) shovel test and pedestrian survey of a proposed soil storage area for a proposed coal mining operation in Section 7, Township 8

South, Range 4 East in Williamson County. The survey area was located within the current survey boundaries (see Figure 3), and it was conducted on behalf of Williamson Energy LLC (Permit Application Number 375). According to the Archaeological Survey Short Report (ASSR), no sites were discovered during the survey.

Map Review

In addition to the site file search, a review of available maps was initiated to help identify potential historic properties (structures) or historic archaeological site locations within the proposed project area. The following maps were reviewed:

1804 Government Land Office map (available online at: http://landplats.ilsos.net) (accessed March 10, 2009)

1908 Williamson County, Illinois Including a Plat Book of the Villages, Cities, and Townships of the County (Ogle & Company)

1940 Plat Book of Williamson County, Illinois (Marion Daily Republican and Marion Weekly Leader)

1959 Soil Survey of Williamson County, Illinois (Johnston City sheet) (Fehrenbacher and Odell 1959)

1963 Pittsburg, Illinois 7.5-minute series USGS digital topographic quadrangle (USGS)

1972 [1876] Williamson County Map. Atlas of the State of Illinois (Warner & Beers, Proprietors)

2001 [1920] Williamson County, Illinois Plat Map. (Williamson County Historical Society)

The maps utilized during the course of the current project indicate a long history of land use patterns in this portion of the county dating back to the early to mid-nineteenth century. The online version of the 1804 Government Land Office map for the project area did not indicate structures within, or in the vicinity of, the project area. The 1876 Illinois Atlas also did not indicate the presence of historic structures during the late nineteenth century. It was not until the early twentieth century (1908) that structures were indicated in the project area (Figure 8). The 1908 Williamson County plat map indicates a structure (Map Structure [MS] 1) was present on the 4.0-ha (10-acre) tract owned and occupied by H.C. Rodgers. This structure was east and adjacent to 11WM364 just outside of the project area. Three other map structures are also indicated on this plat map: MS 2 on the 12.1-ha (30-acre) W.W. Williams property, MS 3 on the 16.2-ha (40-acre) H.W. Williams property, and MS 4 on Madison Coal Company property of unknown acreage owned by George G. Thorne. However, none of these structures are near or correspond with Sites 11WM123 or 11WM365, which were located on the Madison Coal Company and H.W. Williams properties, respectively. It should be remarked, though, that MS 3 is located approximately 400 m east of 11WM365 within the same property denoted as H.W. Williams on the 1908 plat map. Its association is uncertain, but archival information suggests that there be a connection between the site and MS 3 (see site discussion in Chapter 5).

By 1920, no map structures are shown within the bounds of the project area (Figure 9). That year, the property containing 11WM364 was associated with Mary J. Raines, and 11WM123 and 11WM365 were within the confines of Madison Coal Company property (refer to site locations on Figure 8). The 1940 plat map indicates that Mary J. Raines continued to be associated with the tract containing 11WM364, and 11WM123 and 11WM365 were still within the confines of the Madison Coal Company tract (Figure 10).

No other maps reviewed for this project show structures within the bounds of the survey area. The 1963 Pittsburg 7.5-series topographic quadrangle map shows structures in the surrounding community, but none within the project area limits (USGS 1963). Based on the map and structure data, it appears that 11WM364 was occupied from at least 1908 until possibly 1940. While the 1908, 1920, and 1940 plat maps show properties associated with Sites 11WM123 and 11WM365, no map structures were shown in the vicinities of those sites.

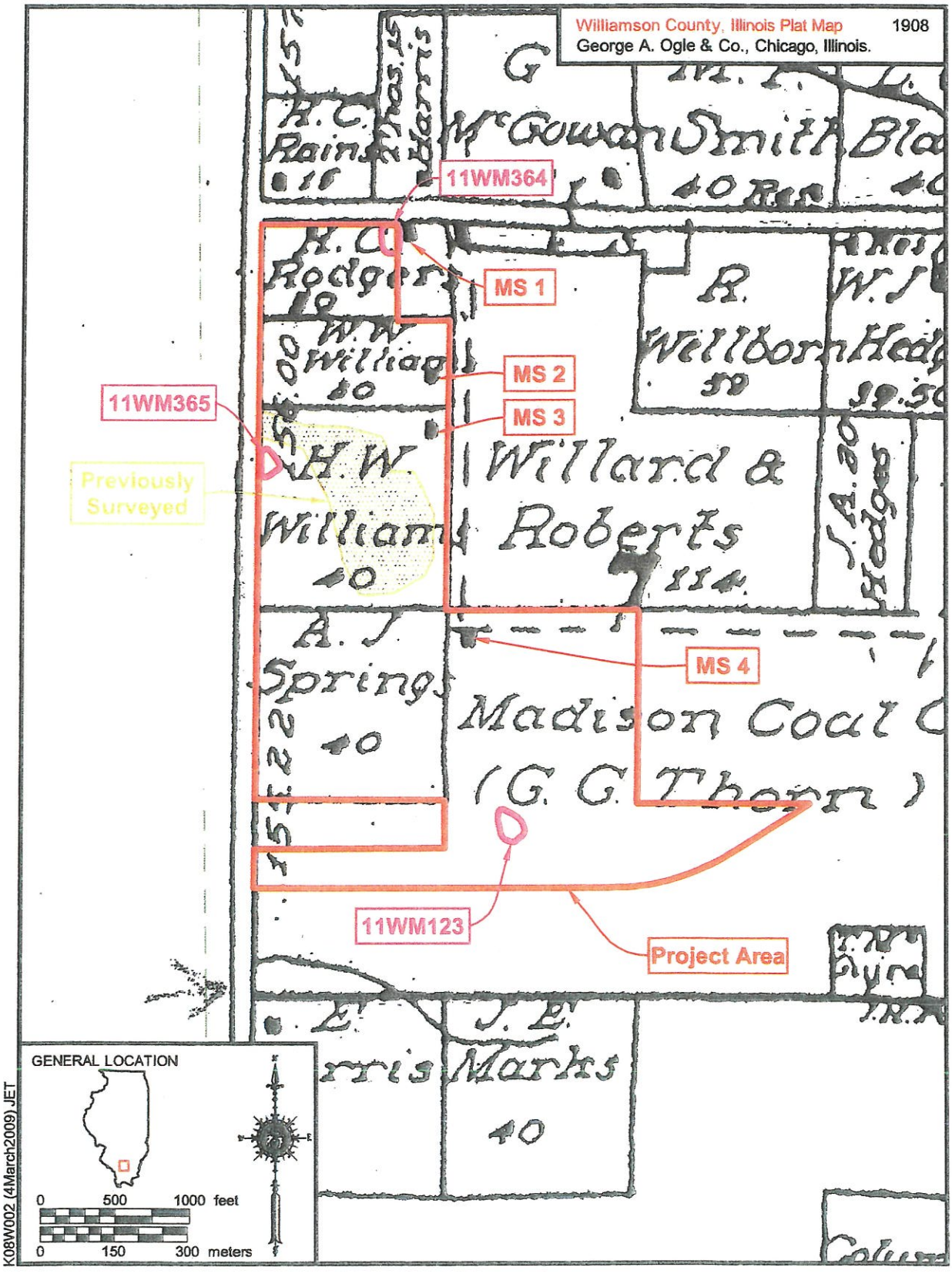


Figure 8. The 1908 Williamson County plat map showing property ownership and structures in the project area (Section 7). The approximate location of the project area has been indicated in red. Note that 11WM364 is adjacent to MS 1 in the "H.C. Rodgers" tract.

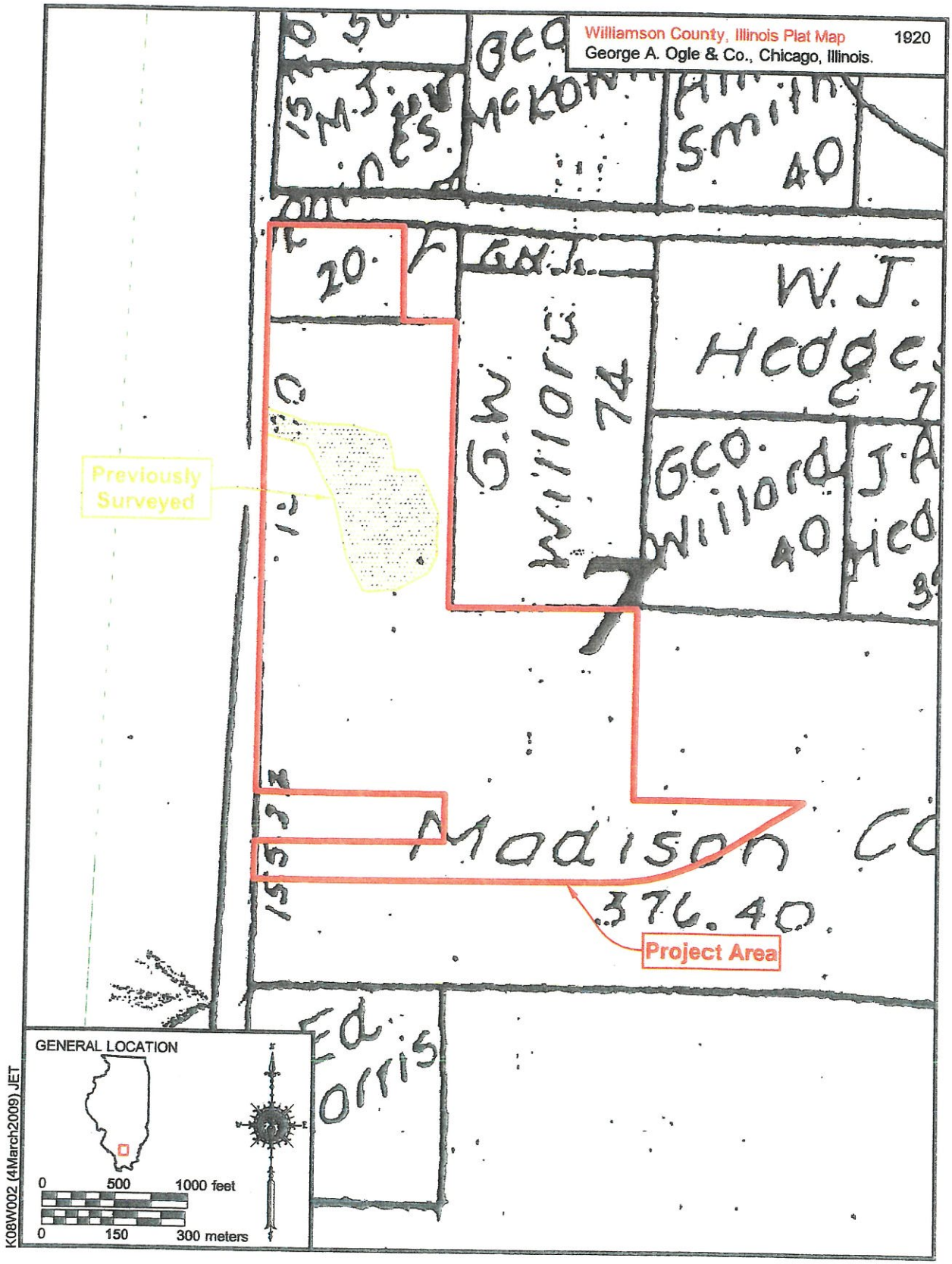


Figure 9. 1920 plat map of Williamson County Illinois showing properties within the project area.

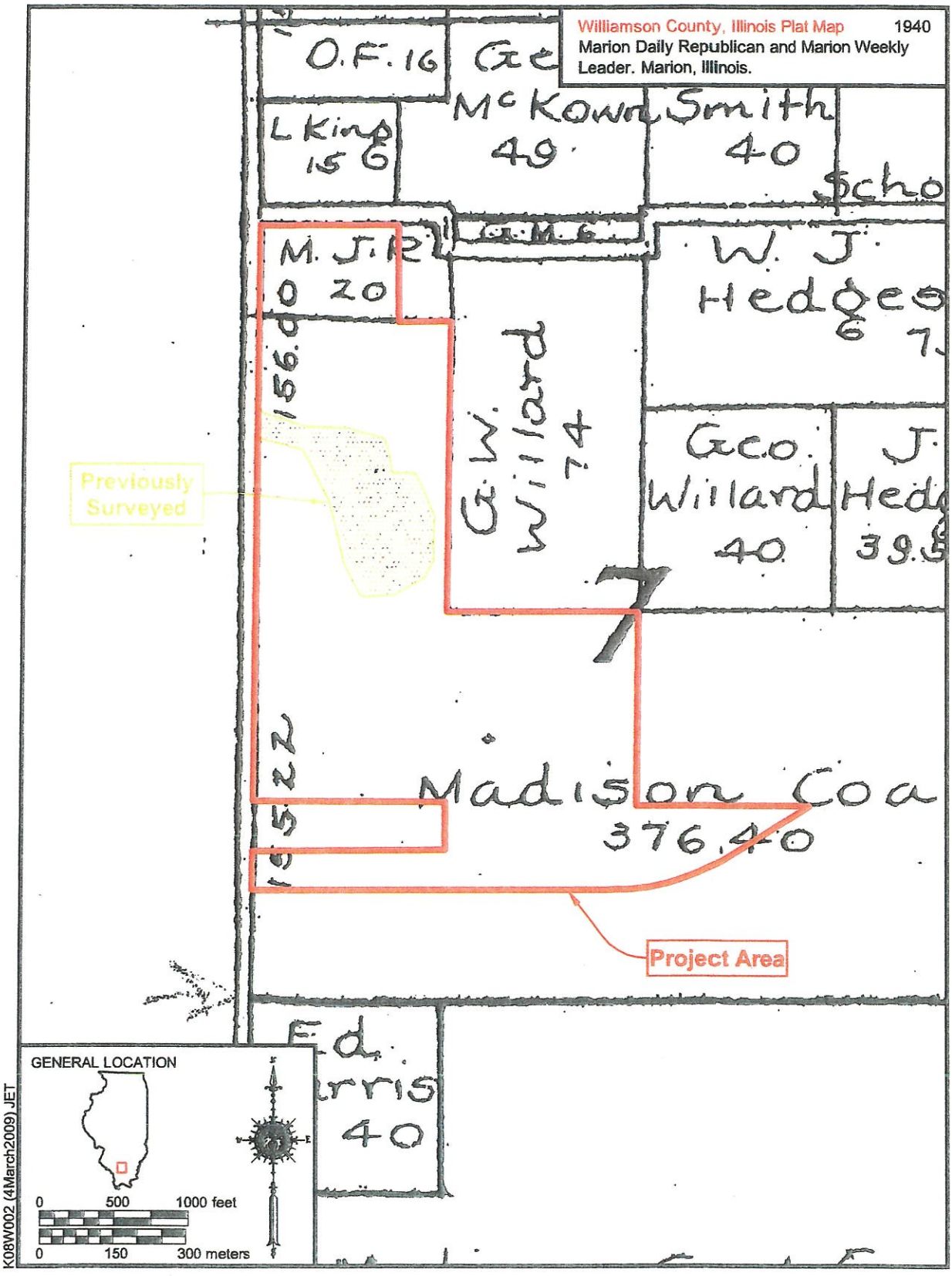


Figure 10. 1940 plat map of Williamson County Illinois showing properties within the project area.

Prehistoric and Historic Cultural Sequence

This cultural sequence provides context for the prehistoric and historic components identified at the sites investigated during this project. The prehistoric background is provided as a general context for 11WM364, which included an undiagnostic prehistoric component. Because this site included no artifacts diagnostic of a specific prehistoric period, the full range of prehistory is presented. The historic sequence provides a specific history of Williamson County, which details the framework in which the nineteenth and twentieth century occupants of Sites 11WM123, 11WM364, and 11WM365 lived.

Earliest Humans in the Eastern Woodlands

Most archaeologists believe that humans first arrived in North America via the Bering land bridge that once joined Siberia and Alaska (Dragoo 1976:4). These earliest Americans may have followed Pleistocene mega fauna or other animal species to this continent and populated both North and South America. Muller-Beck (1966) notes that this migration may have occurred as early as 40,000 B.C.; however, there is little conclusive evidence to support this view of an early arrival.

Until recently, only a few sites had good evidence of pre-Clovis occupations. At Meadowcroft Rockshelter in western Pennsylvania, for example, dates exceeding 17,000 B.C. were obtained from material recovered from the deepest microstrata in Stratum IIa (Adovasio and Johnson 1978:638–639). Additional but controversial evidence of a pre–hafted biface horizon has been found at the Wells Creek Crater Site in Tennessee (Dragoo 1973). Despite this evidence, the early human occupation of the North American continent remains open to question because pebble tool artifacts such as choppers, scrapers, and planes persisted into Paleoindian and later periods. Paleoindian tool kits also exhibit many similarities to Old World Upper Paleolithic industries, which exhibited fine craftsmanship not seen in the reported pre-Clovis industries. Despite repeated claims of new finds that might suggest a pre-12,000 B.P. human population in North America, nearly all of these claims have been reexamined and rejected for one reason or another. Meltzer sums up the traditional paradigm by stating: "The net result, so far, is that the Clovis 'barrier' remains intact. A pre-12,000 B.P. human occupation of North America does not now exist publicly" (Meltzer 1989:471).

Although many archaeologists accept Clovis as the first culture in America, this view is far from universally accepted. At the controversial Meadowcroft Rockshelter in Pennsylvania, a lanceolate biface and chert flakes were discovered below deposits dated to 11,300 B.P. (Adovasio et al. 1977, 1990). More recently, the Monte Verde site in northern Chile (Dillehay 1989, 1997) has provoked much discussion (e.g., Meltzer et al. 1997). An occupational surface (MV-II) dating to approximately 12,500 B.P. was documented at the site (Dillehay 1989, 1997). The Monte Verde occupation includes wooden huts, hearths, and associated stone artifacts dating approximately 1,000 years earlier than the generally accepted dates for Clovis, but it is situated approximately 16,000 km south of the Bering Land Bridge.

Monte Verde remains the best documented, however several other sites in the United States also have been suggested as candidates for pre-Clovis occupations. Additional evidence of pre-Clovis occupations has been documented at the Cactus Hill site (McAvoy and McAvoy 1997). This southwest Virginia site has produced evidence that it was used between 11,000 and 15,000 B.P. A thermal feature containing a few core blade tools returned a radiocarbon date of 15,070 ± 70 B.P. (McAvoy and McAvoy 1997:179), and core blades, blade cores, worked flakes, and thin, lanceolate, hafted bifaces were found in occupation levels below Clovis-aged materials.

Paleoindian Period (before 8000 B.C.).

The Paleoindian cultural tradition in the northeastern United States has been recognized as part of a wide-spread, homogeneous New World culture typified by a distinctive lithic assemblage. The most distinctive members of this assemblage are lanceolate shaped, often fluted, hafted bifaces. Artifact types, which remain relatively consistent throughout much of the eastern woodlands and American Midcontinent ranging from the Holcombe Beach site in Michigan (Fitting et al. 1966) to the Debert site in Nova Scotia (MacDonald 1968), represent predominantly hunting, butchering, and hide-working activities. Regionally, Paleoindian sites displaying similar toolkits include several southwestern Illinois sites, such as Bostrom (Tankersley 1995), the CB North (Evans et al. 1997), and Ready/Lincoln Hills (Morrow 1995) sites. Recent studies in the Mississippi-Missouri River confluence region have indicated a wide range of early Paleoindian tool types (Morrow 1996).

The overall lack of non-lithic artifacts in various Paleoindian assemblages throughout the eastern woodlands has often been attributed to unfavorable preservation conditions; and, bone tools and ornaments are assumed to have been used (Griffin 1978:226; Pearson 1999).

Post-Pleistocene adaptive strategies were geared for coping with a harsh, but rapidly changing, environment. In general, Paleoindian sites are reflective of areas where small groups of people would perform specific tasks of short duration. This type of site casts a very low archeological profile across the landscape. It has been argued that the earliest subsistence strategies in the eastern United States were not typified by a lopsided harvest of mega-fauna, but rather were characterized by a balanced hunting economy based on the exploitation of migratory game, especially caribou, and supplemented by foraged food (Fitting 1965:103–104; Ritchie and Funk 1973:336; Walker et al. 2001).

Archaic Period (8000–1000 B.C.)

The division between early fluted point hunters and their descendants in the Archaic Period is a purely arbitrary one (Griffin 1978:226). Yet, as the time dimension increases, typological comparisons of artifact assemblages begin to take on distinct regional characteristics. The Archaic is customarily divided into three subperiods: Early (8000–6000 B.C.), Middle (6000–3500 B.C.), and Late (3500–1000 B.C.) (Denny 1972; Jefferies 1990). During the Early Archaic, the last glaciers had retreated and the arctic-like boreal forest was developing into the eastern deciduous forest. By the Middle Archaic, the environment was much as it is today. This subperiod is marked by the introduction of groundstone tools, some of which have been interpreted as plant processing implements. With the beginning of the Late Archaic, the modern deciduous climax forest covered the entire eastern United States. In response to the changing environment and its concurrent changes in plant and animal communities, Archaic Period peoples developed a more diversified subsistence strategy that included a shift to exploitation of riverine ecosystems and perhaps, the beginnings of a planned seasonal round exploitation strategy.

The typical artifact assemblage for the Archaic is typically composed of corner- and side-notched/stemmed, hafted bifaces. These bifaces generally increase in quantity and stylistic variability throughout time, although along with this increase, there is a concomitant decrease in quality of individual workmanship. Stemmed bifaces, including Karnak, Karnak, Ledbetter, and the Cypress Stemmed types also appear during this time span (Justice 1987). Throughout southern Illinois, Late Archaic assemblages are typically identified by the presence of stemmed hafted bifaces along with smaller Merom/Trimble specimens (Denny 1972; Koldehoff 1992). In recent years, several Late Archaic components were documented in sealed contexts at the Little Muddy Rockshelter (Moffat et al. 1992). Late Archaic components were also identified in the Carrier

Mills Archaeological District (Jefferies and Butler 1982).

The Late Archaic in southern Illinois, as many other regions of the American Midwest, reflects the continued regional specialization and adaptation first apparent in the Middle Archaic (Jefferies 1990:153). In certain regions, Late Archaic populations appear to have shifted towards more floodplain localities (Brown 1985). There is also additional evidence for population growth of those local groups during this time span along with the concurrent reduction in the overall size of group territories. It has been suggested that the reduction of territory size may have likely reduced the chance that mobility would have played a significant role in mitigating local resource shortages (Ford 1974). With reduced mobility, Native groups would have needed to rely more heavily upon their local environments, as was witnessed in the nearby Wabash Valley (Winters 1967, 1969). It is also at this time that Late Archaic populations began to form long-distance exchange networks as a way of decreasing local pressures (Jefferies 1996a).

Woodland Period (1000 B.C.–A.D. 900)

Griffin (1978:231) notes that during the Late Archaic there was "considerable evidence for the long distance movement of goods." The interregional movement of goods provided a structure for the transmission of information as well. During this period of interregional dynamism, there was a trend towards a more sedentary lifestyle with increasingly elaborate burial ceremonialism and possibly stratified social organization. These trends, along with the appearance of fired ceramic vessels, mark the transition between Archaic and Woodland peoples.

The Woodland Period, like the preceding Archaic Period, is divided into three subperiods: Early Woodland (1000–200 B.C.), Middle Woodland (200 B.C.–A.D. 400), and Late Woodland (A.D. 400–900) (Butler and Wagner 2000; Denny 1972; Emerson et al. 2000; Railey 1990). Overall, the Woodland period witnessed a continuation and elaboration of cultural practices that began during the Late Archaic. Woodland peoples became increasingly dependent on the cultivation of plant foods, which allowed for a more sedentary lifestyle. Except for the latter part of the Late Woodland, subsistence practices remained similar to the Archaic subsistence patterns—a combination of hunting, plant food gathering, and fishing in a seasonal round exploitation pattern (Simon 2000; Styles 1981). It is within the Woodland Period that highly visible site types such as mounds and enclosures were beginning to be constructed in the region, at sites such as Twenhafel (Hofman 1980), Rutherford (Fowler 1957); and Giant City Stonefort (Butler et al. 2002).

Mississippian Period (A.D. 900–1650)

Late Prehistoric times within the region have been associated with the Mississippian cultures commonly recognized throughout the American Midwest (Lewis 1990). The Mississippian Period was characterized by a chiefdom level of sociopolitical organization and the intensive utilization of agricultural based subsistence. Maize (*Zea mays*), beans (*Phaseolus vulgaris*), and squash (*Cucurbita* sp.) were the principle crops. Nevertheless, hunting and gathering continued to be important in many areas (Jefferies 1996b; Smith 1978).

Settlements were arranged in a hierarchical manner, were often fortified, and commonly contained substructure mounds that were for either ceremonial purposes or dwelling for the elite and were occupied year-round. Mississippian structures were built utilizing wattle and daub construction and the wall posts were set in trenches. Although continuously occupied villages were in the settlement system, much of the Mississippian population lived in smaller hamlets and farmsteads. These were scattered up and down not only the major rivers, but also along the secondary streams.

History of Williamson County

Williamson County has a relatively long history within the state of Illinois. Modern-day Williamson County was originally a portion of Franklin County, which had been created in 1818 at the same time that Illinois was ratified as a state. Williamson County was not created until 1839, when Franklin County was divided by an act of the Illinois Legislature (Erwin 1876). Williamson County was named after Williamson County, Tennessee, and after Hugh Williamson, a physician in the Revolutionary War and a North Carolina delegate to the United States Constitutional Convention. Shortly after Williamson County was established, the town of Marion was named the county seat. During this early time, many of the first European American settlers in the region were from Kentucky, Tennessee, and the Carolinas. Settlements of free African Americans, such as "Africa," were also present in the county (Musgrave 2004).

In 1852, the Illinois Congress enacted a gradation law to dispose of less desirable land in the state, and this included a large section of southern Illinois. As a result, the land prices dropped from $1.25 to 12.5 cents an acre (the new minimum), and the county began to experience a second wave of land purchase and settlement, especially in the northeast quadrant of the county (Howard 1972:259). By the end of the decade, approximately one-half of all lands in Williamson County had been purchased. This is significant in comparison to the decades prior to the 1850s when only one-fifth of the county land had been purchased or settled (Goodspeed Publishing Company 1887:442).

Although a large section of southern Illinois was considered undesirable by the State of Illinois, Williamson County was generally considered fertile and productive in the mid-nineteenth century. The county was popularly known as "Egypt," a moniker representative of its agricultural productivity, because the county was recognized for supplying large quantities of food to the northern part of the state (Wilcox 1905:8). Non-food crops such as tobacco and cotton were also major sources of agricultural output in the county during the middle of the nineteenth century, and Williamson County produced the highest yield of tobacco out of the 16 counties encompassing southern Illinois.

With the onset of the Civil War, Williamson County farmers prospered because of increasing demands for grains and meat required to support Union troops. The yellowish clay typical of the county was fertile enough to grow corn, wheat, and potatoes, and the pasture land was ample enough to support herds of cattle for meat production (Wilcox 1905:8). New rail lines constructed through southern Illinois facilitated the distribution of grains and cattle meat to the north, and increasing demands for the wool required for military uniforms influenced a boom in the sheep industry in the county.

In the early years of the war, volunteerism ran high in southern Illinois in spite of predominating Confederate sympathies (Howard 1972:300). According to Jensen (1978:69), if Missouri or Kentucky had seceded from the Union early on in the war, it is likely that southern Illinois would have made an attempt to break away from the northern half of the state, because many of the residents of the region maintained ties with the southern states such as Tennessee, Kentucky, or the Carolinas, where they or their families were from. By the latter half of the war, Confederate sympathies were rampant throughout Williamson and neighboring counties. Confederate-sympathizing guerrilla bands began terrorizing Unionists, discouraging enlistment, and a full-scale riot against Federal troops was even reported to have occurred. Both Union and Confederate supporters engaged in bushwhacking, murder, arson, and pillaging in order to suppress minority opinions throughout the region (Howard 1972:314). It was not until Union troops entered southern Illinois, using brute force and making mass arrests, that southern Illinois' loyalty to the Union was guaranteed (Jensen 1978:69). With the Union occupation of southern Illinois, over 800 deserters were arrested by Federal troops in Perry, Saline,

Jackson, and Williamson counties, 40 percent of the statewide total of arrests for desertion during that time.

Following the Civil War, an agricultural recession impacted the market prices of tobacco, cotton, grain, and meat, but overall, Williamson County farmers continued to prosper. Increasing regulations on tobacco quickly resulted in a decrease in production, so that by the late nineteenth century it was no longer produced in the county (Wilcox 1905:10). Cotton also ceased to be produced in Williamson County. One unanticipated consequence of the mid- and late nineteenth-century boom in agricultural production was that the fertile farmlands became exhausted. Lack of proper crop rotation and little or no use of fertilizer led to an overall decrease in the volume of corn and wheat produced in the county. By 1900, many Williamson County farmers had turned to truck farming, producing varieties of berries, fruits, and vegetables (Wilcox 1905:10). By 1930, soybeans had also become one of the county's staple crops (Fehrenbacher and Odell 1959:11).

Industry and railroad building boomed in Williamson County after the Civil War, although some industries such as coal mining maintained a continual presence in the county after 1810 (Fehrenbacher and Odell 1959:11). By 1876, at least 10 separate and distinct veins of bituminous coal had been located in the county, and dozens of outcroppings made it easy and inexpensive to mine (Erwin 1876:3). Prior to 1882, coal was mined primarily for household needs. It was not until after this time that Illinois coal began making headway as an energy source for heavy industry (Horsley 1986:107).

In the history of Illinois, Williamson County is second only to Franklin County in the overall production of coal from the nineteenth through the twentieth centuries. With coal mining leading as a major industry in the county for such a long period of time, it is not surprising to find that the majority of the labor pool in the county has been historically comprised of miners. Many of the miners, particularly those that worked for Samuel T. Brush, owner of the St. Louis and Big Muddy Coal Company in the late nineteenth and early twentieth centuries, lived in dilapidated company housing. In addition to the horrible living conditions, most of the miners also worked in unsafe mines, and accidents and deaths were common occurrences (Angle 1952:92–93). As miners in the county moved toward unionization in the late 1890s, tensions increased between union and non-union workers as well as European American and African American workers, and violence often erupted. Although unionism eventually prevailed throughout the county, antagonism between miners and operators continued throughout the early twentieth century.

Williamson County's population has steadily increased from 22,226 in 1890 to 48,621 in 1950, and 61,296 by 2000. In spite of the violence that characterized aspects of Williamson County's history in the nineteenth and early twentieth centuries, industry continues to be attracted to the county's large labor force, good transportation networks, waterways, and coal. Workers have also been attracted to the county's foundry and factories. In addition, agricultural ventures suited to the soils of the county have continued to flourish, typically in the form of grassland farming (Fehrenbacher and Odell 1959:12).

Chapter 4. Methods

This section provides a description of the various methods employed during the current survey. Site-specific field methods are discussed in further detail in the Site Description section of the report. Field methods employed during this current survey consisted of shovel testing. Laboratory methods specific to each of the individual analyses are discussed in the specific analysis sections of this report.

Field Methods

Prior to the current archaeological survey, the client provided a topographic map of the proposed project area boundaries that included standing structures, existing roads, and other topographic features. Aerial photographs of the project area were independently obtained prior to the beginning of the fieldwork. These photographs were used in conjunction with the client-provided project map in order to delineate the project boundaries. James Plumley, the contact person for the project, also assisted the field aspect by meeting the field crew onsite and indicating the project boundaries and a number of access points.

The entire project area was subjected to systematic shovel testing. Ground visibility within the project area was poor. A little less than half of the project area consisted of floodplains left in pasture, while slightly more than half of the project area consisted of forested areas with dense secondary growth. The forested areas were generally found on dissected upland ridgeslopes and drainageways. All of the forested areas showed evidence of logging activities and erosion.

All GPS coordinates were recorded with a Trimble GeoExplorer 3 receiver. All UTM coordinates presented in this report are based on the North American Datum (NAD) 27. Positions recorded during the survey were taken under both cloudy and sunny conditions with at least six satellites being tracked. The Garmin pocket receiver has a margin of error of 3–5 m after differential correction. Although a phase I site datum was used for each archaeological site identified during the survey, no physical datum marker was placed on site for future use.

Two sets of UTM coordinates are provided for each site, these include field derived and ISM generated coordinates. Field generated UTM coordinates were recorded while standing at the site datum using the GPS receiver. The ISM-generated UTM coordinates are based on the estimated site centers generated for the state-wide site file database. Both values are indicated in the Chapter 5 site descriptions in order to provide a level of consistency with the state data and continuity with the site datum location provided in the field generated coordinates.

Shovel Testing

Shovel testing is often used to identify sites during surveys. There has been much discussion in recent decades about the reliability and usefulness of shovel testing as a site discovery method (e.g., Krakker et al. 1983; Lightfoot 1986, 1989; Nance and Ball 1986; Shott 1985, 1989). Problems and biases aside, shovel testing still appears to be the "most efficient discovery technique now available for detecting buried cultural remains on a regional scale" (Lightfoot 1989:413).

Shovel testing was the primary investigative method used during this survey due to poor surface visibility. Following IHPA protocol, shovel testing was implemented in areas with less than 40 percent ground surface visibility. Shovel tests were completed at 15-m intervals along transects spaced 15 m apart.

Additional shovel tests excavated at a 5-m interval were completed to further investigate archaeological materials identified as a result of shovel testing. This was completed to determine the spatial distribution of archaeological materials and to define the limits of the cultural remains at the location.

Two negative shovel tests at 5-m intervals were used to delineate archaeological sites.

In all cases, shovel tests measured not less than 35 cm in diameter and extended well into subsoil. Shovel tests were excavated in natural levels. The plow zone was removed as one level. After the plow zone was removed, additional levels were excavated based on the local pedon. All fill removed from each shovel test was screened through .25-inch (.64 cm) mesh hardware cloth, and the sidewalls and bottoms were examined for evidence of cultural materials and features. All artifacts recovered from shovel tests were bagged by shovel test number and depth.

Field Notes

The field director kept detailed records of the investigation to fully document the techniques, methods, observations, and results of the fieldwork. They were responsible for seeing that maps and notes were properly completed. All bags containing artifacts were checked at the end of each day and logged to ensure that these were properly labeled.

Laboratory Methods

All cultural material recovered from the project was transported to the CRAI office in Lexington, Kentucky, for processing and analysis. Initial processing of the recovered artifacts involved the washing of all cultural materials, sorting artifacts into the major material classes (i.e., lithic, ceramic, historic, faunal, etc.) for further analysis, and assigning catalog numbers. Catalog numbers consisted of the site number and a unique number for each provenience lot or diagnostic specimen. Each prehistoric modified implement (e.g., biface, uniface) or diagnostic ceramic sherd received a unique catalog number. Historic artifacts received a unique catalog number for each material group and class by provenience. Non-diagnostic material, such as flake debris, was cataloged by provenience lot where all flakes in the same provenience received the same number.

Following the initial processing of artifacts, subsequent analysis was undertaken. The methods, specifics, and results of subsequent analysis are briefly discussed below. The results of the artifacts analyses are presented under the appropriate sites. All the artifacts and records pertaining to this project will be curated at the Illinois State Museum.

Lithic Analysis Methods

Brian G. DelCastello

This section provides a brief description of the methods used to analyze and describe the lithic artifacts recovered during the current project. A more detailed description and interpretation of the lithic assemblage recovered during the current investigations is presented under the appropriate site.

The analysis of flake debris involved the recording of several attributes, including flake size, weight, raw material type, presence of cortex, and probable stage of lithic reduction during which the flake was produced. Reduction stage follows Magne's (1985) definitions and was determined by the number of facets on the platform or the number of flake scars on the dorsal surface. Early stage reduction is defined as core reduction, middle stage as the first half of tool production, and late stage as the second half of tool production and subsequent maintenance. For flakes that retain platforms, zero to one facet on the platform indicates early stage, two facets indicate middle stage, and three or more facets indicate late stage. Biface thinning is a specialized form of late stage reduction. A biface thinning flake is defined as a flake with a lipped platform having three or more facets. For non-platform-bearing flakes, dorsal flake scars were counted instead of platform facets; zero or one dorsal flake scar indicates early stage, two scars middle stage, and three or more flake scars late stage. Stage of reduction was not determined for blocky debris or flakes smaller than .25 inch.

Raw material identification was conducted of all lithic artifacts larger than .25 inch in size. The identification was determined by comparison with the sample collection housed at CRAI. Identification of lithic raw materials was not conducted for flake debris smaller

than .25 inch. Given the wide range in macroscopic attributes (such as color, texture, luster, and inclusions) occurring in some lithic raw materials, raw material identification for small-sized flake debris is considered too imprecise.

A summary of the recovered prehistoric artifacts from each site is described in Chapter 5 in the appropriate site section.

Historic Artifact Analysis Methods

Jennifer M. Faberson

The historic assemblage includes artifacts classified and grouped according to a scheme originally developed by Stanley South (1977). South believed that his classification scheme would present patterns in historic site artifact assemblages that would provide cultural insights. Questions of historic site function, the cultural background of a site's occupants, and regional behavior patterns were topics to be addressed using this system.

South's system was widely accepted and adopted by historical archaeologists. However, some have criticized South's model on theoretical and organizational grounds (Orser 1988; Wesler 1984). One criticism is that the organization of artifacts is too simplistic. Swann (2002) observed that South's groups have the potential to be insufficiently detailed. She suggested the use of sub-groups to distinguish between, for example, candleholders used for religious purposes and those used for general lighting. Others, such as Sprague (1981), have criticized South's classification scheme for its limited usefulness on late nineteenth- and early twentieth-century sites, sites which include an array of material culture—such as automobile parts—not considered by South. Despite its shortcomings, most archaeologists recognize the usefulness of South's classification system to present data.

Stewart-Abernathy (1986), Orser (1988), and Wagner and McCorvie (1992) have subsequently revised this classification scheme. In this report, artifacts were grouped into the following categories: Domestic, Architecture, Arms, Clothing, Furnishings, Personal, Maintenance and Subsistence, and Unidentified.

Grouping artifacts into these specific categories makes it more efficient to associate artifact assemblages with historic activities or site types. One primary change associated with the refinement of these categories is reassigning artifacts associated with the "Miscellaneous and Activities" under South's (1977) original system. Considering the potential variety of historic dwellings and outbuildings within the project area, a refinement of the artifact groupings was considered important to perhaps observe whether the distribution of specific artifact groups would produce interpretable patterns related to activity areas or structure types. Each one of these groups and associated artifacts is discussed in turn.

Information on the age of artifacts as described in the artifact tables is derived from a variety of sources cited in the discussion of the materials recovered. The beginning and ending dates cited need some clarification. Usually, an artifact has specific attributes that represent a technological change, an invention in the manufacturing process, or simple stylistic changes in decoration. These attribute changes usually have associated dates derived from historical and archaeological research. For example, bottles may have seams that indicate a specific manufacturing process patented in a certain year. The bottle then can be assigned a "beginning," or incept, date for the same year of the patent. New technology may eliminate the need for the same patent and the bottle would no longer be produced. The "ending," or terminal, date will be the approximate time when the new technology took hold and the older manufacturing processes were no longer in use.

Specific styles in ceramic decorations are also known to have changed. Archaeological and archival researchers have defined time periods when specific ceramic decorations were manufactured and subsequently went out of favor (e.g., Lofstrom et al. 1982; Majewski

and O'Brien 1987). South's (1977) mean ceramic dating technique uses this information. The dates presented here should not be considered absolute, but are the best estimates of an artifact's age available at this time. A blank space indicates that the artifact could not be dated, or alternately, that the period of manufacture was so prolonged that the artifact was being manufactured before America was colonized. An open-ended terminal date was assigned for artifacts that may be acquired today. The rationale for presenting dates for the artifacts recovered is to allow a more precise estimate of the time span the site was occupied, rather than the mean occupation date of a site.

A summary of the artifacts recovered follows. The artifacts recovered from the current project area will be discussed by site in the next chapter. A complete inventory of the historic artifacts can be found in Appendix C.

Architecture Group

The architecture group is comprised of artifacts directly related to buildings, as well as those artifacts used to enhance the interior or exterior of buildings. These artifacts primarily consisted of window glass, plate glass, nails, and construction materials, such as brick. The architecture group is discussed below.

Construction Materials

Construction materials refer to all elements of building construction. For this project, the building materials collected included primarily brick. When possible, bricks were separated into hand-made, machine-made, and indeterminate brick fragments. Bricks were further separated based on other diagnostic features such as vitrification, which often occurs on paver bricks. Hand-made or early machine-made bricks often have a glaze resulting from the sand in the clay turning to glass in the kiln. The paste is usually more porous and the shape of the early bricks is more irregular. The later machine-made bricks have a harder, more consistent paste and are uniform in shape. Machine-made bricks will often have marks in the clay related to the machine manufacturing process (Greene 1992; Gurcke 1987). Since no research has been conducted regarding the local history of brick-making facilities near the project area, the brick fragments recovered were not assigned specific dates. However, in Franklin County, Kentucky hand-made bricks were generally produced before 1880 and machine-made bricks were generally produced after 1880 (Hockensmith 1997). It is likely that bricks in Williamson County, Illinois were made around the same time period since many areas in the Ohio Valley region manufactured items during a relatively similar time frame. When possible, bricks were also measured for dimensions.

Flat Glass

Cylinder glass was developed in the late-eighteenth century to enable the inexpensive production of window glass. With this method, glass was blown into a cylinder and then cut flat (Roenke 1978:7). This method of producing window glass replaced crown glass, which dated back to the Medieval period, and could only be made into very small, usually diamond shaped, panes (Roenke 1978:5). Cylinder glass was the primary method of window glass production from the late-eighteenth century through the early-twentieth century, wherein cylinder glass windows were slowly replaced by plate glass windows, whose production became mechanized after 1900 but did not become a commercial success in the U.S. until around 1917 (Roenke 1978:11).

Cylinder window glass has been shown to gradually increase in thickness through time, and can be a useful tool for dating historic sites. Several dating schemes and formulas have been devised that use average glass thickness to calculate building construction or modification dates. These include Ball (1984), Roenke (1978), and Chance and Chance (1976) to name a few. Like previously derived formulas, Moir (1987) developed a window glass dating formula to estimate the initial construction dates for structures built primarily during the nineteenth century. Although Moir (1987:80) warns that analysis

on structures built prior to 1810 or later than 1915 have shown poor results, most research in this area shows the regression line extending back beyond 1810 (Moir 1977; Roenke 1978). Hence, dates calculated back to 1785 were considered plausible. Sample size is also a consideration when using the Moir window glass regression formula. According to Moir (1987:78), sample sizes also need to be "reasonable and not collected from a point or two" in order to accurately date the construction of a building. For the purposes of this investigation, a "reasonable" sample size is considered 25 window glass sherds.

Each fragment of flat glass was measured for thickness and recorded to the nearest hundredth of a millimeter using digital calipers. The differences between cylinder window glass and plate glass were in part determined by the thickness and wear of each flat glass fragment. Although Moir (1987:80) states that dating window glass after 1915 is not as reliable for dating sites, for our purposes, window glass that measured 2.41 mm (dating to 1916) was included in the calculations because according to Roenke (1978:11), plate glass did not become widely or successfully produced in the U.S. until 1917.

Nails

There are three stages recognized in the technological chronology of nails: wrought nails, cut nails, and wire-drawn nails.

Wrought nails were handmade and were the primary type of construction fastener in the eighteenth and early-nineteenth centuries. Their use ended around 1810 with the widespread use of square cut or machine cut nails (Nelson 1968:8).

The cut nail, introduced in approximately 1800, originally had a machine-cut body with a hand-made head. Around 1815, crude machine-made heads replaced hand-made heads on cut nails, and overall, cut nails replaced wrought nails in the construction industry. Early fully machine-cut nails exhibit a "rounded shank under the head," and therefore, often appear pinched below the head of the nail (Nelson 1968:8). By the late 1830s, these "early" fully machine-cut nails were replaced with "late" fully, or modern, machine-cut nails.

The first wire-drawn nails were introduced into the United States from Europe by the mid-nineteenth century. These early wire nails were primarily used for box construction and were not well-adapted for the building industry until the 1870s. Although the cut nail can still be purchased today, the wire nail nearly universally replaced it by the turn-of-the-twentieth century (Nelson 1968:8). Nails may be useful for suggesting a general date range for individual sites and project areas due to the specific date ranges for each nail type.

Arms Group

The arms group includes artifacts generally associated with civilian and military weaponry. Examples of arms include gun parts, bullets or projectiles, cartridge cases (Figure 11), and gunflints.

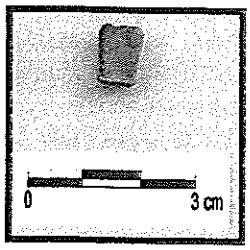


Figure 11. .22 rimfire cartridge recovered from 11WM364, STP10.

Clothing Group

The clothing group includes buttons, clothing fasteners, footwear, and other clothing related items, such as belts, hats, and fabric.

Domestic Group

Artifacts included in the domestic group consisted of ceramics, container glass, glass tableware, container closures, cookware, utensils, metal food containers, housekeeping, and undiagnostic container glass. Only a few of these classes were represented in the historic assemblage recovered from the current survey.

The ceramic inventory consisted of a variety of refined and utilitarian wares dating from the late-eighteenth century through the twentieth century. A full description of ceramic types recovered from the project area is listed below, followed by descriptions of other domestic group artifacts.

Ceramics

The ceramics recovered were grouped into five major ware types: whiteware, ironstone, porcelain, stoneware, and yellowware. Ceramics within each of these ware groups were separated into decorative types that have temporal significance. Each of these ware groups is reviewed below, followed by discussions of associated decorative types.

Whiteware

As a ware type, whiteware includes all refined earthenware that possesses a relatively non-vitreous, white to grayish-white clay body. Undecorated areas on dishes exhibit a white finish under clear glaze. This glaze is usually a variant combination of feldspar, borax, sand, nitre, soda, and china clay (Wetherbee 1980:32). Small amounts of cobalt were added to some glazes, particularly during the period of transition from pearlware to whiteware and during early ironstone manufacture. Some areas of thick glaze on whiteware may therefore exhibit bluish or greenish-blue tinting. Weathered paste surfaces are often buff or off-white and vary considerably in color from freshly exposed paste (Majewski and O'Brien 1987).

Most whiteware produced before 1840 had some type of colored decoration. These decorations are often used to designate ware groups (i.e., edgeware, polychrome, and colored transfer print). Most of the decorative types are not, however, confined to whiteware. Therefore, decoration alone is not a particularly accurate temporal indicator or actual ware group designator (Price 1981).

The most frequently used name for undecorated whiteware is the generic "ironstone," which derives from "Ironstone China" patented by Charles Mason in 1813 (Mankowitz and Haggar 1957). For purposes of clarification, ironstone will not be used when referring to whiteware. Ironstone is theoretically harder and denser than whiteware produced prior to about 1840. Manufacturer variability is, however, considerable and precludes using paste as a definite ironstone identifier or as a temporal indicator. Consequently, without independent temporal control, whiteware that is not ironstone is difficult to identify, as is early versus later ironstone. For our analysis, the primary determining factor in classification of a sherd as whiteware was the hardness and porosity of the ceramic paste. Decorative types observed on the whiteware and other refined white earthenware sherds in our assemblage are summarized and defined in the following discussions.

PLAIN

This decorative type includes vessels with no decoration. While some researchers such as Lofstrom et al. (1982:10) and Wetherbee (1980) include molded designs with "plain" whiteware, we agree with Majewski and O'Brien (1987:153) that molded vessels should be grouped on their own. Plain whiteware vessels became very popular following the Civil War and continued in popularity throughout the late-nineteenth and early-twentieth centuries (Faulkner 2000). Bacteriological research emerged after the Civil War, and it was not long before it became widely known that there is a link between bacteria and disease (Duffy 1978:395). Since bacteria could not be seen with the naked eye, it was commonly thought that plain, undecorated wares were best suited for maintaining and serving clean, bacteria-free food. Hence, bacteriological research helped spur the rise in popularity of undecorated vessels which resulted in increasing competition between whiteware and ironstone manufacturers.

Purity crusades also indirectly helped increase the popularity of plain, white vessels in the late-nineteenth and early-twentieth centuries as social reformers—many of whom were white and middle class—focused on cleaning up city streets, improving sanitation,

and ridding cities of disease epidemics. Part of this crusade was the public promotion of purity at the dinner table. Unfortunately, many of these white public health reformers were also motivated by Social Darwinist ideas, and sanitation problems and disease epidemics were often blamed on African Americans and East-European immigrants who were stereotyped as being the harbingers of disease and social decay (Friedman 1970:123).

It should be noted that while many of these sherds may come from plain vessels, it should be noted that these sherds may be undecorated parts of decorated vessels.

MOLDED/EMBOSSED

As transfer printing became popular on pearlware, molded designs were simplified. Molded designs were revived with the introduction of whiteware in the late 1830s, but they did not attain the elaborateness of previous forms. Specialized moldings for whiteware were common in the 1840s when the ware had a more limited and generally more affluent market.

During the 1860s, molding, also referred to during this time as embossed, tended to become softer in relief as opposed to the angular and sculpted forms of the 1840s and 1850s (Wetherbee 1980). During the 1870s and 1880s, molded decorations occupied smaller areas on dishes, with elaboration confined to handles and lids. British stylistic trends dominated the embossed and molded whiteware industry throughout most of the nineteenth century (Wetherbee 1980).

TRANSFER PRINTED

By the late 1780s, transfer printing was being developed in the potteries of Staffordshire, England, as a fast and inexpensive method of mass-producing decorated pearlware and whiteware. It was originally perfected circa 1756 for use on porcelains and was not used on earthenwares until Thomas Minton designed his blue willow pattern in 1780, which initiated a wider commercial use (Little 1969:15–17; Norman-Wilcox 1978). A description of the process follows.

The required pattern is first engraved by hand on a copper plate, from which a tissue-paper print called a "pull" or "proof" is taken. Then, by pressing the tissue against a piece of undecorated ware, the design is deposited or transferred to the surface of the vessel. Glazing and baking complete the process [Norman-Wilcox 1978:167].

According to Hughes and Hughes (1968:150) and others, such as Godden (1964), blue was the dominant color of transfer-printed wares prior to the 1830s. With advances in ceramic technology, brown and black prints appeared after 1825 and, by 1830, green, red, pink, mulberry, and light blue were also being produced (Bemrose 1952:23; Little 1969:13–22; Wetherbee 1980:15). By the late 1840s, a technique for transferring more than one primary color to a vessel was perfected (Godden 1964). Green transfer-printed wares were generally no longer produced after 1859 (Samford 1997:20).

Early patterns include the willow pattern and other Chinese design motifs. Although some Chinese-style motifs were still being used, the use of classical and romantic scenic themes became popular in the early-nineteenth century. These patterns included country scenes, floral motifs, and travel scenes. Patterns depicting American buildings and scenery were popular after 1812 (Snyder 2000:5). The patterns on these sherds were suggestive of prints of the early-nineteenth century (Price 1979:19).

HAND PAINTED

Hand-painted decorations began to appear on whiteware vessels immediately after their introduction in the first quarter of the nineteenth century and are still used on ceramics today. In the early-nineteenth century, blue (cobalt oxide) was the most frequently used color, because only colors capable of withstanding the heat of the glost firing could be applied. Pink, green, yellow, and red were commonly used from about 1830 through the mid-nineteenth century. The dominant motifs were banding or borderlines, usually surrounding the rim and floral designs. Without the complete vessel, it is impossible

to determine if the banding or borderline sherds date to the nineteenth century or represent ceramics that became popular in the early-twentieth century (Majewski and O'Brien 1987:160). Price (1979:21) suggests a circa 1830 to 1860 time frame for hand-painted whiteware ceramics recovered in Missouri, while Garrow and Wheaton (1986:Appendix 2) have utilized an 1830 to 1875 manufacturing range. When only one color was utilized, blue was typically selected.

FLOW DECORATED

Flowed decoration is a variant of transfer printing and was popular from 1839 to 1908 (Lange and Carlson 1985; Majewski and O'Brien 1987:142–143; Samford 1997:20). One peak period of production was approximately 1850 to 1860 (Freeman 1954:8); another was in the late-nineteenth/early-twentieth century. Little (1969:21) indicates that "flowing" or "flown blue" was developed in England during the 1820s. Some modern varieties of flow decorated wares occur and often exhibit gilding or molding. These decorations are not normally found on whiteware.

The term "flow blue" is derived from the fact that the transfer print, or other underglaze decoration, actually flows or blends with the clear glaze during the glost firing. The effect is a blurring of print or hand-painted details and a deep creamy glaze. Many have attributed its success to the reduction in the mechanical effect of the print. The "flowing" was obtained by placing either a flow powder or cups of a flow liquid in the saggers during the glost firing. The "flowing" compound was usually a volatilizing mixture such as lime or chloride of ammonia, which would evolve chlorine at the glost firing temperature. As chlorine evolved from the mixture, it combined with the cobalt glaze, in effect rendering it soluble in the glaze (Dodd 1964:117; Little 1969:21). It is also possible to find black decorated ware types with a flown decoration.

It should be noted that there is disagreement as to what should actually be classified as flow decorated. Some individuals (often collectors and antique dealers) base classification on pattern and maker's marks. This frequently results in pieces with dark transfer-print designs being classified as flow blue. For our purposes as well as to set a standard of consistency within the CRAI lab, only sherds that exhibit a blurred look due to excess dye or ink are classified as flow decorated.

DECAL

Decal-decorated ceramics were not commonly available before 1900 except on imported ceramics (Majewski and O'Brien 1987:147). The process of decalcomania consists of applying decals—designs printed on a film or paper—to ceramic vessels. This decorative technique is often confused with transfer printing; however, decals can be distinguished from transfer prints by the sharpness of the design, the presence of shading, the use of bright colors, and the slight relief often felt when touching the edge of a decal design (Majewski and O'Brien 1987:146). Decals are applied to vessels prior to firing or glazing and are usually put through the decorating kiln in order to harden the decal for permanency. The decals include stipple and line-engraved motifs created using a lithographic process in an assortment of colors (Majewski and O'Brien 1984:36).

In contrast to the polychrome sprig and broadline floral style popular in the mid-nineteenth century, floral decals are characterized by their use as a border or vessel accent. Frequently, these appear as small sprays of flowers applied off-center and often were applied in conjunction with thin-line border stripes, raised-border motifs, hand painting, and gilding (Majewski and O'Brien 1984:36). Occasionally, decals were lightly touched up by hand in order to give a hand-painted appearance. Majewski and O'Brien (1987) suggest that this motif began in the late 1800s as an inexpensive alternative to multi-colored hand painted techniques. Decals remained a popular method of decoration until the introduction of new decorating methods, including chromatic glazes and silk screening in the mid-twentieth century (Blaszczyk

2000:155). Decal decorations can occur on whiteware, ironstone, and porcelain.

Ironstone

Ironstone is a white or gray-bodied, refined stoneware with a clear glaze. It is often indistinguishable from whiteware. Ironstone differs from whiteware in that the body is more vitreous and dense. In addition, a bluish tinge or a pale blue-gray cast often covers the body. In some cases, a fine crackle can be seen in the glaze; however, this condition is not as common as it is in whiteware (Denker and Denker 1982:138).

Confusion in the classification of white-bodied wares is further compounded by the use of the term as a ware type or trade name in advertising of the nineteenth century. Both ironstones and whitewares were marketed with names such as "Patent Stone China," "Pearl Stone China," "White English Stone," Royal Ironstone," "Imperial Ironstone," "Genuine Ironstone," "White Granite," and "Granite Ware" (Cameron 1986:170; Gates and Ormerod 1982:8). These names do not imply that true ironstone was being manufactured. Some investigators avoid the distinctions entirely by including ironstones as a variety of whiteware. Others, however, such as Wetherbee (1980), refer to all nineteenth century white-bodied earthenwares as ironstone. For this analysis, the primary determining factor in classification of a sherd as ironstone was the hardness and porosity of the ceramic paste. Sherds with a hard vitreous paste were classified as ironstone.

Charles James Mason is usually credited with the introduction of ironstone (referred to as Mason's Ironstone China) in 1813 (Dodd 1964:176). Others, including the Turners and Josiah Spode, produced similar wares as early as 1800 (Godden 1964). As a competitive response to the highly popular oriental porcelain, British potters initiated this early phase of ironstone production. The ironstone of this early phase bears a faint blue-gray tint and oriental motifs much like Chinese porcelain. A second phase of ironstone began after 1850 in response to the popularity of hard paste porcelains produced in France. This variety of ironstone had a harder paste and reflected the gray-white color of French porcelains.

While some ironstones continued to use oriental design motifs after 1850, the general trend was toward undecorated or molded ironstones (Collard 1967:125–130; Lofstrom et al. 1982:10). Ironstone continued to be produced in England, and after 1870, it was also manufactured by numerous American companies. For many years, classic ironstone — the heavy, often undecorated ware — had been frequently advertised as being affordable and suitable for "country trade" (Majewski and O'Brien 1987:121). By the late 1800s, these thick, heavy ironstones began losing popularity and were often equated with lower socio-economic status (Collard 1967:13). At the same time, ironstone manufacturers began shifting to thinner, lighter weight ironstones. As a result, this type of ironstone became popular tableware in American homes during most of the twentieth century (Majewski and O'Brien 1987:124–125). In spite of the shift towards thinner and lighter ironstones, heavy ironstone remained on the market and continues to be popular in hotel/restaurant service (hence, this heavy, twentieth century ironstone is sometimes called "hotelware"). However, its production for home use all but ceased by the second decade of the twentieth century (Lehner 1980:11).

Sherds categorized as ironstone in the current study included both phases of ironstone production previously discussed (Figure 12a). See whiteware section for full descriptions of decorative types.

Porcelain

Porcelain is the name given to high-temperature fired, translucent ware. This ware type was first developed by the Chinese. Chinese, or hard paste, porcelain was introduced to Europe by Portuguese sailors that had traveled to China during the sixteenth century. The formula for true, or feldspathic, porcelain was not discovered in Europe until 1708 and not marketed until 1713 (Boger 1971:266). The production of true porcelain was limited to three factories in England; all

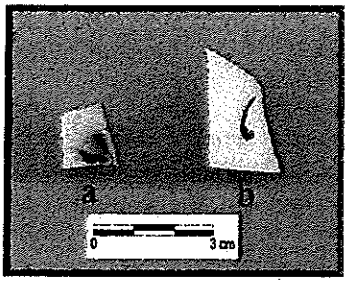


Figure 12. Ceramics recovered: (a) blue flow-decorated ironstone from 11WM364, STP26; (b) hand-painted modern porcelain from 11WM364, STP24.

other products were softer porcelains made with glass, bone ash, or soapstone. Porcelain made with bone ash, often called "bone china," became the preferred product after 1800, since the paste was harder and the ware was cheaper to produce with bone than with glass or soapstone (Mankowitz and Haggar 1957:179). Among the more affluent households in Europe and North America, porcelain was a common tableware used during the eighteenth and nineteenth centuries (Fay 1986:69). Porcelain production in America was not successful until 1826, and the number of porcelain factories in the United States remained small throughout the nineteenth century.

In the lab, bone china can be differentiated from hard paste porcelain by placing it under ultraviolet light. Bone china fluoresces blue-white while hard paste porcelain fluoresces magenta (Majewski and O'Brien 1987:128). Like pearlware, few undecorated porcelain vessels were manufactured from the eighteenth through the nineteenth century, as well as the previous centuries. However, plain porcelain was manufactured in quantity in the twentieth century. Hence, it is possible that plain porcelain recovered from historic sites may be undecorated portions of decorated vessels. Decorations on porcelain wares are generally consistent with those described for whiteware (Figure 12b). See whiteware section for full discussions of decorative types.

Stoneware

Stoneware served as the "daily use" pottery of America, particularly rural America, after its introduction during the last decade of the eighteenth century. By 1850, this ware generally replaced coarse redware as the primary utilitarian ware used in American households. Stoneware is a semi-vitreous ware manufactured of a naturally fine, but dense, clay. The pottery was fired longer and to a higher temperature than earthenwares; a kiln temperature of at least 2,192–2,282 degrees Fahrenheit had to be obtained (Cameron 1986:319; Dodd 1964:274–275). As a result, stoneware generally exhibits a hard body and a very homogeneous texture. The paste may vary from gray to brown, depending on the clay source, and length and intensity of the firing.

Because this ware is fired at such high temperatures, its body is nonporous and well suited to liquid storage. Stoneware, as mentioned, was not typically manufactured as a refined ware (such as its cousin, ironstone, or eighteenth-century refined white salt-glazed stoneware), and hence, it was, for the most part, utilized for utilitarian activities associated with jars, churns, crocks, tubs, jugs, mugs, pans, and pots. These vessels were typically glazed, with salt glazing and slip glazing most common.

Although refined salt glazing was practiced in England during the eighteenth century, by 1780, the production of English salt-glazed tableware had been virtually supplanted by the manufacture of cream colored earthenwares (Lewis 1950:29). The salt-glazing technique continued to be utilized for utilitarian vessels, however, and was eventually introduced to the United States in the early-nineteenth century. Salt glazing was accomplished by introducing sodium chloride into the kiln during the firing process, where the salt quickly volatilized. The vapor reacted with the clay to form a sodium aluminum silicate glaze (see Billington 1962:210; Dodd 1964:239). The surface of the glaze is typically pitted, having what is commonly known as an "orange peel" effect.

Stoneware may also be coated with a colored slip (a suspension of fine clay and pigment). The Albany slip—named after the

rich brown clay found near Albany, New York—first appeared in the 1820s. Initially, it was mainly used for the interior of stoneware vessels. However, by the 1850s, it was also used as an exterior glaze. Bristol glaze, an opaque white slip, was introduced late in the nineteenth century. When used in combination with Albany slip, Bristol-glazed stoneware vessels have a general date range of 1880 to 1925 (Ketchum 1983:19; Raycraft and Raycraft 1990:5).

A third glaze often used on stoneware is the alkaline glaze. Like the Albany slip, it was developed in the 1820s. The basic alkaline glaze is made up of wood ash, clay, and sand. Other additions may be slaked lime, ground glass, iron foundry cinders, or salt. These additions affected the color and texture of the glaze. Colors vary from olive to brown to a gray-green or yellowish hue, depending on adjustments in proportion of ingredients (Ketchum 1991:9). Although not as prevalent, alkaline glazing has been used in combination with salt glazing. This causes the stoneware vessel to exhibit the colors of alkaline glazing with the pitted texture of a salt glaze.

Yellowware

Ramsay (1939:148) states that yellowware represents the transition from "pottery" to earthenware. The paste is finer than the coarse earthenwares, but coarser than whiteware and ironstone. Prior to the glost firing, the paste is a buff or cream color; however, the addition of an alkaline glaze creates a deep yellow upon firing. Universally, yellowware was a utilitarian ware commonly produced for chamber pots, slop jars, urinals, mugs, pitchers, bowls, cuspidors, pie plates, food molds, and canning jars.

For the purposes of this study, yellowware is assumed to be American, although it is realized that the wares were generally of English inspiration, and some English yellowware was imported into this country. James Bennett, an English emigrant who left Cincinnati in 1839, is generally credited with the introduction of American yellowware to East Liverpool in 1840 (Stout 1923:16; Gates 1984:47). Vodrey and Frost of Pittsburgh were the first to produce yellowware in the United States, perhaps as early as 1827 (Ramsay 1939:74).

Yellowware, produced in molds, was very conducive to mass production and other potters in Ohio, Vermont, and New Jersey opened factories in the 1840s. Ohio was one center of yellowware manufacture, and it is estimated that in 1850, half of all U.S. yellowware was manufactured in East Liverpool (Gates 1984:47). Yellowware is rarely marked, although William Bromley, who operated potteries in Cincinnati and Covington during the mid-nineteenth century, included an elaborate molded mark on some of his finer Cincinnati pieces (Genheimer 1987).

One decorative treatment of yellowware, called Rockingham, is simply a mottled, brown-glazed yellowware. It is sometimes referred to as Bennington ware; however, it was manufactured throughout the eastern United States. A glaze of pure oxide of manganese produced a brown or purple brown tint resulting in a mottled or streaked effect (Hughes and Hughes 1968:130). Originally, Rockingham ware referred to ornate porcelain manufactured between 1826 and 1842 at Swinton, Yorkshire, England on the estate of the Marquis of Rockingham (Dodd 1964:232). Hence, the term is not actually paste specific; the characteristic glaze was applied to redwares, whitewares, porcelain, and yellowware.

Christopher Webber Fenton at Bennington, Vermont, introduced Rockingham wares to the United States around 1845. Yellowware potteries in East Liverpool and other parts of Ohio and the eastern United States quickly took up its production. Bennington designs were closely copied in Ohio, including round-handled pitchers, book flasks, picture frames, mugs, pie plates, and milk pans (Ramsay 1939:76–77). During the mid-nineteenth century, both Rockingham and yellowware were marketed as "Liverpool" ware and "Queensware" (Gates and Ormerod 1982:7).

Another prominent decorative treatment for yellowware includes the application of

annular-slip bands, which were usually blue, white, or brown as well as mocha techniques, such as cat's eye, swirl/wormware, and dendritic. Slip decorating, variously termed dipped, annular, or banded, refers to a technique used to apply bands or stripes horizontally to hollow vessel forms such as mugs, bowls, cups, and covered dishes (Majewski and O'Brien 1984:163). The bands or stripes applied to the particular vessel, unlike hand-painted, flat decorations, will have slight relief. Various colors can be found on slip-decorated wares. Over time, the bands became wide, and the colors changed from earthen browns, greens, yellows, blues, and black to bolder colors such as bright blues, yellows, and white. Very narrow bands of white or black were often found on the later, brightly colored vessels. Slip-decorated vessels may be further enhanced with one or more of the following decorative types: rouletted or engine-turned decoration, hand-painted swirls, marbled motifs, and mocha designs.

Rouletted decoration is produced when a shaped instrument is pressed onto a still damp slipped vessel as it is turned on a potter's wheel, thereby exposing the contrasting paste color beneath (Godden 1963:105). Hand-painted decorations were often used on annular wares as accents between bands. These designs were often swirled resembling finger painting or black-and-white "cat's eyes." In addition to these hand-painted motifs, zigzag and other abstract-shaped concentric lines were often applied between bands (Majewski and O'Brien 1984:163). Mocha decoration is produced when an acidic mixture (usually consisting of various combinations of tobacco juice, hops, urine, dry printer's black, turpentine, citric acid, and water) is dripped onto the colored slip, where it spreads into forms resembling trees, seaweed, fronds, etc. (Majewski and O'Brien 1984:163).

Container Glass

A variety of container glass was recovered during the current investigations. Research by Baugher-Perlin (1982), Jones and Sullivan (1985), and Toulouse (1972) were used to date glass containers. Glass color was the only attribute that could be used for dating those fragments that were not be identifiable as to type of manufacture.

The approximate date of manufacture for bottles and bottle fragments recovered from the project area was established by determining the manufacturing process associated with the bottle (i.e., creation of the base and lip of the container) and using any patent or company manufacturing dates embossed on the bottle.

The lip on a bottle can be informative. A lipping tool, patented in the U.S. in 1856, smoothes and shapes the glass rim into a more uniform edge than a hand-smoothed lip or "laid-on ring." Certain types or styles of lips were associated with specific contents; for example, medicines were often contained in bottles with prescription lips (Jones and Sullivan 1985). A "sheared" or unfinished bottle lip typically dates before 1880.

Lipping tools were used throughout the middle and end of the nineteenth century until the advent of the fully automatic bottle machine (ABM) in 1903. It should be noted, however, that as automated bottle manufacture became available after the turn-of-the-twentieth century (see below), tooled finishes continued to be produced—albeit in steadily decreasing numbers—after the advent of automated bottle manufacturing became available. That is, there is a lag time between tooled finishes and ABM finishes, and although ABM glass is given an incept date of 1903, most tooled-glass vessel sherds will be given a terminal date around the 1920s due to this lag time, unless other diagnostic characteristics are observed enabling one to give it an earlier terminal date.

The manufacturing process can be roughly divided into three basic groups including free blown, blown in mold (BIM), and machine manufactured (ABM) vessels (Baugher-Perlin 1982:262–265). Only BIM and ABM glass was recovered from the current project. An unidentified category was used for those that

could not be determined. Each process will be discussed separately.

Blown in Mold (BIM)

Most molded bottles are constructed in pieces and have distinctive seams. The dip mold was used from the late-seventeenth through the mid-nineteenth century (Baugher-Perlin 1982:262). It leaves no seams, unless glass adhered to the edges of the bottle mold as it was attached to the free blown shoulder and bottle neck. The key mold, on the other hand, was a type of two-piece mold that was used from about 1750 to 1880 (Jones and Sullivan 1985:27). Key mold seams cross the base and are concealed in the corners of a flat-sided body.

The turn paste mold was used from about 1870 to the early-twentieth century and does not contain seams because the glass is blown into a container that is spun. The glass conforms to the mold from the centrifugal force produced. Vessels formed from this process usually have faint horizontal lines from the spinning process. The three-part mold has seams running around the shoulder of the vessel and partially up the neck of the vessel. This style of mold lost popularity around 1870. The blow back mold was another mold type, and this was used in the manufacture of jars such as the distinctive Mason jar, which was patented in 1858.

Embossing on container glass vessels was made possible by engraving the mold the glass was blown into. This was first conducted in the mid-eighteenth century and continued into the twentieth century (Figures 13a and 13b). The panel bottle came into popular existence around 1860, and the shape of this vessel was useful because the name of the commodity or the manufacturing company could be changed on the bottle form by substituting a different "slug-plate" into the mold. This process can be identified through the distinctive seams, as they follow the rectangular shape of the nameplate. The date of the manufacturer's patent on the bottle and the name of the company, when present, can often be utilized to determine a date of manufacture for the container.

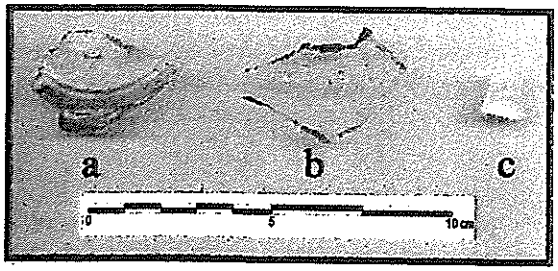


Figure 13. Container glass and toy artifacts: (a) BIM amethyst cup/post mold, recessed panel sherd from 11WM123, STP6; (b) ABM amethyst embossed sherd from 11WM364, STP18; (c) bisque porcelain doll fragment from 11WM364, STP24.

The finish is the top part of the neck of a bottle or jar made to fit the cork or other closure used to seal the vessel. The finish is often simply referred to as either the lip or rim. Glass factories in the late-nineteenth and early-twentieth centuries produced a wide variety of finishes for their containers (Jones and Sullivan 1985:78). Finishes were formed by manipulating the glass at the end of the bottle neck, by shaping glass added to the end of the neck, by the lipping tool, or by being blown into a mold (Jones and Sullivan 1985:79). The term "finish" originated with the mouth-blown bottle manufacturing process where the last step in the completion of a finished bottle was to "finish the lip."

Mouth-blown bottles were removed from the blowpipe by two primary methods: either through the cracking-off process or by shearing the neck off of the blowpipe. Once this was completed the bottle was reheated in a furnace to smooth out the sharp edges where the blowpipe was detached (Lindsey 2008). This method, referred to as fire polishing, was completed even if no specific finish was to be formed. Once this method was complete a finish could be either added or formed on the top of the bottle neck. These finish types included a laid-on ring, a rolled finish, a flared or flanged finish, an applied finish, and a tooled finish. The most commonly found finish types are the applied finish and the tooled finish. An applied finish, also referred to as early applied, was created when applied hot glass is added at the point where the blowpipe was removed. This applied hot glass was manipulated with various tools in order to

form a wide variety of finish styles (Lindsey 2008). A tooled finish, also referred to as late applied, was created by reheating the severed end of the bottle near the neck. Once reheating or refiring the end of the neck was accomplished, a lipping tool was inserted into the neck of the bottle and rotated while squeezing the jaws to form the finish desired. Semi-automatic rims were also noted in the glass assemblage recovered during the current excavations. These rims exhibited a ground or external thread ground finish. The body and base of these vessels were created via machine and the rims were finished by hand. This finish type was dated from the late nineteenth century into the early twentieth century (Miller and Sullivan 1984).

Jones and Sullivan (1985) observed that chemicals color glass, either as natural inclusions or additions by the manufacturer. According to Lockhart (2006), amethyst glass began to be manufactured around 1870, when manganese was being added to the glass recipe. Although initially colorless, the glass will turn a distinctive purplish color when exposed to sunlight over time. It was previously thought that amethyst glass production ceased by 1914 due to a shortage of manganese from Germany during World War I; however, the change was actually a result of technological advancements in the glass industry, mainly the conversion to automatic bottle machines (Lockhart 2006:53). Although manganese was more difficult to obtain after World War I, and selenium was often less expensive, the improvement in technology was the major reason for the change. The use of selenium proved to be an inexpensive decolorant in glass production and ultimately displaced manganese as a decolorizer by 1920 (Lockhart 2006:53). Amber glass had a general application in the mid-nineteenth century, but was not widely used until after 1860. Cobalt glass is produced with the addition of the coloring agent cobalt oxide to the glass batch (Lindsey 2008). The introduction of what Lindsey (2008) calls "true blue" glass began in 1840 with the production of soda, mineral water, and ink bottles. With the growing public desire to see the contents of the bottles, clear glass came into demand and was popular beginning in the 1860s (Baugher-Perlin 1982:261). However, it should be noted that clear glass was available to a limited degree before this time. Aqua, light green, and olive colored glass were also used for many different containers, but they cannot be assigned specific dates due to their long period of use over the last several centuries and continuing popularity.

Automatic Bottle Machine (ABM)

The Owens automatic bottle-making machine was patented in 1903 and creates distinctive seams that run up the length of the bottle neck and onto the lip, in addition to suction scars. This ABM mold provides a firm manufacturing date at the beginning of the twentieth century. Another automatic bottle machine called the Individual Section was also used in the commercial production of bottles. This machine was widely used starting in 1925 and by 1940 became the most widely used bottle manufacturing device (Jones and Sullivan 1985:39). This bottle machine was more cost effective than the Owens machine which was no longer used after 1955. Cup and post molds continued to be used in the ABM industry. These were still formed similarly to the BIM method and were not assigned mold specific incept dates.

Finishes were formed differently on ABM bottles and jars than on BIM vessels. Unlike BIM vessels where the finish is formed last, the finish on ABM bottles and jars is formed first. The automatic machines typically held the neck ring and finish before the bottle or jar was expanded to the desired size. The most obvious distinguishing characteristic on an ABM finish versus a BIM finish is that ABM finishes exhibit machine mold seams that travel up the entire finish of the vessel. ABM vessels also contain a horizontal mold seam that circles the vessel neck just below the finish. Thirdly, ABM finishes contain another mold seam at the top of the finish which encircles the vessel opening (Jones and Sullivan 1985; Lindsey 2008; Toulouse 1969b).

Undiagnostic Container Glass

When no other diagnostic features were present, the color of the glass was noted, although there is some subjectivity inherent in color classification. Jones and Sullivan (1985) observed that chemicals color glass, either as natural inclusions or additions by the manufacturer. The concern here was primarily to note the presence of purple or "amethyst" glass, selenium glass, cobalt glass, and "milk" glass.

Glass Tableware

Press molding was first used (although at a very small scale) in England in the late-seventeenth century to make small, solid glass objects, such as watch faces and imitation precious stones (Buckley 1934). By the end of the eighteenth century, decanter stoppers and glass feet for objects were also being produced (Jones and Sullivan 1985). The production of complete hollowware glass objects did not become possible until there were innovations in press-molded techniques in the United States during the late 1820s (Watkins 1930). Mass production of press-molded glassware was well established by the 1830s (Watkins 1930).

Earlier press-molded glass objects were predominately made of colorless lead glass (Jones and Sullivan 1985). William Leighton of the Hobbs-Brockunier Glass Works in Wheeling, West Virginia, invented lime glass. This type of glass looked like lead glass, had superior pressing attributes, and was much more inexpensive than lead glass (Revi 1964). Advancements in mold technology in the 1860s and 1870s led to the application of steam-powered mold operation. This in turn led to increased production and reduced costs (Revi 1964). Modern press molding is conducted entirely by machine (Jones and Sullivan 1985).

Press-molded table glass was made by dropping hot pieces of glass into a mold. A plunger was then forced into the mold, pressing the hot glass against it. The outer surface of the glass took on the form of the mold, while the inner surface of the glass was shaped by the plunger. The plunger was withdrawn and the glass object was removed from the mold. The surface of the glass was often fire polished to restore the brilliance of the glass surface that was disturbed by its contact with the mold (Jones and Sullivan 1985).

Press-molded glass may be recognized by several characteristics. Usually, the glass object must be open-topped in order for the plunger to be withdrawn from the mold. Narrow mouthed vessels were produced, but additional manipulation of the glass was necessary after the plunger was removed from the mold. Evidence of this manipulation should be present on the vessel (Jones and Sullivan 1985). There is no relationship between the exterior shape and design of a press-molded vessel to the interior shape and design because the plunger shapes the interior of the object most often leaving behind a smooth surface. This differs from earlier glass vessel production techniques like blown glassware, where interior shape was related to the exterior shape and design (Jones and Sullivan 1985).

Another characteristic of press-molded containers was that mold seams were generally present. The seams were sharp and distinct, unless steps had been taken to deliberately remove them. The texture of the glass surface of press-molded glass was disturbed and often disguised by an all-over stipple design. The edges of the designs on press-molded glass had a predisposition toward rounded edges. The bases of press-molded objects were usually polished. The quality of the designs on press-molded glassware was precise and the design motifs were numerous (Jones and Sullivan 1985).

In contrast to press-molded glass, cut glass generally had a polished, smooth, and glossy surface texture. The design edges were sharp and distinct. Cut glass designs consisted mostly of panels, flutes, and miters. The designs were often slightly uneven and asymmetrical. Mold seams were usually absent; they were polished off prior to cutting (Jones and Sullivan 1985). Contact-molded

glass also differs from press-molded glass in that the exterior and interior of the vessel will portray parallel patterns. The interior of the vessel is also generally much more diffuse towards the base (see container glass section above for full descriptions of glass colors).

Closures

Bottle closures serve both to prevent the spilling of a bottle's contents and to protect a bottle's contents from contamination and evaporation (Berge 1980). Closures have been used almost as long as animal skins and bottles have been employed to contain liquids. Closures range from a utilitarian piece of paper or cloth stuffed into the mouth of a bottle to a delicately crafted crystal stopper for a decanter. There are three primary closure types: caps, stoppers, and seals (Berge 1980).

Caps are secured to a bottle by overlapping the outside edge of the finish or mouth. Common cap types include external screw, lugs, crown, and snap-on. External screw caps were first introduced in the mid-nineteenth century (Jones and Sullivan 1985; Toulouse 1977). External thread caps were attached to bottles by means of grooves in the cap that screwed down on continuous glass threads on the finished exterior of a bottle. External thread caps were first produced using metal in 1858 (Jones and Sullivan 1985; Toulouse 1977). Advances in technology led to the introduction of a Bakelite external thread cap around 1922 (Berge 1980; Meikle 1995), an aluminum shell roll-on cap in 1924 (Berge 1980; Rock 1980), and modern plastic caps in the mid-1930s (Meikle 1995). Examples of the external thread cap include canning jar, mayonnaise jar, and pickle jar lids.

The crown cap was patented on February 2, 1892, by William Painter of Baltimore, Maryland (Rock 1980). The crown cap was placed over the finish, and then crimped around a lip or groove in the finish to seal the container. This closure was lined with cork from 1892 until circa 1965 (IMACS Users Guide 2001; Riley 1958; Rock 1980). Crown caps with composition liners appeared in 1912, and both cork and composition liners were gradually phased out following the introduction of the plastic liner in 1955 (IMACS Users Guide 2001; Riley 1958). The majority of commercially produced glass soda bottles have crown cap closures.

Stoppers, the second major closure type, are secured to the finish interior of bottles, usually by forcing a portion of the stopper into the bore of the finish. Stopper types include cork, glass, inside screw, porcelain-top, Hutchinson Spring, Electric, Pittsburgh, and Lightning. Cork stoppers were the most common historic closure type.

Most glass stoppers use ground or roughened tapered stems along with a roughened finish inside to seal bottles. The "modern" ground and tapered glass stopper was developed in Europe around 1725 (Holscher 1965). Glass stoppers came in many shapes, sizes, and styles and were used as closures in many different types of bottles. As with the cork stopper, the glass stopper was phased out in the 1920s with the advent of the crown cap closure (Berge 1980; Jones and Sullivan 1985).

Seal closures utilized the vacuum on the interior of the glass container. The heating and then cooling of the bottle's contents created the vacuum. Seal closures, although dating back to 1810, did not become popular until the mid-twentieth century. These closures were most often used in food jars (Berge 1980). There were several types of seal closures including Phoenix, Sure Seal, Giles, spring seal, and disc seal.

The disc seal was used as early as 1810 by Nicholas Appert (Berge 1980). John L. Mason used this type of closure on his patented fruit jar in 1858 (Berge 1980). Mason's closure was made of zinc and was held in place with an exterior screw cap ring. Unfortunately, the zinc reacted with the contents of the jars, giving the contents an unpleasant metal taste (Jones and Sullivan 1985). Glass liners were then developed and added to the disc around 1869 by Lewis R. Boyd (Toulouse 1969a, 1977). These liners prevented the zinc from reacting with the contents of the jar. To aid in opening, Boyd added a handle to the disc circa

1900 (Toulouse 1977). Both of these disc seal types were used until around 1950 (Jones and Sullivan 1985; Toulouse 1969a, 1977). In 1865, the Kerr two piece seal was patented. This system utilized a metal seal disc held in place by an exterior screw cap with no center. This seal and cap type system is still in use today.

Furnishings Group

The Furnishings category includes artifacts usually associated with the home or building, but are not elements of the actual construction. Examples of furnishings include decorative elements, furniture, heating, lighting, and wall decorations. Artifacts were collected from two of the above categories.

Personal Group

The Personal group includes artifacts assumed to have belonged to individuals. This category of artifacts includes health and grooming items, jewelry and beads, coins, music and art items, personal items, toys (Figure 13c), and games. Tobacco products are also subsumed into this category.

Maintenance and Subsistence Group

The maintenance and subsistence group contains artifacts related to general maintenance activities on a farmstead. These artifacts were grouped into classes containing non-food containers, electrical, farming and gardening, hunting and fishing, stable and barn activities, general hardware, general tools, transportation, and fuel-related items such as coal. Only two of these classes were represented in the historic assemblage recovered from this site.

General Hardware

This class of artifacts includes a wide variety of hardware fasteners and items used for a variety of purposes. Most of the items in this class could have been manufactured throughout the late nineteenth and into the twentieth century.

Fuels

This group of artifacts includes charcoal, coal, cinder, slag, and containers indicative of fuel.

Unidentified Group

This category contains artifacts that could not be identified beyond the material from which the artifact was made. There were two material classes included within this group. These material classes included metal, and stone.

The unidentified metal consisted of a variety of material types and shapes such as flat, thick fragments; flat, thin fragments; item/parts; and amorphous fragments. The function of these metal pieces was difficult to ascertain so the metal was grouped into the unidentified category. It is possible that many of these pieces may have been nails, tools, or other hardware, but excessive rust and corrosion prevented a definite identification. Slate and sandstone were categorized under unidentified stone. These items were not assigned specific dates.

Curation

Artifacts and attendant data generated from this investigation will be curated in accordance with federal guidelines. It is proposed here to curate the materials with the ISM in Springfield, Illinois.

3001-15
Part 8

Chapter 5. Results

During the course of the current survey, two previously unrecorded archaeological sites (11WM364 and 11WM365) and one previously recorded site (11WM123) were documented. Two previously recorded site locations (11WM121 and 11WM122) were also resurveyed; however, these sites could not be relocated. In addition, the 1908 plat map of Williamson County (see Figure 8 in Chapter 3) indicated that there were possibly three structures (MS 2–4) within the project area. These areas were intensively shovel tested, but no evidence of these structures was discovered. A description of the recorded sites with the exception of 11WM121 and 11WM122 are presented below, and the location of each site is depicted in Figures 2 and Figure 3.

Each site description begins with a brief summary of salient characteristics (i.e., site setting, components, type, size, NRHP status). This is followed by a narrative site description and an explanation of the investigative techniques used to identify and delineate the site. Subsequent sections include depositional context, artifact analysis, feature data, archival data (when applicable), summary of NRHP status, and project impacts. Appendix D provides the Illinois Archaeological Survey site forms as filed with the ISM, and Appendix E includes the ASSR.

Site 11WM123

UTM Coordinates (Site Center): (Zone 16) N4189114.0, E340643.0
UTM Coordinates (Field Derived Datum): (Zone 16) N4189317.0, E340614.3
Legal Description: NW1/4 SE1/4 SW1/4 Sec 7 T8S R4E
Elevation: 158.5 m (520.0 ft) AMSL
Components: Historic farmstead/residence
Site Type: Historic scatter
Size: 3,900 sq m (41,979.3 sq ft)
Distance/direction to nearest water: 300 m (984.2 ft) east to intermittent tributary of Pond Creek
Type and extent of previous disturbance: Logging, erosion; 50–75 percent disturbed
Topography: Dissected upland ridge
Vegetation: Forest, dense underbrush
Ground surface visibility: Less than 10 percent
Soil Association: Ava-Bluford-Wynoose
Slope Direction (Aspect): Northeast
Recommended NRHP status: Not eligible

Site Description

Site 11WM123 is a mid- to late nineteenth-century to early twentieth-century farmstead/residence located in the northwest quadrant of the southeast quadrant of the southwest quadrant of Section 7 Township 8 South Range 4 East (see Figure 2) within a wooded section near the southern boundary of the project area that had been very disturbed by past logging activities and subsequent erosion. It is situated on a generally southwest to northeast trending, broad dissected upland ridge approximately 300 m west of an unnamed intermittent tributary of Pond Creek.

The site was originally documented by EHA in 1981 via shovel testing, and it was recorded as a nineteenth- to twentieth-century historic cabin or farmstead site consisting of a moderate density of domestic and architectural materials. Items recovered at that time included ceramics, container glass, window glass, cut nails, metal, brick fragments, cinders, sandstone, and plaster fragments. Specific dates or detailed information was not provided. The National Register eligibility of the site was not addressed during the 1981 survey (Vander Leest 1981).

The current project re-identified the site as a result of systematic shovel testing. Site dimensions, established by positive shovel test positions within the project boundaries, were 60 m (196.8 ft) north–south and 65 m (213.3 ft) east–west. This is somewhat larger than the site area recorded by EHA in 1981. At that time, site dimensions were recorded as 35 m (114.8 ft) north–south and 20 m (65.6 ft) east–west. The difference in site size is likely due

to the disturbance/dredging associated with logging activities in the vicinity. Based on the current survey results, the site covers approximately 3,900 sq m (41,979.3 sq ft), or .4 ha (1.0 acres). The ISM-derived site size, which is not based on field observations but on topographic quadrangle map data is 5,031 sq m (54,153.2 sq ft), or .5 ha (1.2 acres).

Vegetation at 11WM123 at the time of investigation consisted of forest with a dense understory of shrubs, small trees, and briars. Evidence of former logging activities was abundant with the presence of felled tree tops and underbrush, such as dense briar patches, which typically occur in areas that have been highly disturbed. Ground surface visibility (less than 10 percent) was limited due to ground cover (Figure 14).

A moderate density of historic domestic, architectural, clothing, furnishing, and maintenance and subsistence artifacts, generally dating from the mid- to late nineteenth century to the early twentieth century, was recovered during the current survey. No structures within the vicinity of the site were observed on available historic maps.

Investigation Methods

The site was relocated as a result of shovel testing at a 15-m interval, and the site boundaries were delineated using a 10-m grid. All material from shovel tests was visually inspected and screened through .25-inch mesh.

Seventy-four screened shovel test pits (STPs) were excavated to delineate the boundaries of the site. Fifty-one shovel tests fall within the indicated site boundary, with 21 shovel tests (STP 1–8, 10–22) yielding cultural material. STP 9 was originally assigned a shovel test number, but following the lab analysis, the STP was determined to be devoid of cultural material. The density and distribution of recovered material is discussed below in the Artifacts and Summary sections.

Data pertaining to the site location was recorded and the site was indicated on appropriate maps. A site datum was established and its UTM coordinates were recorded using a hand held GPS unit. A site sketch map was drawn showing the placement of the shovel test positions in relation to physiographic features and the project area boundary (Figure 15). The location of the site was also marked on a copy of the Pittsburg 7.5-minute series quadrangle map (USGS 1963) and layout maps provided by the client, which served as field maps.



Figure 14. Overview of 11WM123, facing west.

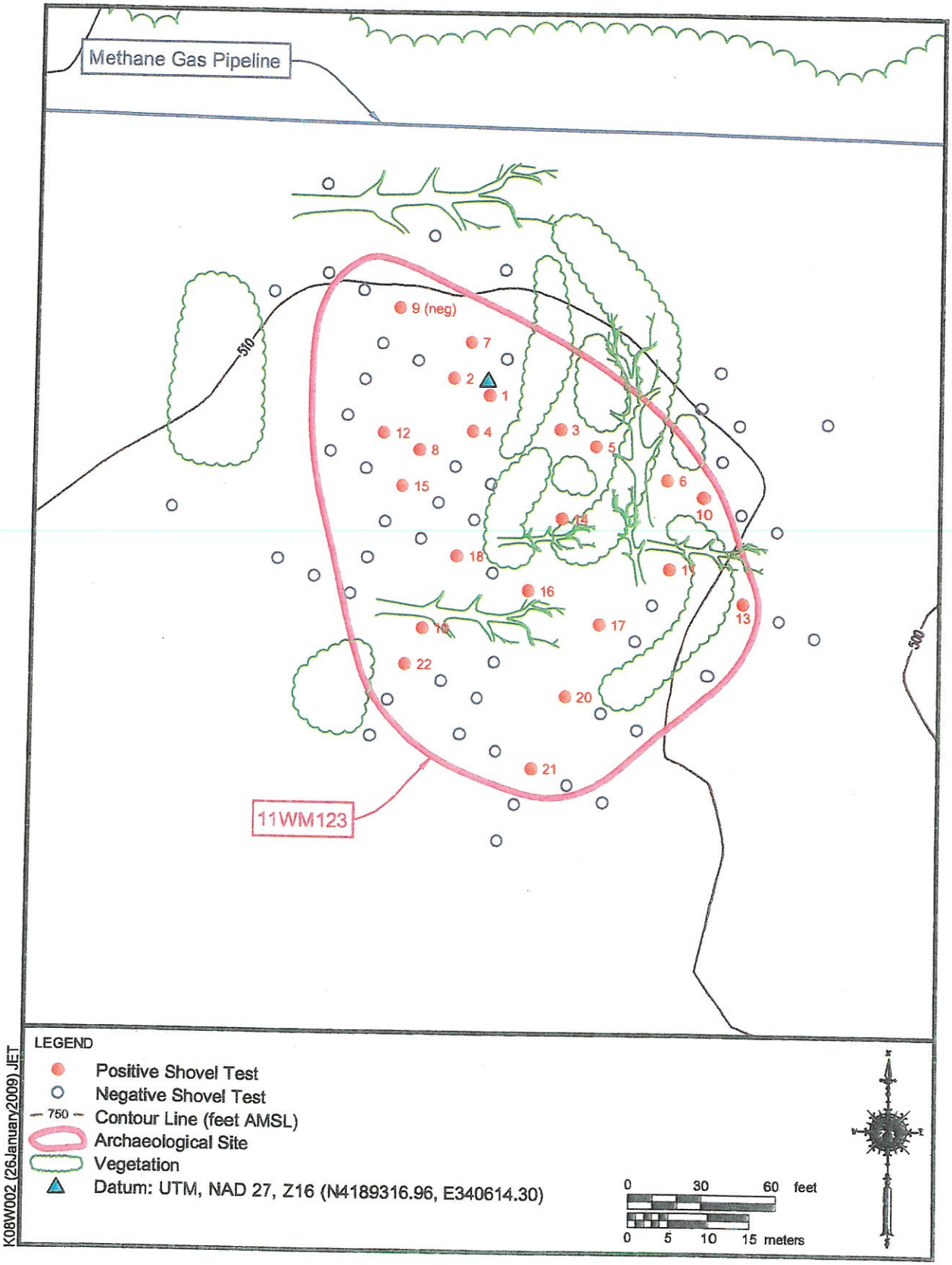


Figure 15. Site 11WM123 site schematic.

Depositional Context

Shovel tests generally revealed an A horizon of dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/1) silt loam from 0 to 25 cm bgs. In some parts of the site, the A horizon was extremely shallow, only extending to a depth of 0–5 cm bgs. In those cases, the soils generally displayed a bioturbated B horizon of yellowish brown (10YR 5/4) silt loam from 5 to 25 cm bgs that at times contained material culture that had been carried down into the stratum by roots and fauna. Yellow (10YR 7/8) and yellowish brown (10YR 5/4) silt loam sterile subsoil was typically encountered by 25 cm bgs (Figure 16). In general, the surface soils observed at 11WM123 appeared disturbed, likely resulting from a combination of logging and erosion.

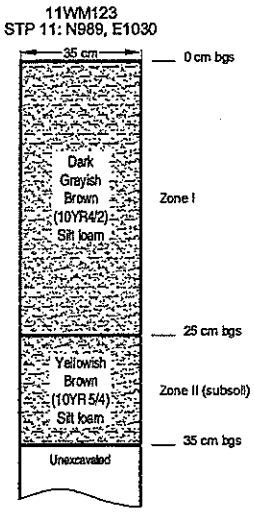


Figure 16. Site 11WM123 soil profiles.

Site 11WM123 was located on topography mapped as Bluford silt loam (13B2), which is further characterized as being eroded. As discussed in the second chapter of this report, Bluford series soils are generally characterized by an Ap horizon of brown (10YR 4/3) silt loam from 0 to 17.8 cm bgs underlain by two E horizons of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, 18.0–51.0 cm bgs. A series of Bt horizons underlay the E horizons consisting of grayish brown (10YR 5/2) silty clay to gray (10YR 5/1) silty clay loam extending to a depth of more than 1 m bgs (NRCS 2007a). The soils observed at 11WM123 differed somewhat from the Bluford series with regard to the observed subsoil, which was yellowish brown silt loam rather than grayish brown silty clay. While the soil series mapped for this area is characterized as eroded, the soil differences and disturbance noted in the STP profiles during the current survey of the site are likely due to long-term logging activities, as well as the subsequent erosion.

Archival Data

Very little information regarding the chain of ownership and occupancy of Site 11WM123 could be discovered for this report. The first known owner of the property was William Beasley, Jr., who purchased 15.7 ha (38.8 acres), encompassing the southeast quadrant of the southwest quadrant of Section 7, Township 8 South, Range 4 East, for $4.85 as part of a public domain land tract sale (Williamson County Clerk's Office [WCCO], Land Tract Index Book [LTIB], Marion, Illinois) (Table 1). In 1850, William Beasley, Jr., was 22-years-old and resided with his father, William Beasley, Sr., age 64, who was a farmer; his mother, Ann, age 63; his brother, Martin, age 19, who worked as a farm laborer; and his brother, Carrole, age 15. While William, Jr., was enumerated as being a part of William Beasley, Sr.'s, household, he was enumerated at the bottom of the household list as a farmer (U.S. Bureau of the Census, 1850, Washington, D.C.). It is possible that while William, Jr., resided at home that he already worked his land, possibly the approximately 16.2-ha (40-acre) tract.

Table 1. Chain of Ownership of Property Containing Site 11WM123.

Date	Quadrant/s	Owner	Acreage	Cost
October 11, 1854	SESW	William Beasley	38.8	$4.85
October 18, 1854	E2SW	Oliver Wiley	80	$26.25
1870–1910?	Unknown	Alex Beasley?	Unknown	Unknown

William Beasley, Jr., must have also acquired an additional 40 acres encompassing the northeast quadrant of the southwest quadrant of Section 7, because only a few days following his official purchase of the 40-acre tract in the southeast quadrant of the southwest

quadrant of Section 7, on October 18, 1854, he sold 32.4 ha (80 acres) to Oliver H. Wiley for $26.25 in a mortgage sale (WCCO DB H:552). Oliver Wiley was a land speculator who owned a great deal of property in Williamson County in the mid-nineteenth century, especially in the Marion area, where he resided (U.S. Bureau of the Census 1860). The deed chain could not be traced after Oliver Wiley purchased the land, but based on the known neighbors enumerated in the census nearly 30 years later, Alex Beasley, age 27, who happened to be the nephew of William Beasley, Jr., resided in the approximate location of the site with his wife, Emily, age 22, and their son, Louis, age 3. At that time, Alex Beasley was a teacher (U.S. Bureau of the Census 1880). Twenty years later, Alex, age 48, appears to reside in the same location with his wife, Emily, age 43, and their children, Louis, age 22, Flora, age 18, Walter, age 16, Anda, age 9, G.W., age 7, and Hettie, age 1, as well as Alex's brother, William Beasley, age 50. Alex Beasley worked as a farmer by that time, and his adult sons worked as farm laborers. His brother, William, did not have an occupation and may have not been able to work (U.S. Bureau of the Census 1900).

According to a local informant, an old road ran east–west just north of the location of 11WM123 in the early twentieth century. Along this road was a line of residences and a post office (Paul Hillman, personal communication 2008). Paul Hillman stated that the methane gas pipeline (refer to Figure 6) is in the general location of the former road. Based on this information and the location of 11WM123, it is likely that the Beasley household fronted this road. By 1910, Alex Beasley and his family had moved to the Stonefort Township of Williamson County. The 1908 plat map of the county (see Figure 8) shows the site within the confines of the Madison Coal Company. Based on the map data, it is possible that the residence and post office were no longer present by that time. However, it is also possible that while Gilbert G. Thorne of the Madison Coal Company owned the property, residents remained on the land as tenants for a number of years.

Artifacts

Jennifer M. Faberson

There were 69 historic artifacts recovered from this site during the current survey (see Appendix C). Materials collected included architecture (n = 47), clothing (n = 1), domestic (n = 15), furnishings (n = 1), unidentified (n = 5) group items (Table 2). The domestic group items consisted of ceramics and container glass.

Table 2. Summary of Artifacts Recovered from 11WM123.

Group	Total	Percent
Architecture	47	68.2
Arms	0	0
Clothing	1	1.4
Domestic	15	21.7
Furnishings	1	1.4
Maint/Subsist.	0	0
Personal	0	0
Unidentified	5	7.3
Total	69	100

Whiteware was the most prominent ceramic type recovered. Six of these were plain sherds date after 1830 (Majewski and O'Brien 1987:119). One blue transfer printed whiteware sherd was recovered, dating from 1830 to 1859 (Samford 1997:20). One cup was identified in the whiteware assemblage.

Other ceramics were recovered from this site during the current phase I survey. Three ironstone sherds were recovered. All of these were plain sherds dating from 1830 to the present (Majewski and O'Brien 1987:122). One yellowware sherd was identified. This sherd exhibited a Rockingham decoration and dated from 1830 to 1925 (Raycraft and Raycraft 1992:7).

Four container glass fragments were recovered from this site. Three of these were identified as BIM glass. One amethyst glass cup/post mold, recessed panel fragment was recovered dating from 1870 to 1920 (Lindsey 2008; Lockhart 2006:54). One clear sherd dating from 1864 to 1920 and one aqua sherd dating before 1920 were recovered. Three

miscellaneous bottles were identified in the BIM assemblage. One ABM glass fragment was also identified in the historic assemblage. This sherd was light green glass.

Architectural debris included 1 hand-made brick, 1 machine-made brick, 30 indeterminate brick fragments, 5 window glass fragments, 5 late fully machine-cut nail fragments, and 5 wire nail fragments. The brick fragments were not assigned specific dates.

The window glass found at this site during the current survey dated from 1852 to 1876. Moir's window glass technique (discussed in the previous chapter), which relies on statistically meaningful samples from discreet contexts for accuracy, was not used to determine the approximate site date since only five sherds were found. The late fully machine-cut nail fragments were dated from 1830 to 1890 and the wire nail fragments were dated after 1880 (Nelson 1968).

One clothing artifact was recovered from this site. This item was identified as a sew-through porcelain, "Prosser" button dating from 1840 to 1955 (Albert and Kent 1949:35; Sprague 2002).

The furnishings debris consisted of only one furniture artifact. This item was identified as a metal handle and was not assigned a specific date. Five unidentified items were also recovered. One sandstone fragment and four metal fragments were found. The metal items consisted of three iron/steel fragments and one lead fragment.

Features

No features, prehistoric or historic, were observed during the current investigations of the site. In addition, no fire cracked rock (FCR), charcoal, or burnt soil were observed that would indicate the presence of a prehistoric component.

Summary

Sixty-nine mid- to late nineteenth-century to early twentieth-century historic domestic, architectural, clothing, furnishing, and unidentified artifacts were recovered from 11WM123. None of the artifacts recovered from the site were spatially patterned. Indeed, the architecture and domestic artifacts were evenly distributed throughout the site, and the clothing and furnishing artifacts were recovered near the center of the site. Soil profiles observed during shovel testing at 11WM123, as well as the presence of felled tree tops (see Figures 14 and 15) and dense underbrush that frequently results from major ground disturbance, suggest that logging activities and subsequent erosion have severely impacted the site.

The artifact scatter observed at 11WM123 is indicative of a residential occupation. The temporal range of the historic artifacts recovered from the site examined in comparison with the archival data suggests that the material culture at 11WM123 may represent the remains of the occupation of the site by the Alex Beasley family. Alex Beasley was the nephew of William Beasley, Jr., who purchased the property in 1854, and based on the known neighbors within proximity of the land tract, Alex Beasley resided there from at least 1880 until sometime between 1900 and 1910. While the number of window glass sherds recovered is not statistically significant, a calculated average date of 1869, as well as the number of late fully machine-cut nails, suggest that the site may have been occupied as early as the 1860s–1870s. One blue transfer-printed whiteware body sherd of an unknown vessel dating between 1830 and 1859 was recovered, but the number of plain whiteware and ironstone sherds that were collect suggests an occupation period post-dating the Civil War. Several artifacts dating to the turn-of-the-twentieth century, such as the amethyst glass sherd and the ABM glass, respectively, indicate that the site was likely occupied into the early twentieth century, as well. Hence, the material culture appears consistent with the archival data, which indicates that the Alex Beasley family resided at 11WM123 until sometime between 1900 and 1910, after which they resided in the Stonefort Township. The average date range of the artifacts, utilizing 1910 as a tentative

terminal date based on the archival data, is 1850–1900 with a mean date of 1875.

National Register Evaluation and Recommendations

Site 11WM123 is located in the northwest quadrant of the southeast quadrant of the southwest quadrant of Section 7 Township 8 South Range 4 East. Unless mining activities are altered, 11WM123 will be impacted by the proposed mining operation. The archival data in relation to the material culture recovered from the site tie the occupation of 11WM123 to the Alex Beasley family. However, due to severe disturbance created by logging activities and erosion, Site 11WM123 lacks archaeological integrity, and further research would likely yield little or no results beyond those recorded during the current survey. Hence, the site is not significant and is considered not eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation.

Site 11WM364

UTM Coordinates (Site Center): (Zone 16) N4190325.0, E340414.0
UTM Coordinates (Field Derived Datum): (Zone 16) N4190311.3, E340401.3
Legal Description: NE1/4 NW1/4 NW1/4 Sec 7 T8S R4E
Elevation: 140.1 m (459.6 ft) AMSL
Components: Historic farmstead/residence and open habitation
Site Type: Historic scatter and lithic scatter
Size: 2,166 sq m (23,314.6 sq ft)
Distance/direction to nearest water: 150 m (492.1 ft) northeast
Type and extent of previous disturbance: Agricultural activities (plowing), erosion; 50–75 percent disturbed
Topography: Floodplain
Vegetation: Pasture (grass, weeds)
Ground surface visibility: Less than 10 percent
Soil Association: Ava-Bluford-Wynoose
Slope Direction (Aspect): N/A
Recommended NRHP status: Not eligible

Site Description

Site 11WM364 was identified as a multicomponent site consisting of a turn-of-the-twentieth-century historic farm/residence and a prehistoric open habitation component. It was located in the northeast quadrant of the northwest quadrant of the northwest quadrant of Section 7 Township 8 South Range 4 East (see Figure 2) at the northeast corner of the project area adjacent to Dean Road in a pasture that had been significantly disturbed by previous agricultural activities and erosion. It is situated in a floodplain setting, approximately 150 m southwest of an unnamed intermittent tributary of Pond Creek.

Unlike Site 11WM123, 11WM364 was newly documented during the current survey. It was identified via systematic shovel testing. Site dimensions, established by positive shovel test positions within the project boundaries, were 57 m (187.0 ft) north–south and 38 m (124.7 ft) east–west. The area of the site is approximately 2,166 sq m (23,314.6 sq ft), or .2 ha (.5 acres). The ISM-derived site size, which is not based on field observations but on topographic quadrangle map data, is 4,689 sq m (50,472.0 sq ft), or .5 ha (1.2 acres).

Vegetation at 11WM364 at the time of the survey consisted of pasture grass and weeds. Evidence of former agricultural activities was apparent with an established, yet eroded, plow zone. Ground surface visibility (less than 10 percent) was limited due to ground cover (Figure 17).

A moderate to heavy density of historic domestic, architectural, arms, furnishing, maintenance and subsistence, and personal artifacts dating to the turn-of-the-twentieth century, as well as one temporally undiagnostic prehistoric flake, were recovered from the site during the current survey. The site appears to have been associated with a historic residence shown on the 1908 plat map of Williamson County that would have been located adjacent to and east of 11WM364 just outside of the project area boundary (Figure 8; Ogle & Co. 1908). While the portion of



Figure 17. Overview of 11WM364, facing northeast. Trailer in distance is outside of project area across Dean Road.

11WM364 that was surveyed during the current work was heavily disturbed and lacked archaeological integrity, it should be noted that the eastern boundary of the historic component of the site likely extends an unknown distance east beyond the current project limits onto private property. It is not anticipated that the prehistoric component extends beyond the current project boundary due to the paucity of remains.

Investigation Methods

The site was relocated as a result of shovel testing at a 15-m interval, and the site boundaries were delineated using a 10-m grid. All material from shovel tests was visually inspected and screened through .25-inch mesh.

Sixty-seven screened STPs were excavated to delineate the boundaries of the site. Fifty-two shovel tests fall within the indicated site boundary with 31 shovel tests (STP 1–6, 8–32) yielding cultural material (Figure 18[1]). STP 7 was originally assigned a shovel test number but, following the lab analysis, the bagged item was determined to be non-cultural. The density and distribution of recovered material is discussed below in the Artifacts and Summary sections.

Data pertaining to the site location was recorded and the site was indicated on appropriate maps. A site datum was established and its UTM coordinates were recorded using a hand held GPS unit. A site sketch map was drawn showing the placement of the shovel test positions in relation to physiographic features and the project area boundary. The location of the site was also marked on a copy of the Pittsburg 7.5-minute series quadrangle map (USGS 1963) and layout maps provided by the client, which served as field maps.

[1] A quick overview of the site schematic shows a concentration of shovel tests in the north half of the site. This was not intentional, as the purpose of the 10-m interval was to delineate the site boundaries and not over-invasively test the site, creating greater disturbance of the archaeological deposits. Rather, it was difficult for the crew to ascertain the site limits on this end, creating a cluster of small-interval STPs.

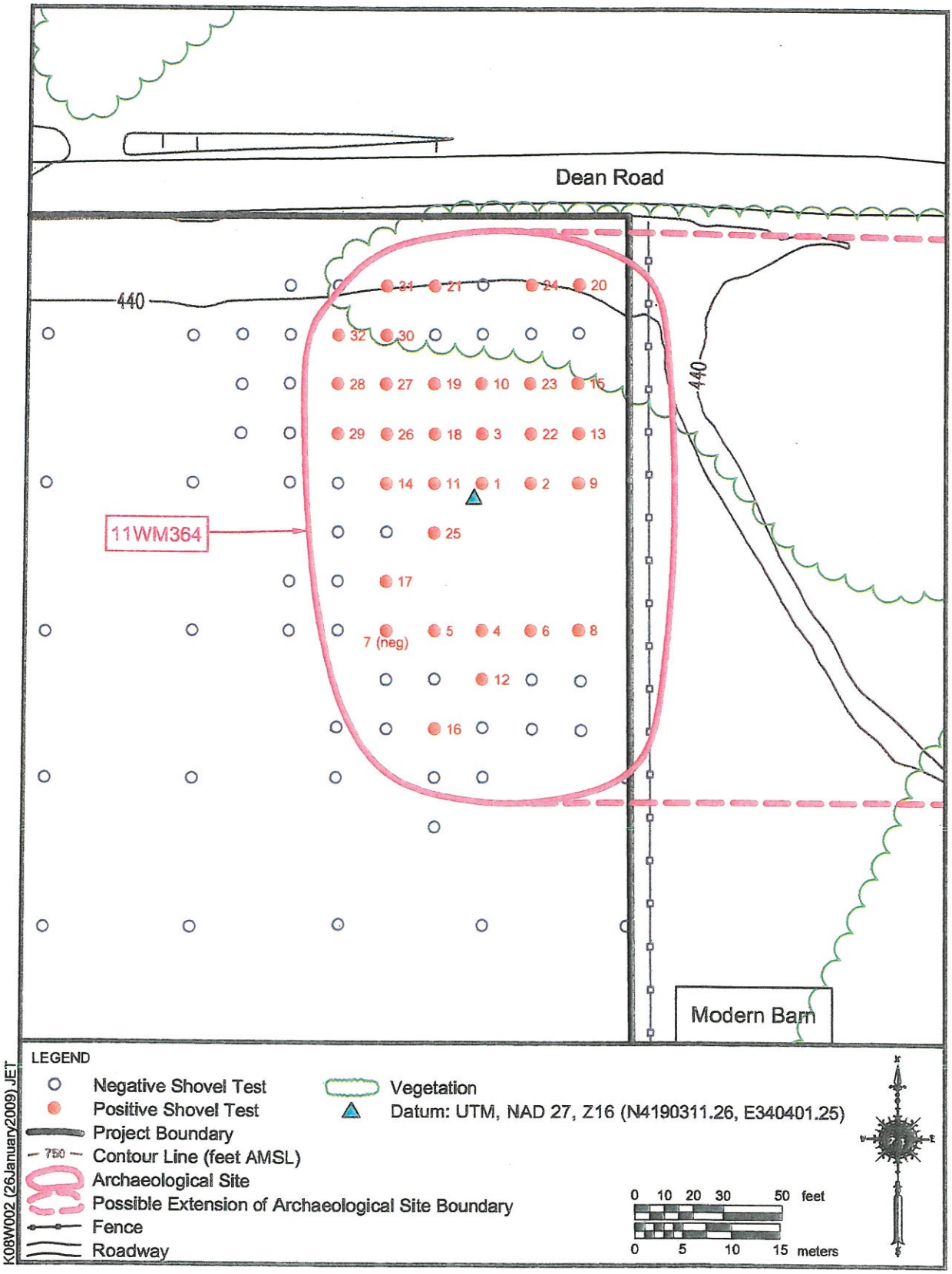


Figure 18. Site 11WM364 site schematic.

Depositional Context

Shovel tests at 11WM364 revealed a shallow plow zone of brown (10YR 5/4) silt loam with manganese concretions extending to approximately 25 cm bgs. The underlying subsoil consisted of light gray (10YR 7/1) silt loam with manganese concretions extending to approximately 35 cm bgs (Figure 19). In general, the surface soils observed at 11WM364 were depleted and disturbed as a result of long-term agricultural activities (plowing).

Site 11WM364 was located on topography mapped as Bluford silt loam (3640A). As discussed in the second chapter of this report, Bluford series soils are generally characterized by an Ap horizon of brown (10YR 4/3) silt loam from 0 to 17.8 cm bgs, underlain by two E horizons of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, 18.0–51.0 cm bgs. A series of Bt horizons underlay the E horizons consisting of grayish brown (10YR 5/2) silty clay to gray (10YR 5/1) silty clay loam extending to a depth of more than 1 m bgs (NRCS 2007a). The soils observed at 11WM364 were generally consistent with the Bluford series mapped for this part of the project area. It should be noted, however, that while there was a consistency between the soil profiles observed in the field and the Bluford series, several of the shovel tests were very shallow, suggesting that parts of the site may not only be disturbed due to agricultural activities, but erosion as well.

Archival Data

The earliest known owner of the property containing Site 11WM364 was Cornelius A. Shaw (Table 3). He purchased 28.0 ha (69.3 acres) of land that encompassed the west half of the northwest quadrant of Section 7, Township 8 South, Range 4 East as part of a public domain land tract sale on September 23, 1854 (WCCO DB 112:129). He bought the property for $8.66. In 1850, Cornelius was 24 years old and worked as a mechanic, residing with his widowed mother and his siblings in Williamson County (U.S. Bureau of the Census 1850). Based on the Shaw's neighbors enumerated in the census at that time, such as Samuel Beasley and Thomas Riddle, it appears that the Shaw family resided within the vicinity or near the property in question. Cornelius Shaw was 28 years old when he purchased the 69.3-acre farmstead.

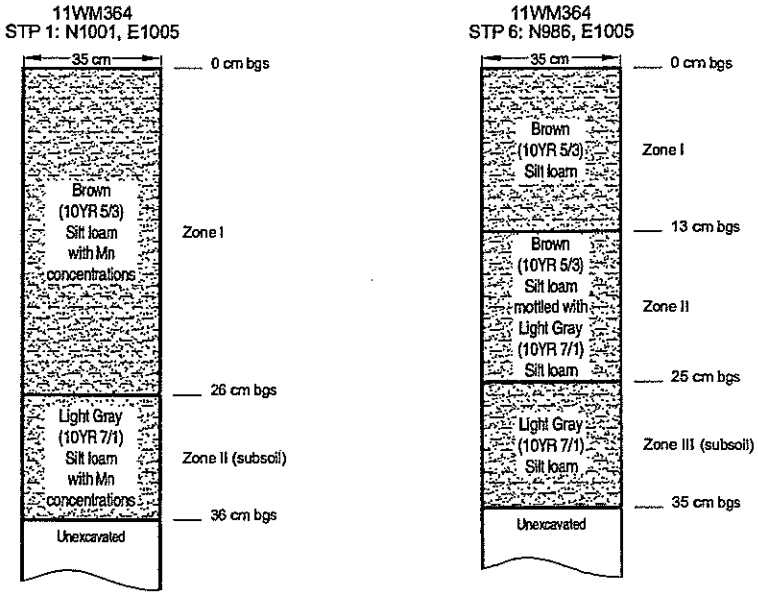


Figure 19. Site 11WM364 soil profiles.

Table 3. Chain of Ownership of Property Containing Site 11WM364.

Date	Quadrant/s	Owner	Acreage	Cost
September 23, 1854	W2NW	Cornelius A. Shaw	69.3	$8.66
Between 1854 and 1860	N2NWNW	T.F. and Martha A. Clarida	20	Unknown
September 5, 1877	N2NWNW	Daniel H. Fleming	20	$150
September 24, 1881	N2NWNW	William H. Forbes	20	$200
September 1, 1882	N2NWNW	Millard M. Williams	20	$225
Between 1882 and 1901	N2NWNW	Isam and Annis E. Harris	20	Unknown
April 12, 1901	N2NWNW	Jasper Williams	20	$700
March 31, 1903	N2NWNW	H.W. Rodgers	20	$750
Between 1908 and 1912	N2NWNW	Henry C. and Janey Rains	20	Unknown
March 9, 1912*	N2NWNW	Jasper and Elizabeth Williams	20	$1000
July 29, 1913*	N2NWNW	Mary J. Rains	20	$1000
February 24, 1916	N2NWNW	Gilbert G. Thorne (Madison Coal Company)	20	Unknown

** Excepted were the coal and mineral rights.*

It is not certain when Cornelius sold his property, but it was sometime before 1860. By 1860, he was with his mother and one of his brothers lived in Township 11 Range 4 East (U.S. Bureau of the Census 1860). Between 1854 and 1860, T.F. and Martha A. Clarida acquired 8.1 ha (20 acres) of the original tract. It is unknown whether T.F. and Martha Clarida ever resided on the property. No Claridas could be found in the U.S. Census records in the 1870s, but a number of people with this surname did reside in Township 9 Range 4 East (U.S. Bureau of the Census 1870). On September 5, 1877, T.F. and Martha Clarida sold the 20 acres to Daniel H. Fleming for $150.00 (WCCO DB 8:364).

In 1880, Daniel Fleming, age 33, resided with his wife, Susan C., age 32, and their children Cora and Allie, as well as another child, John Allsup, in the Northern Township[2] of Williamson County. Daniel Fleming worked as a farm hand (U.S. Bureau of the Census 1880). It is unknown exactly where the Flemings resided on their property, but it seems plausible that they resided within the bounds of this 20-acre tract. They resided there for four years, Daniel and Susan C. Fleming selling the 20-acre property to William H. Forbes on September 24, 1881 (WCCO DB 13:22). William Forbes only owned the tract until the following year when he and his wife, Alsha E. Forbes, sold it to Millard M. Williams on September 1, 1882 for $225 (WCCO DB 18:251). Interestingly, William Forbes and his wife are enumerated in the 1880 census living within the Lake Creek Township (Township 8 South, Range 3 East), but the census taker had crossed out their names after they were listed. It is unknown what the purpose of crossing out their names was. They may have been mistakenly enumerated in that township while living elsewhere, but no further information could be discovered. In 1880 Millard Williams was the 23-year-old son of Terry and Amanda Williams and lived in the Lake Creek Township (U.S. Bureau of the Census 1880). While his father, Terry, was a farmer, Millard was a school teacher at that time. He would have been 25 when he purchased the 20-acre tract in the Northern Township.

Millard Williams owned the property from 1882 until sometime before 1900. The 1900 census indicates that by that year he was residing with his family in the Eagle Creek Township of Gallatin County, Illinois (U.S. Bureau of the Census 1900). In 1901, Millard Williams sold the 20-acre tract to Isam and Annis E. Harris. Isam and Annis Harris appear to never have resided there, living instead in the Barhaus Addition of Johnston City since 1898. On April 12, 1901, the Harrises sold the land to Jasper Williams for $700 (WCCO DB 47:52, 54:211). It is unknown whether Jasper Williams was related to Millard Williams, but he and his family moved to the 20-acre tract at least by 1901, and possibly even earlier. That they moved there is supported by the presence of neighboring community residents who had been there in as early as 1880. In 1900, Jasper was a 56-year-old farmer who resided with his

[2] Williamson County's Township 8 South Range 4 East was known as the Northern Township at least by the 1870s (Warner & Beers, Proprietors 1972 [1876]).

wife, Pattie, age 53, and adult children Millie, age 33, James, age 30, Mallie, age 28, and Walter, age 21 (U.S. Bureau of the Census 1900).

Jasper Williams and his family did not remain on the property long. On March 31, 1903, Jasper and Elizabeth N. Williams sold the property to H.W. Rogers[3] for $750 (WCCO DB 65:443). By that point, the longest ownership/occupation of the land had been by Millard Williams, who may have resided there from 1882 until sometime before 1900. It is not exactly certain whether Millard Williams resided there himself, however. He also owned a 24.3-ha (60-acre) tract just south of this one in the vicinity of 11WM365, and he owned it from 1879 until 1896.

A residence (MS 1) within the bounds of the tract can be seen on the 1908 plat map of Williamson County (see Figure 8) (Ogle & Co. 1908). It is east and adjacent to Site 11WM364, and the site is likely associated with the household or yard activities of this residence. The name on the plat is H.C. Rodgers[4] and the tract encompassed 4.0 ha (10 acres), not the 20 acres mentioned in the 1903 deed. H.C, or Henry C. Rodgers, whose name is shown as landowner on the 1908 plat map, was the son of James W. Rodgers, a local farmer. James Rodgers and his family were natives of Tennessee, having immigrated to Williamson County, Illinois, sometime between 1880 and 1900 (U.S. Bureau of the Census 1880).

By 1910, the Rodgers family had moved to the Southern Township of Williamson County (U.S. Bureau of the Census 1910). Many of their neighbors had also moved out of the area, their lands having been sold to Samuel T. Brush[5], owner of the St. Louis and Big Muddy Coal Company (refer to Williamson County history section discussed previously in this report), at the turn of the twentieth century. It is not certain when Rodgers actually sold the tract, but the coal and mineral rights likely had been sold to Samuel T. Brush between 1903 and 1905.

Between 1908 and 1912, Henry C. and Janey Raines acquired the land, probably from the Rodgers family. They owned a 6.1-ha (15-acre) tract directly across Dean Road from the Rodgers tract they purchased. They in turn sold it to Jasper and Elizabeth Williams on March 9, 1912 for $1,000.00 (WCCO DB 108:220). Jasper and Elizabeth Williams had owned the property nearly a decade earlier. It should be noted that the property contained 20 acres, not the 10 acres shown on the 1908 plat. In the sale to Jasper and Elizabeth Williams, excepted in the deed were the coal and minerals rights underlying the land. Just one year later on July 29, 1913, Jasper and Elizabeth Williams resold the 20-acre tract to Mary J. Raines for $1,000.00 (WCCO DB 124:571). Mary J. Raines was likely the same "Janey Raines" who had owned the property with her husband, Henry C. Rains, between 1908 and 1912. The fact that Jasper and Elizabeth Williams owned the property for only one year and then sold it back to Mary J. Raines suggests that the property remained under the care and control of the Raineses since they purchased it sometime between 1908 and 1912. However, it is uncertain whether they ever resided in the same residence as the Rodgers family shown on the 1908 plat adjacent to 11WM364, because a residence is shown within the bounds of their property across Dean Road (see Figure 8).

By 1916, the former Rodgers land was owned by the Madison Coal Company, owned by George G. Thorne (WCCO DB 124:571). However, it appears that Mary J. Raines either utilized the property or resided there until at least 1940. In 1920, she continued to be associated with the Rodgers tract as well as the tract across Dean Road (refer to Figure 9). But on the 1940 plat, her name is exclusively associated with the former Rodgers tract, which suggests that between 1908 and 1940, she may have changed her residence from the tract across Dean Road to the residence adjacent to 11WM364 on the former Rodgers

[3] The spelling of this surname varied between "Rogers" and "Rodgers" throughout the archives.
[4] Based on the occupancy information, it is likely that the deed mistakenly indicated H. Rodger's middle initial as "W" when it should have been "C."
[5] Samuel T. Brush resided in the city of Carbondale in Jackson County, Illinois.

tract (refer to Figure 10) (Marion Daily Republican and Marion Weekly Leader 1940; Williamson County Historical Society 2001).

Artifacts

Prehistoric Assemblage

Brian DelCastello

The lithic assemblage recovered from site 11WM364 consisted of one artifact, which was recovered from a plow zone context in STP 11 (0–25 cm bgs). It was a smaller than .25 inch chert flake (.1 g). Raw material identification was not conducted on the flake as it was smaller than .25 inch. Little else can be said of this artifact. No FCR was recovered from the site during the current investigations.

Historic Assemblage

Jennifer M. Faberson

There were 249 historic artifacts recovered from 11WM364 during the current survey, including architecture (n = 72), arms (n = 1), domestic (n = 155), furnishings (n = 5), maintenance and subsistence (n = 6), personal (n = 1), and unidentified (n = 9) group items (Table 4). The domestic group items consisted of ceramics, container glass, container closures, and glass tableware.

Table 4. Summary of Artifacts Recovered from 11WM364.

Group	Total	Percent
Architecture	72	28.9
Arms	1	0.4
Clothing	0	0
Domestic	155	62.3
Furnishings	5	2
Maint/Subsist.	6	2.4
Personal	1	0.4
Unidentified	9	3.6
Total	249	100

Ironstone was the most prominent ceramic type. Thirteen ironstone sherds were recovered from this site. Nine plain ironstone sherds were recovered, dating from 1830 to the present (Majewski and O'Brien 1987:122). Three molded/embossed ironstone sherds were recovered, dating after 1860 (Faulkner 2000). One blue flow decorated ironstone sherd was found dating from 1839 to 1908 (Samford 1997:24). Cups and one saucer were identified in the ironstone assemblage.

Other ceramics also were recovered from this site during the current phase I survey. Twelve whiteware sherds were identified. Eleven of these were plain whiteware sherds, dating after 1830 (Majewski and O'Brien 1987:119). One flow-blue decorated whiteware sherd was recovered, dating from 1839 to 1908 (Samford 1997:24). Two porcelain sherds were also recovered. One of these was plain, dating after 1800, and the other was decal decorated, dating from 1880 to 1940 (Blaszczyk 2000:155; Faulkner 2000; Majewski and O'Brien 1984:128). Seven stoneware sherds were recovered from this site. Three Albany/brown slip sherds dating from 1830 to 1925, two Bristol/Bristol sherds dating from 1880 to 1925, one salt/brown slip sherd, dating from 1780 to 1925, and one salt/Albany sherd, dating from 1830 to 1925, were identified (Greer 1999; Ketchum 1983).

One hundred and eight container glass fragments were recovered from this site. Thirty-nine of these were identified as BIM glass. Base types included two aqua cup/post mold sherds, dating from 1850 to 1920, and one amethyst cup/post mold sherd, dating from 1870 to 1920 (Lindsey 2008; Jones and Sullivan 1985). Body types included one aqua embossed sherd dating from 1750 to 1920 and two aqua embossed canning jar fragments dating from 1850 to 1920 (Berge 1980; Fike 1987:5; Lindsey 2008; Pullin 1986:355; Toulouse 1977). Four embossed recessed panel sherds were recovered including one amethyst sherd dating from 1870 to 1920, two aqua sherds dating from 1850 to 1920, and one amber sherd dating from 1860 to 1920 (Berge 1980; Fike 1987:5; Lockhart 2006:54; Pullin 1986:355). One clear recessed panel sherd was also recovered dating from 1864 to 1920 (Faulkner 2000; Lindsey 2008; Miller and Sullivan 1984). One aqua late applied ground rim was recovered dating from 1881 to 1927. The manufacture of this rim is also classified as semi-automatic manufacturing (Berge 1980:75–76; Fike 1987:4; Miller and Sullivan 1984:94). The remaining BIM fragments

totaled 27 including amber (n = 4), amethyst (n = 3), aqua (n = 10), and clear (n = 10). Five canning jars, two medicine bottles, and 16 miscellaneous bottles were identified in the BIM assemblage.

Sixty-seven of the container glass fragments were identified as ABM glass. Body types included one aqua embossed sherd and one amethyst embossed sherd. The amethyst sherd was dated from 1903 to 1920 (Lockhart 2006:54). One finish/rim type was identified. This sherd was a clear external thread rim. The remaining ABM fragments totaled 64 including amber (n = 1), amethyst (n = 3), aqua (n = 16), clear (n = 39), cobalt (n = 1), and light green (n = 4). Three canning jars, one miscellaneous jar, and eight miscellaneous bottles were identified in the ABM assemblage. Unless otherwise noted, ABM glass dated after 1903. Two undiagnostic container glass sherds were also recovered. Both of these were opaque white glass dating from 1830 to 1960 (Fike 1987:13; Husfloen 1992:163; Lindsey 2008).

Other domestic artifacts recovered from this site included closures, glass tableware, and a utensil fragment. Six container closures were recovered from this site during the current phase I project. All of these closure fragments were identified as glass liners for mason zinc canning jar lids dating from 1869 to 1950 (Toulouse 1969b:350; Toulouse 1977:91,96). Seven glass tableware fragments were also recovered. Four clear sherds dating after 1864 and three amethyst sherds dating from 1870 to 1920 were identified (Lockhart 2006:54; Pullin 1986:355). All of these were press molded.

Architectural debris included 2 hand-made brick fragments, 29 indeterminate brick fragments, 4 machine-made brick fragments, 11 plate glass fragments, 16 window glass fragments, 8 fully machine-cut nail fragment, and 2 wire nail fragments. The brick fragments were not assigned specific dates.

The window glass found at this site during the current project dated from 1830 to 1915. Moir's window glass technique (discussed in the previous chapter), which relies on statistically meaningful samples from discreet contexts for accuracy, was not used to determine the approximate site date since only sixteen sherds were found. Eleven plate glass fragments were found dating after 1917 (Roenke 1978:11). Eight fully machine cut nails were found dating from 1830 to 1890 and one wire nail was found dating after 1880 (Nelson 1968).

One arms artifact was found at this site. This item was identified as a rimfire cartridge dating after 1857 (Ball 1997).

The furnishings debris consisted of only lighting artifacts. Five lamp chimney glass fragments were recovered dating from 1854 to 1940 (Faulkner 2000). Six maintenance and subsistence artifacts were recovered from this site. Four fuel artifacts were recovered, including two coal fragments and two cinder/slag fragments. Two general hardware artifacts were recovered including one fence staple and one smooth brass wire.

One personal item was recovered during the current survey. This item was a bisque porcelain doll head fragment dating from 1860 to 1925 (Coleman et al. 1968:74, 582). Nine unidentified items were also found. Seven of these were iron/steel fragments. Two of these were slate fragments. None of the unidentified items were assigned specific dates.

Features

No features, prehistoric or historic, were observed during the current investigations of the portions of the site within the limits of the project area. In addition, no FCR, charcoal, or burnt soil were observed that would indicate the presence of a prehistoric component.

Summary

One temporally undiagnostic prehistoric flake and 249 turn-of-the-twentieth-century historic architecture, arms, domestic, furnishings, maintenance and subsistence, personal, and unidentified artifacts were recovered from 11WM364 during the current survey. None of the artifacts recovered from the site were spatially patterned. Like 11WM123, the entire range of artifact types

generally was evenly distributed throughout the site. Soil profiles observed during shovel testing at 11WM364 suggest that agricultural activities have severely impacted the site.

The artifacts recovered from the site are indicative of a turn-of-the-twentieth-century residential occupation. The prehistoric flake was recovered in conjunction with historic artifacts, indicating that the prehistoric component of the site lacks integrity. While the number of window glass sherds was not statistically significant, a calculation of the average window glass date tentatively suggests that the adjacent structure may have been constructed as early as 1869. A late nineteenth century construction date is further supported by the presence of late fully machine-cut nails. The presence of the 11 plate glass sherds indicates that the structure was present at least as late as 1917.

When comparing the archaeological assemblage with the archival data, the average temporal range of the historic artifacts recovered, 1874–1929[6] with a mean date of 1901, suggests that the material culture at 11WM364 more likely represents a later construction date in the 1870s. This is further supported with a mean ceramic date (MCD) of 1885. Since this is just an average, the house could have been constructed and occupied by the Claridas or Flemings. However, based on the archival data, the house may not have been continually occupied (if even built) until the 1880s, when Millard Williams purchased the property. Following Millard Williams' ownership (and possible occupation), Jasper Williams may have occupied the property from 1901 to 1903; followed by the Rodgers family between 1903 and sometime between 1908 and 1912 and the Raines family between 1908–1912 and 1940. At the very least, the Rodgers and Raines family resided there, but based on the presence of the late nineteenth century artifacts and Millard Williams owning the property from 1882 until sometime before 1901, it is likely that he resided there with his family as well. It is possible, of course, that while the owners of these properties may not have resided in the residence shown on the 1908 plat map (Figure 8) themselves; however, the census records showing these individuals enumerated around the same neighbors suggests that they probably did reside there.

A structure can be observed east and adjacent to the survey site boundaries outside of the project boundary, and it is highly likely that the historic scatter observed during the current survey is associated with it. However, no foundations or subsurface features, such as a cellar, were observed in the project area site limits that would suggest that the structure viewed on the map was actually within the project boundary or that an outbuilding or subsurface feature had been present there at one time. Rather, it is plausible that the scatter observed at 11WM364 during the current survey is a material remnant of the occupation and demolition of the MS 1 observed on the 1908 map. This building was razed sometime in the early to mid-twentieth century.

National Register Evaluation and Recommendations

Site 11WM364 is located in the northeast quadrant of the northwest quadrant of the northwest quadrant of Section 7 Township 8 South Range 4 East. Unless mining activities are altered, the portion of 11WM364 within the bounds of the project area will be impacted by the proposed mining operation. The prehistoric component of the site lacked intact archaeological context. The archival data in relation to the material culture recovered from the site indicates the site may have been occupied as early as the 1870s by the Clarida or Fleming families. If not, the site was occupied at least by the 1880s with the purchase of the land by Millard Williams. It is not known whether Millard Williams ever resided there, but the structure appears to have been built by that time based on the material culture recovered from the site. Several different families lived there over the turn of the twentieth century, ending with the Raines

[6] A terminal date of 1940 was used in these calculations based on the last known occupation of the site vis a vis the archival data.

family until possibly as late as the early to mid-twentieth century.

Due to disturbance created by agricultural activities, the portion of Site 11WM364 within the limits of the project area lacks archaeological integrity. Further research within this portion of the site would likely yield little or no results beyond those recorded during the current survey. Hence, the prehistoric and historic components are not significant and are not considered eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation for the portion of the site within the current project boundary. If at any time the portion of 11WM364 outside of the project boundary would be impacted by the proposed construction, then it is recommended that the area be archaeologically surveyed to determine the eastern limits of the site and evaluate its significance.

Site 11WM365

UTM Coordinates (Site Center): (Zone 16) N4189870.0, E340148.0
UTM Coordinates (Field Derived Datum): (Zone 16) N4189881.43, E340157.1
Legal Description: NW1/4 SW1/4 NW1/4 Sec 7 T8S R4E
Elevation: 139.6 m (458.0 ft) AMSL
Components: Historic farmstead/residence
Site Type: Historic scatter
Size: 2,030 sq m (21,850.7 sq ft)
Distance/direction to nearest water: 50 m (164.0 ft) east
Type and extent of previous disturbance: Agricultural activities (plowing), erosion; 50–75 percent disturbed
Topography: Floodplain
Vegetation: Pasture (grass, weeds)
Ground surface visibility: Less than 10 percent
Soil Association: Ava-Bluford-Wynoose
Slope Direction (Aspect): N/A
Recommended NRHP status: Not eligible

Site Description

Site 11WM365 was documented as a turn-of-the-twentieth-century historic farm/residence located in the northwest section of the project area. Its legal description is the northwest quadrant of the southwest quadrant of the northwest quadrant of Section 7 Township 8 South Range 4 East (see Figure 2). It was discovered in a pasture adjacent to Dwina Road that had been significantly disturbed by agricultural activities and erosion. It was situated in a floodplain setting roughly 50 m west of an unnamed, intermittent tributary of Pond Creek.

This site was newly documented during the current survey. It was identified via systematic shovel testing. Site dimensions, established by positive shovel test positions within the project boundaries, were 58 m (190.3 ft) north–south and 35 m (114.8 ft) east–west. The area of the site is approximately 2,030 sq m (21,850.7 sq ft), or .2 ha (.5 acres). The ISM-derived site size, which is not based on field observations but on topographic quadrangle map data is 2,878 sq m (30,978.5 sq ft), or .3 ha (.7 acres).

Vegetation at 11WM365 at the time of the survey consisted of pasture grass and weeds. Evidence of former agricultural activities was apparent with an established plow zone. Ground surface visibility (less than 10 percent) was limited due to ground cover (Figure 20).

A moderate scatter of turn-of-the-twentieth-century historic material culture was recovered. No structures were observed near the site on available historic maps.

Investigation Methods

The site was discovered as a result of shovel testing at a 15-m interval, and the site boundaries were delineated using a 10-m grid. All material from shovel tests was visually inspected and screened through .25-inch mesh.

Sixty-five screened STPs were excavated to delineate the boundaries of the site. Thirty-four shovel tests fall within the indicated site boundary with 17 shovel tests (STP 1–17) yielding cultural material. The density and distribution of recovered material is discussed below in the Artifacts and Summary sections.

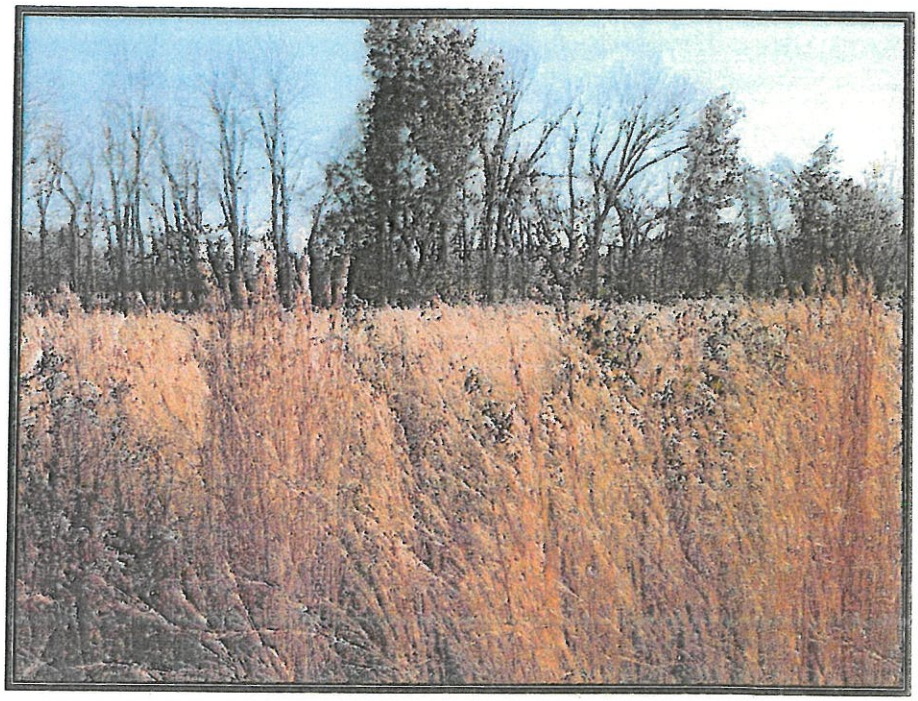


Figure 20. Overview of 11WM365, facing east.

Data pertaining to the site location was recorded and the site was indicated on appropriate maps. A site datum was established and its UTM coordinates were recorded using a hand held GPS unit. A site sketch map was drawn showing the placement of the shovel test positions in relation to physiographic features and the project area boundary (Figure 21). The location of the site was also marked on a copy of the Pittsburg 7.5-minute series quadrangle map (USGS 1963) and layout maps provided by the client, which served as field maps.

Depositional Context

Shovel tests generally revealed an Ap horizon of dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2) silt loam from 0 to 20–25 cm bgs. In some shovel tests, the dark grayish brown silt loam was mottled with light brownish gray (10YR 6/2) silt loam and contained manganese concretions. The typical sterile subsoil that was observed was classified as dark yellowish brown (10YR 4/6) silt loam encountered by 25 cm bgs (Figure 22). Where the dark grayish brown mottled with light brownish gray silt loam Ap horizon was encountered, the subsoil differed from the dark yellowish brown silt loam with a sterile B horizon of brown (10YR 5/3) silt loam mottled with light brownish gray (10YR 6/2) silt loam and manganese concretions. These shovel tests were generally shallower, with the subsoil being encountered by 20 cm bgs. In general, the surface soils observed at 11WM365 appeared disturbed, likely resulting from a combination of agricultural activities, and in some areas, erosion as well.

Site 11WM365 was located on topography mapped as Belknap silt loam (3382A). As noted previously in this report, this soil series consists of very deep, somewhat poorly drained soils formed in acid, silty alluvium on flood plains. Belknap soils have an Ap and an A horizon of dark grayish brown (10YR 4/2) silt loam from 0 to 33.0 cm bgs. The Ap and A horizons are underlain by a Bg horizon of dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam, 33.0–68.6 cm bgs. Two Cg horizons underlay the Bg horizon, and consist of light grayish brown (10YR 6/2) to dark gray (10YR 4/1) silt loam to greater than 1 m bgs (NRCS 2007a).

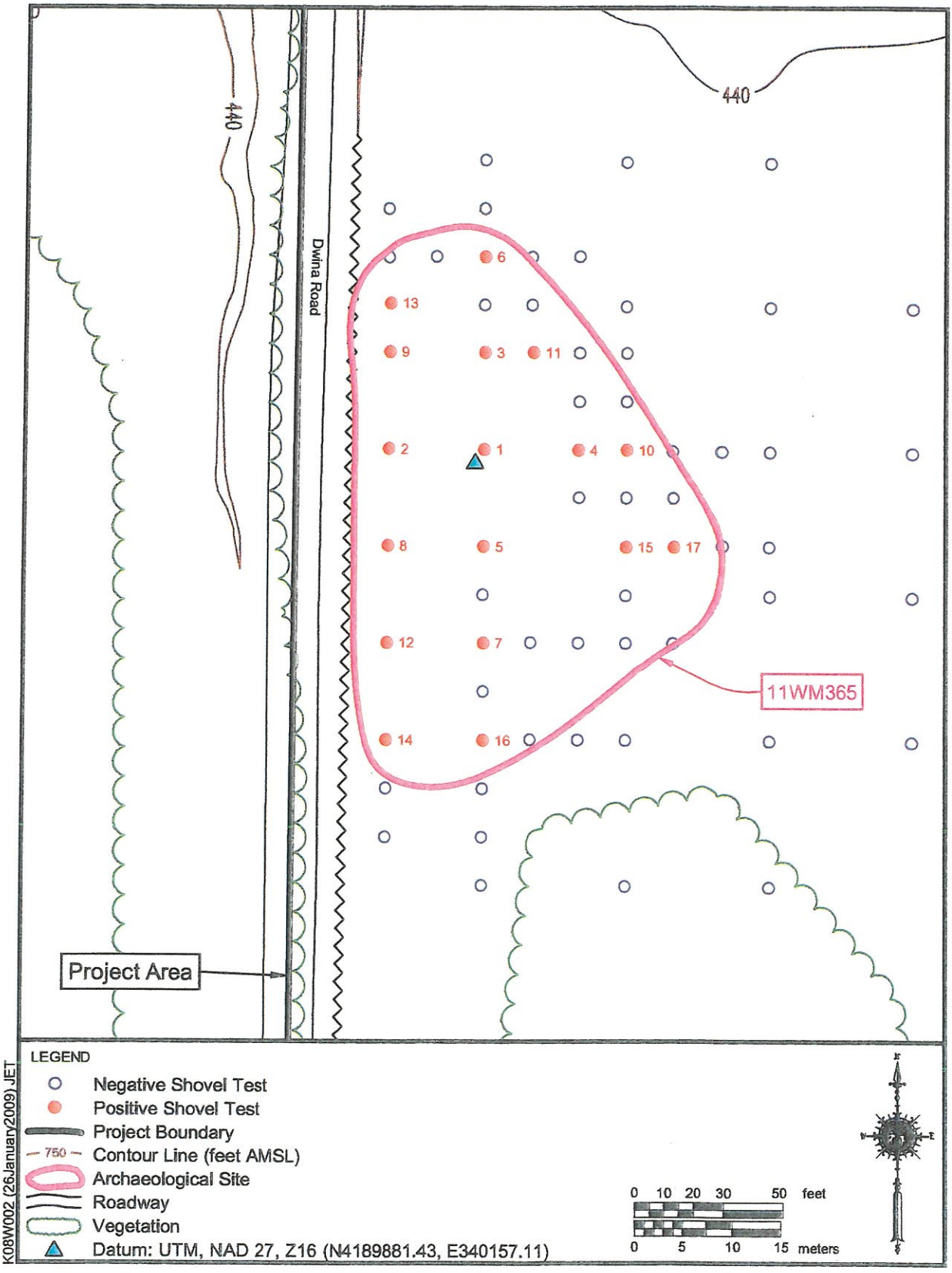


Figure 21. Site 11WM365 site schematic.

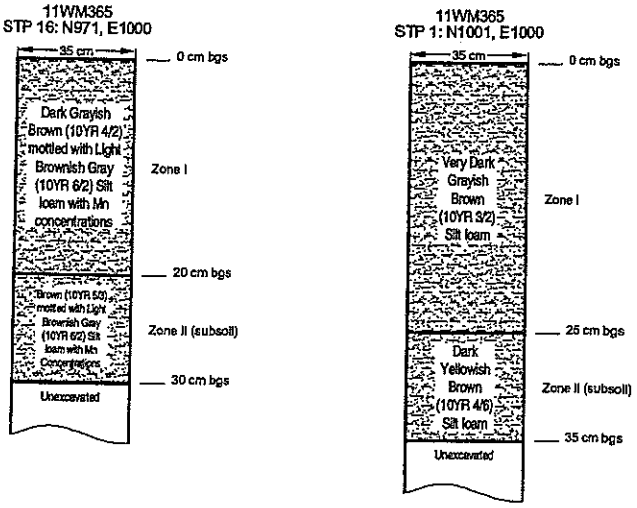


Figure 22. Site 11WM365 soil profiles.

The soils observed at 11WM365 differed somewhat from the Belknap series in that the Ap horizon was generally shallower. The observed subsoil, which was for the most part dark yellowish brown silt loam, differed from the soil series, which is typically dark grayish brown, grayish brown, or brown silt loam. The differences between the field observed soil profiles and the soil series mapped for this part of the project area are likely due to long-term agricultural activities and erosion.

Archival Data

Like Site 11WM364, the earliest known owner of the property containing Site 11WM365 was Cornelius A. Shaw (Table 5). On September 23, 1854, he purchased 28.0 ha (69.3 acres) of land which encompassed the west half of the northwest quadrant of Section 7, Township 8 South, Range 4 East as part of a public domain land tract sale (WCCO DB 112:129). As noted previously, Cornelius was 24 years old and worked as a mechanic, residing with his widowed mother and his siblings in Williamson County in 1850 (U.S. Bureau of the Census 1850). It is not certain when Cornelius sold the 69.3-acre tract, but it was sometime before 1860. By 1860, he lived in Township 11 Range 4 East with his mother and one of his brothers (U.S. Bureau of the Census 1860).

At an unknown date between circa 1854 and 1877, the tract was sub-divided, and Isham[7] and Martha A. Raney became owners of the 16.2-ha (40-acre) tract containing 11WM365. On May 9, 1877, Isham and Martha Raney sold the tract to Ishum Harris in a title sale for $1.00 (WCCO Title Deed Book [TDB]:176). Two years later, Isam[8] and Matilda Harris sold the 40 acres to John Gambill on September 15, 1879, for $300.00 (WCCO DB 8:580). Gambill may have had possession of the property before that time, because two days previous to him receiving formal title to the land, John Gambill had filed a deed to sell the tract, as well as 8.1 additional hectares (20 acres), to Millard M. Williams for $250.00 (WCCO DB 18:249). Considering the extra acreage, it is surprising that the land was sold at such a low cost. It suggests that the land was not improved. No information regarding the Raneys or the Harrises[9] could be discovered in the census records of this time, and it is uncertain whether the tract was occupied from circa 1860–1879.

[7] Ishams's name actually may have been "Isam."

[8] Isam was written as Ishum on the deed. No Ishums could be found in the census records, but Isam was found by the turn of the twentieth century.

[9] It is possible that this Ishum/Isam Harris is the same individual who purchased the 20-acre tract containing Site 11WM364 from Millard Williams in 1901. By 1900, his wife's name was Annis, suggesting that Matilda Harris may have died or that they divorced before he married Annis sometime between 1877 and1900.

Table 5. Chain of Ownership of Property Containing Site 11WM365.

Date	Quadrant/s	Owner	Acreage	Cost
September 23, 1854	W2NW	Cornelius A. Shaw	69.3	$8.66
Between 1854 and 1877	N2SWNW and S2NWNW	Isham and Martha A. Rainey	69.3	Unknown
May 9, 1877	N2SWNW and S2NWNW	Isam Harris and Matilda Harris	40	$1.00
September 15, 1879*	N2SWNW and S2NWNW	John Gambill	40	$300.00
September 13, 1879	N2SWNW and S2NWNW	Millard M. Williams	40	$250.00
February 4, 1896	N2SWNW and S2NWNW	John W. Williams	60	$900.00
April 12, 1905	N2SWNW and S2NWNW	Samuel T. Brush (St. Louis and Big Muddy Coal Company)	60	$3,400.00
April 14, 1905	N2SWNW and S2NWNW	Gilbert G. Thorne (Madison Coal Company)	60	$5,377.23

** Note that John Gambill had sold the property two days before he was officially conveyed the tract by Isam and Matilda Harris.*

In 1880, Millard Williams was the 23-year-old son of Terry and Amanda Williams and lived in the Lake Creek Township (U.S. Bureau of the Census 1880). While his father, Terry, was a farmer, Millard was a school teacher at that time. He would have been 25 when he purchased the 40-acre tract sold to him by John Gambill.

Millard Williams owned this 60-acre tract from 1879 until February 4, 1896, when he sold the land to John W. Williams for $900.00 (WCCO DB 42:294). Considering that he also owned the 20-acre tract containing Site 11WM 364 approximately 250 m (820.2 ft) northeast of this tract from 1882 until sometime before 1900, it is uncertain where Millard Williams might have made his homestead. The 1900 census indicates that by that year he resided in the Eagle Creek Township of Gallatin County, Illinois (U.S. Bureau of the Census 1900).

In 1900, John W. Williams, age 56, resided in the Lake Creek Township of Williamson County, Illinois, with his wife, Frances E., age 48, their children, George A., age 25, and James L., age 17, as well as Bertie A. Odle, age 13, and Benjamin W. Odle, age 10 (U.S. Bureau of the Census 1900). The fact that John Williams did not reside in the Northern Township suggests that he did not reside within the 60-acre tract he purchased from Millard Williams.

Samuel T. Brush, owner of the St. Louis and Big Muddy Coal Company, purchased the 60-acre tract from John Williams on April 12, 1905, for $3,400 (WCCO DB 69:300). It is notable that Brush purchased the land for $3,400.00, which was far more than the $900.00[10] John Williams paid for the land. This was typical of coal companies that purchased land for much more than it was worth during this time, knowing that the coal and minerals beneath the surface were worth an exponential amount more than what would have to be paid for them. The increased land purchase prices also aided in convincing land owners to sell their properties to the coal companies.

Two days later, Samuel T. Brush sold the Williams property to Gilbert G. Thorne, who owned the Madison Coal Company for $5,377.23, again raising the purchase price and providing Samuel Brush with a profit (WCCO DB 69:376).

In spite of the land being sold successively to two coal companies, the property containing 11WM365 continued to be resided on. In 1908, the plat map of Williamson County indicates that a 40-acre portion of the plat was occupied by H.W. Williams (refer to Figure 8) (Ogle & Co. 1908). H.W., who went by the name of William, was a farmer who was originally from Tennessee. Based on the neighbors enumerated in the federal census records from 1900 to 1910, it is very possible that H.W. Williams, and his wife, Julia, resided on this tract with their children as tenants (U.S. Bureau of the Census 1900–1910). A residence can be observed on the northeast corner of the H.W. Williams property on the 1908 plat map, but it is not near the location of 11WM365, which was in the northwest corner of the property. By 1920, it appears that the Williams family may no longer have resided there and that land was in

[10] Note that the price of the land was $900.00 in 1896 compared to $250.00 in 1879. This suggests that the land was improved.

full use by the Madison Coal Company, who had purchased the tract in 1905 (Williamson County Historical Society 2001).

Artifacts

Jennifer M. Faberson

Forty-nine historic artifacts were recovered during the phase I survey at 11WM365, including domestic (n = 35), architecture (n = 12), maintenance and subsistence (n = 1), and unidentified (n = 1) group items (Table 6). The domestic group items consisted of ceramics, container glass, container closures, and glass tableware.

Table 6. Summary of Artifacts Recovered from 11WM365.

Group	11WM365	Percent
Architecture	12	24.6
Arms	0	0
Clothing	0	0
Domestic	35	71.4
Furnishings	0	0
Maint/Subsist.	1	2
Personal	0	0
Unidentified	1	2
Total	49	100

Three ceramic types were recovered from this site including ironstone, porcelain, and whiteware. Two plain ironstone sherds were recovered dating from 1830 to the present (Majewski and O'Brien 1987:122). Three decal-decorated porcelain sherds were also recovered dating from 1880 to 1940 (Blaszczyk 2000:155; Majewski and O'Brien 1984:128). One plain whiteware sherd was identified dating after 1830 (Majewski and O'Brien 1987:119).

Twenty-six container glass fragments also were recovered from this site. Fifteen of these were identified as BIM glass. One embossed aqua body was recovered dating from 1850 to 1920 (Berge 1980; Fike 1987:5; Lindsey 2008; Pullin 1986:355). The remaining BIM fragments totaled 14, including amber (n = 2), amethyst (n = 2), aqua (n = 6), and clear (n = 4). Five miscellaneous bottles and one canning jar were identified in the BIM assemblage.

Ten of the container glass fragments were identified as ABM glass. One aqua cup/post mold base was recovered. Two external thread rim sherds were also recovered. One of these was amethyst glass dating from 1903 to 1920 (Lockhart 2006:54). The other was aqua glass. One clear unknown finish/rim was also found. The remaining ABM fragments totaled 6 and included aqua (n = 3), clear (n = 2), and light green (n = 1) glass. Three canning jars, two miscellaneous bottles, and one miscellaneous jar were identified in the ABM assemblage. Unless otherwise noted, all ABM glass dated after 1903.One undiagnostic aqua glass sherd was also recovered but was not assigned a specific date.

Other domestic artifacts recovered from this site included closures and glass tableware. The closure artifact was identified as a mason zinc lid liner dating from 1869 to 1950 (Toulouse 1969b:350; Toulouse 1977:91, 96). Two glass tableware fragments were also recovered. One amethyst sherd dating from 1870 to 1920 and one clear sherd dating after 1864 were identified (Lockhart 2006:54; Pullin 1986:355). Both of these were press molded.

Architectural debris included 5 indeterminate brick fragments, 1 hand-made brick fragment, 2 window glass fragments, 1 late fully machine-cut nail fragment, and 3 wire nail fragments. The brick fragments were not assigned specific dates.

The window glass found at this site during the current project dated to 1902 and 1910. Moir's window glass technique (discussed in the previous chapter), which relies on statistically meaningful samples from discreet contexts for accuracy, was not used to determine the approximate site date since only two sherds were found. One late fully machine cut nail was found dating from 1830 to 1890 and three wire nail fragments were found dating after 1880 (Nelson 1968).

One maintenance and subsistence artifact was recovered from this site. This item was identified as an iron/steel unidentified bolt and was not assigned a specific date. One unidentified iron/steel amorphous fragment was also recovered. This item was not assigned a specific date either.

Features

No features, prehistoric or historic, were observed during the current investigations of the site. In addition, no FCR, charcoal, or burnt soil were observed that would indicate the presence of a prehistoric component.

Summary

Forty-nine turn-of-the-twentieth-century historic domestic, architectural, maintenance and subsistence, and unidentified artifacts were recovered from 11WM365. None of the artifacts recovered from the site were spatially patterned, instead being generally evenly distributed by type across the site. Soil profiles observed during shovel testing at 11WM365 suggest that agricultural activities and erosion have severely impacted the archaeological deposits.

The artifact scatter observed at 11WM365 is consistent with a residential occupation. Architectural items, such as nails, window glass, and bricks, as well as domestic items, such as ceramics, container glass, container closures, and glass tableware, are all consistent with the presence of a former dwelling being in the vicinity of the site.

Only two window glass sherds were recovered. While not statistically significant, it is notable that the two sherds both dated to circa 1900–1910. A late fully machine-cut nail, dating between 1830 and 1890, as well as several wire nails dating after 1880, also suggest a turn-of-the-twentieth-century construction date of the former dwelling. Also consistent with this supposition is an almost equal number of BIM and ABM container glass fragments, plain whiteware and ironstone that typically suggest a post-Civil War date range, and decal-decorated ceramic wares, which were popular between 1880 and 1940. The average date range of the artifact assemblage is 1882–1921[11] , and the mean date is 1901.

When viewed in comparison with the archival data, it is likely that the site is associated with the former turn-of-the-twentieth-century ownership/occupation of the land by the John W. Williams family. John Williams purchased the property from Millard Williams in 1896, and he owned it until 1905, when he sold it to Samuel T. Brush of the St. Louis and Bug Muddy Coal Company. Two days after that sale, Samuel T. Brush sold the land to George G. Thorne of the Madison Coal Company. The 1908 plat map indicates that, while the Madison Coal Company owned the land, it was occupied by the H.W. (William) Williams family. The census data, discussed in the archival section above, indicates that H.W. Williams and his family resided on that land tract as tenants. It is unknown whether H.W. Williams was related to John Williams, but there is a high probability that he was. There could have been a verbal agreement between John Williams and/or H.W. Williams and G. G. Thorne to allow the family to continue residing on the property while it was under the ownership of the coal company. This sort of agreement was not unheard of, especially if the coal company did not have immediate plans to use the land they just purchased.

It is not certain exactly when the H.W. Williams family moved away from the land tract, but based on the differences between the 1908 and 1920 plat maps, it is likely that they left sometime before 1920. It should be said, though, that in spite of the evidence that the site is associated with the ownership and/or occupation by the J.W. Williams and H.W. Williams families, it is not exactly certain who might have resided there considering that MS 3 on the 1908 plat map is shown as the main residence on the property. One possibility is that J.W. Williams resided in MS 3, while H.W. lived at 11WM365. If H.W. Williams was viewed as a tenant by the 1908 plat map cartographer (they may not have known at that point that J.W. Williams no longer technically owned the land), then the structure may not have been included on the map. Unfortunately, one can only speculate at this point without having further evidence since these maps were not necessarily drawn consistently in terms of

[11] A terminal date of 1920 for artifacts still manufactured today was used to calculate this date range. It was based on the archival data indicating that the site was occupied until roughly that time.

land ownerships versus occupations from tract to tract.

No foundations or other subsurface features were discovered, nor where there any intact cultural strata. The site was heavily disturbed by agricultural activities and erosion, and little other archaeological data besides the historic scatter was documented. A broad 300-m radius around the site was also surveyed, and no structural features or artifact scatters were discovered nearby. On the continuum of cogency, all that can be said is that there is a high probability based on the material culture and archival data that the site was occupied by the H.W. Williams family from circa 1900 to sometime between 1908 and 1920.

National Register Evaluation and Recommendations

Site 11WM365 is located in the northwest quadrant of the southwest quadrant of the northwest quadrant of Section 7 Township 8 South Range 4 East. Unless mining activities are altered, 11WM365 will be impacted by the proposed mining operation. The archival data in relation to the material culture recovered from the site tie the occupation of 11WM365 to the H.W. (William) Williams family from circa 1900 to sometime between 1908 and 1920. However, due to severe disturbance created by agricultural activities and erosion, Site 11WM365 lacks archaeological integrity, and further research would likely yield little or no results beyond those recorded during the current survey. Hence, the site is not significant and is considered not eligible for inclusion in the NRHP. Clearance is recommended for the proposed mining operation.

Chapter 6. Conclusions and Recommendations

CRAI personnel completed an archaeological survey of the proposed expansion of existing facilities associated with the Pond Creek 1 coal mine located approximately 12.9 km east of Johnston City adjacent to Dwina Road in Section 7, Township 8 South, Range 4 East of Williamson County, Illinois.

The archaeological survey of the proposed project area consisted of systematic shovel testing. The entire project area was investigated as a result of the current archaeological survey.

Note that a principal investigator or field archaeologist cannot grant clearance to a project. Although the decision to grant or withhold clearance is reached, at least in part, on the recommendations made by the field investigator, clearance may be obtained only through an administrative decision made by the Illinois Department of Natural Resources (IDNR), which consults with the IHPA on the determination.

If any previously unrecorded archaeological materials are encountered during mining activity, the IHPA (217) 785-5027 and the IDNR should be notified immediately. If human skeletal material is discovered, the mining-related activities should cease and the IDNR, the local coroner, and the local law enforcement agency must be notified, as described in Section 4170.200 (Rules for the Protection, Treatment, and Inventory of Unmarked Human Burial Sites and Unregistered Graves) of the Illinois Administrative Code.

Summary of Findings and Recommendations

One previously recorded site (11WM123) and two previously unrecorded archaeological sites (11WM364 and 11WM365) were documented during the current survey. Two previously documented sites (11WM121 and 11WM122) could not be relocated, and the archaeological remains of three map structures (MS 2–4) could not be found. That these sites could not be rediscovered is likely due to the site locations having been disturbed by agricultural and logging activities, as well as subsequent erosion.

Site 11WM123 was a mid- to late nineteenth-century to the early twentieth-century historic farm/residence site. A moderate density of historic domestic, architectural, clothing, and furniture artifacts generally dating generally dating from the mid- to late nineteenth century to the early twentieth century was recovered during the current survey. No structures within the vicinity of the site were observed on available historic maps. Archival information indicates suggests that the site was probably occupied by represent the remains of the occupation of the site by the Alex Beasley family from at least 1880 until sometime between 1900 and 1910. Due to disturbance created by logging and erosion in recent years, all of the cultural materials were recovered from disturbed contexts (and no intact portions of the site were observed).

Site 11WM364 was identified as a multicomponent site consisting of a turn-of-the-twentieth-century historic farm/residence and a prehistoric open habitation component. A moderate to heavy density of historic domestic and architectural artifacts dating to the turn-of-the-twentieth century, as well as one temporally undiagnostic prehistoric flake, were recovered from the site. The site appears to have been associated with a historic residence shown on the 1908 plat map of Williamson County that would have been located adjacent to, and east of, 11WM364, just outside of the project area boundary. Based on the archival information researched for this project, 11WM364 possibly was occupied as early as the 1870s or 1880s. Several different families lived there over time, ending with the Raines family, who owned the property sometime between 1908

and 1912, and the early to mid-twentieth century. While the portion of 11WM364 that was surveyed during the current work was heavily disturbed and lacked archaeological integrity, it should be noted that the eastern boundary of the historic component of the site likely extends an unknown distance east beyond the current project limits onto private property. It is not probable that the prehistoric component extends beyond the current project boundary due to the paucity of remains. If at any time the portion of 11WM364 outside of the project boundary would be impacted by the proposed construction, then it is recommended that the area be archaeologically surveyed to determine the eastern limits of the site and evaluate its significance.

Site 11WM365 was a turn-of-the-twentieth-century historic farm/residence site. It consisted of a moderate scatter of turn-of-the-twentieth-century domestic, architectural, and maintenance and subsistence material culture. No structures were observed near the site on available historic maps; however, a residential structure was observed within the property boundaries several kilometers east of the site on the 1908 plat map. Based on the temporal range of the material culture and the archival data, the site was most likely occupied by the H.W. Williams family, who were tenants on the property from circa 1900 to sometime between 1908 and 1920. The site was heavily disturbed by agricultural activities and subsequent erosion, and all of the cultural materials were recovered from disturbed contexts (no intact portions of the site were observed).

Site 11WM123, the portion of 11WM364 within the bounds of the project area, and 11WM365 are all considered to have a low research potential, and for this reason, all these locations are recommended as not eligible for listing in the NRHP. As a result, no historic properties listed in, or considered eligible for listing in, the NRHP will be affected by the proposed mine operation, and as such, cultural resource clearance is recommended.

REFERENCES

Aberle, Gabrielle, Cally Lence, and Monica Shah
2006 *Phase II Archaeological Investigation at Site 11WM334, a Civil War-era Farmstead, Williamson County, Illinois.* Cultural Resource Management Report Number 1438. American Resources Group, Ltd., Carbondale, Illinois.

Adovasio, James M., Joel D. Gunn, Jack Donahue, and Robert Stuckenrath
1977 Meadowcroft Rockshelter: Retrospect 1976. *Pennsylvania Archaeologist* 47(2–3):1–93.

Adovasio, James M., and William C. Johnson
1978 Meadowcroft Rockshelter, 1977: An Overview. *American Antiquity* 43:632–651.

Adovasio, James M., D. Pedlar, Jack Donahue, and Robert Stuckenrath
1990 The Meadowcroft Rockshelter Radiocarbon Chronology 1975–1990. *American Antiquity* 43:632–651.

Albert, Lillian Smith, and Kathryn Kent
1949 *The Complete Button Book.* Doubleday and Company, Inc., Garden City, New York.

Anderson, David G.
2001 Climate and Culture Change in Prehistoric and Early Historic Eastern North America. *Archaeology of Eastern North America* 29:143–186.

Angle, Paul M.
1952 *Bloody Williamson: A Chapter in American Lawlessness.* Alfred A. Knopf, New York.

Baerreis, David A., Reid A. Bryson, and John E. Kutzbach
1976 Climate and Culture in the Western Great Lakes region. *Midcontinental Journal of Archaeology* 1:39–58.

Ball, Donald B.
1984 Historic Artifact Patterning in the Ohio Valley. *Proceedings of the Second Annual Symposium on Ohio Valley Urban and Historic Archaeology* 2:24–36. Indianapolis.

1997 An Introduction to Metallic Cartridge Case Terminology, Identification, and Headstamps. *Ohio Valley Historical Archaeology* 12:112–129.

Baugher-Perlin, Sherene
1982 Analyzing Glass Bottles for Chronology, Function, and Trade Networks. In *Archeology of Urban America: The Search for Pattern and Process*, edited by Roy Dickens, pp. 250–291. Academic Press, New York.

Bemrose, Geoffrey
1952 *Nineteenth Century English Pottery and Porcelain.* Pitman Publishing Corporation, New York, New York.

Berge, Dale L.
1980 *Simpson Springs Station Historical Archaeology in Western Utah 1974–1975.* Cultural Resource Series Number 6. Bureau of Land Management, Salt Lake City, Utah.

Billington, Dora M.
1962 *The Technique of Pottery.* Hearthside Press Inc., New York, New York.

Blaszczyk, Regina Lee
2000 *Imagining Consumers: Design and Innovation from Wedgwood to Corning.* Johns Hopkins University Press, Baltimore, Maryland.

Boger, L. A.
1971 *The Dictionary of World Pottery and Porcelain.* Charles Scribner and Sons, New York.

Braun, E. Lucy
2001 *Deciduous Forest of Eastern North America.* Reprinted. Blackburn Press, Caldwell, New Jersey. Originally published 1950, Blakiston, Philadelphia, Pennsylvania.

Brown, James A.

1985 Long-Term Trends to Sedentism and the Emergence of Complexity in the American Midwest. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. D. Price, and J. A. Brown, pp. 201–231. Academic Press, New York.

Buckley, Francis
1934 Old English Glass. The Birmingham Glass Pinchers. *Glass* 11(May):187–188.

Bundy, Paul D.
2007 *An Archaeological Survey of 170 Acres for the Proposed Locust Grove Coal Mine Operation in Williamson County, Illinois (Permit Application Number Pending)*. Contract Publication Series 06-200. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Butler, Brian M., and Mark J. Wagner
2000 *Land Between the Rivers: The Late Woodland Period of Southernmost Illinois. In Late Woodland Societies: Tradition and Transformation Across the Midcontinent*, edited by T.E. Emerson, D.L. McElrath, and A.C. Fortier, pp. 685–712. University of Nebraska Press, Lincoln.

Butler, Brian M. Mark J. Wagner, Brian G. DelCastello, Richard L. Herndon, and Kathryn E. Parker
2002 *The Giant City Stone Fort (11J-35), Jackson County, Illinois*. Technical Report 02-2, Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Cameron, Elisabeth
1986 *Encyclopedia of Pottery and Porcelain, 1800–1960*. Facts on File Publications, New York.

Chance, David H., and Jennifer V. Chance
1976 *Kanaka Village, Vancouver Barracks 1974*. Reports in Highway Archaeology, No. 3. Office of Public Archaeology, University of Washington, Seattle.

Collard, Elizabeth
1967 *Nineteenth-Century Pottery and Porcelain in Canada*. McGill University Press, Montreal.

Coleman, Dorothy S., Elizabeth A. Coleman, and Evelyn J. Coleman
1968 *The Collector's Encyclopedia of Dolls*. Crown Publishers, New York.

Denker, Ellen, and Bert Denker
1982 *The Warner Collector's Guide to North American Pottery and Porcelain*. Warner Books, New York.

Denny, Sidney G.
1972 The Archaeology of the Big Muddy River Basin of Southern Illinois. Unpublished PhD dissertation. Department of Anthropology. Southern Illinois University, Carbondale.

Denton, George H., and Wibjorn Karlen
1973 Holocene Climatic Variation: Their Pattern and Possible Cause. *Quaternary Research* 3:155–205.

Dillehay, Thomas D.
1989 *Monte Verde, A Late Pleistocene Settlement in Chile: Paleoenvironment and Site Context, Vol. 1*. Smithsonian Institution Press, Washington, D.C.

1997 *Monte Verde, A Late Pleistocene Settlement in Chile: The Archaeological Context, Vol. 2*. Smithsonian Institution Press, Washington, D.C.

Dodd, Arthur Edward
1964 *Dictionary of Ceramics*. Philosophical Library Inc., New York.

Dragoo, Donald W.
1973 Wells Creek-An Early Man Site in Stewart County, Tennessee. *Archaeology of Eastern North America* 1:1–56.

1976 Some Aspects of Eastern North American Prehistory: A Review 1975. *American Antiquity* 41:3–27.

Duffy, John
1978 Social Impact of Disease in the Late Nineteenth Century. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*,

edited by Judith Walzer Leavitt and Ronald L. Numbers, pp. 395–402. University of Wisconsin Press, Madison.

Emerson, Thomas E., Dale L. McElrath, and Andrew C. Fortier
2000 *Late Woodland Societies: Tradition and Transformation Across the Midcontinent.* University of Nebraska Press, Lincoln.

Ensor, H. Blaine, Cally Lence, and Steve Titus
2005 *Phase I Cultural Resources Survey of the Steelhead Development Corporation, LLC, Williamson County Project Area. Cultural Resource Management Report Number 1324.* American Resources Group, Ltd., Carbondale, Illinois.

Erwin, Milo
1876 *The History of Williamson County, Illinois, from the Earliest Times Down to the Present.* Williamson County Historical Society, Marion, Illinois.

Evans, J. Bryant, Madeleine G. Evans, and Edwin R. Hajic
1997 Paleoindian and Early Archaic Occupations at the CB-North Site, Madison County, Illinois. *Midcontinental Journal of Archaeology* 22:159–197.

Faberson, Tanya A.
2006 *Phase III Mitigation of Site 11WM334 for the Proposed Pond Creek 1 Coal Mine, Williamson County, Illinois.* Contract Publication Series 06-075. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faulkner, Charles H.
2000 Historical Archaeology Laboratory Manual. Department of Anthropology, University of Tennessee, Knoxville.

Fay, Robert P.
1986 *Archaeological Investigations at Liberty Hall, Frankfort, Kentucky.* Kentucky Heritage Council, Frankfort.

Fehrenbacher, J. B., and R. T. Odell
1959 *Williamson County Soils.* Soil Report 79. Agricultural Experiment Station, University of Illinois, Urbana, Illinois.

Fike, Richard E.
1987 *The Bottle Book: A Comprehensive Guide to Historic, Embossed Medicine Bottles.* Pergerine Smith Books, Salt Lake City, Utah.

Fitting, James E.
1965 Observations on Paleo-Indian Adaptive and Settlement Patterns. *Michigan Archaeologist* 11(3–4):3–27.

Fitting, James E., Jerry DeVisscher, and Edward J. Wahla
1966 *The Paleo-Indian Occupation of the Holcombe Beach.* Anthropological Papers No. 27. Museum of Anthropology, University of Michigan, Ann Arbor.

Ford, Richard I.
1974 Northeastern Archaeology: Past and Future Directions. *Annual Review of Anthropology* 3:385–413.

Fowler, Melvin L.
1957 Rutherford Mound: Hardin County, Illinois. *Scientific Papers* Volume 7, Number 1. Illinois State Museum. Springfield.

Freeman, Larry
1954 *Ironstone China.* Century House, Watkins Glen, New York.

Friedman, Lawrence J.
1970 *The White Savage: Racial Fantasies in the Postbellum South.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Fritts, Harold C., G. Robert Lofgren, and Geoffrey A. Gordon
1979 Variation in Climate Since 1602 as Reconstructed from Tree-rings. *Quaternary Research* 12:18–46.

Garrow, Patrick H., and Thomas R. Wheaton, Jr. (editors)
1986 *Oxon Hill Manor Archaeological Site Mitigation Project.* Garrow and Associates, Inc., Atlanta, Georgia.

Prepared for Maryland State Highway Administration, Baltimore, Maryland.

Gates, William C., Jr.
1984 *The City of Hills and Kilns: Life and Work in East Liverpool, Ohio*. The East Liverpool Historical Society, East Liverpool, Ohio.

Gates, William C., Jr., and Dana E. Ormerod
1982 The East Liverpool Pottery District: Identification of Manufacturers and Marks. *Historical Archaeology* 16(1–2):1–358.

Genheimer, Robert A.
1987 *Archaeological Testing, Evaluation, and Final Mitigation Excavations at Covington's Riverfront Redevelopment Phase II Site, Kenton County, Kentucky*. Prepared by R.B. Archaeological Services, Covington, Kentucky and Cultural Resource Analysts, Inc., Lexington, Kentucky. Submitted to the City of Covington, Kentucky.

Godden, Geoffrey A.
1963 *British Pottery and Porcelain 1780–1850*. Baker, London, England.

1964 *An Illustrated Encyclopedia of British Pottery and Porcelain*. Bonanza Books, New York, New York.

Goodspeed Publishing Company
1887 *History of Gallatin, Saline, Hamilton, Franklin and Williamson Counties*. Goodspeed Publishing Company, Chicago, Illinois.

Greene, Lance K.
1992 The Penfield is Mightier than the Sword: Machine Made Bricks in Knoxville and Knox Co. Tennessee. In *Proceedings of the Tenth Symposium on Ohio Valley Urban and Historic Archaeology*, edited by Amy Young and Charles Faulkner, pp. 74–91. Tennessee Anthropological Association Miscellaneous Paper No. 16.

Greer, Georgeanna H.
1999 *American Stonewares: The Art and Craft of Utilitarian Potters*. 3rd Ed. Schiffer Publishing, Atglen, Pennsylvania.

Griffin, James B.
1961 Some Correlations of Climatic and Cultural Change in Eastern North American Prehistory. *Annals of the New York Academy of Sciences* 95:710–717.

1978 Late Prehistory of the Ohio Valley. In Northeast. *Handbook of North American Indians*, Volume 15, edited by B.G. Trigger, p. 547–559. Smithsonian Institution, Washington, D.C.

Grove, Jean M.
1988 *The Little Ice Age*. Metheun, London, England.

Gurcke, Karl
1987 *Bricks and Brickmaking, a Handbook for Historical Archeology*. The University of Idaho Press, Moscow.

Hockensmith, Charles D.
1997 A Study of Frankfort Bricks and Brickmaking, Franklin County, Kentucky. *Tennessee Anthropologist* 22(2):121–176.

Hofman, Jack L.
1980 Twenhafel Archaeology: The Southeastern Connection. *Tennessee Anthropologist* 5(2):185–201.

Holscher, Harry Heltman
1965 Hollow and Specialty Glass: Background and Challenge. Reprint from the *Glass Industry*, Volume 46, June–November. Owens-Illinois, Toledo, Ohio.

Horsley, A. Doyne
1986 *Illinois: A Geography*. Westview Press, Boulder, Colorado.

Howard, Robert P.
1972 *Illinois: A History of the Prairie State*. William B. Eerdmans Publishing Company, Grand Rapids, Michigan.

Hughes, Bernard, and Therle Hughes
1968 *The Collector's Encyclopedia of English Ceramics*. Abbey Library, London, England.

Husfloen, Kyle

1992 *Collector's Guide to American Pressed Glass 1825–1915*. Wallace-Homestead Book Company, Radnor, Pennsylvania.

Illinois State Climatologist Office
2003 Climate of Illinois. Electronic document, http://www.sws.uiuc.edu/atmos/statecli/General/Illinois-climate-narrative.pdf, accessed March 5, 2009.

IMACS Users Guide
2001 *Intermountain Antiquities Computer System Users Guide*. Revised. University of Utah, Bureau of Land Management, U.S. Forest Service. Originally published 1984.

Jefferies, Richard W.
1990 Archaic Period. In *The Archaeology of Kentucky: Past Accomplishments and Future Directions*, vol. 1, edited by D. Pollack, pp. 143–246. State Historic Preservation Comprehensive Plan Report No. 1. Kentucky Heritage Council, Frankfort.

1996a The Emergence of Long-Distance Exchange Networks in the Southeastern United States. In *Archaeology of the Mid-Holocene Southeast*, edited by K.E. Sassaman and D.G. Anderson, pp. 222–258. University Press of Florida, Gainesville.

1996b *Mississippian Settlement in Southeastern Kentucky: A Preliminary Assessment. In Current Research in Kentucky: Volume Four*, edited by S. L. Sanders, T. N. Sanders ,and C. Stout, pp. 115–137. Kentucky Heritage Council, Frankfort.

Jefferies, Richard W., and Brian M. Butler
1982 *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*. 2 volumes. Research Paper No. 33. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Jensen, Richard J.
1978 *Illinois: A History*. University of Illinois Press, Urbana, Illinois.

Jones, Olive, and Catherine Sullivan
1985 The Parks Canada Glass Glossary for the Description of Containers, Tableware, Flat Glass, and Closures. *Studies in Archaeology, Architecture and History*. National Historic Parks and Sites Branch, Parks Canada.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States*. Indiana University Press, Bloomington.

Ketchum, William C., Jr.
1983 *Pottery and Porcelain*. Alfred A. Knopf, New York.

1991 *American Stoneware*. Henry Holt and Company, Inc., New York.

Koldehoff, Brad
1992 Lithic Analysis. In *The Little Muddy Rock Shelter: A Deeply Stratified Prehistoric Site in the Southern Till Plains of Illinois*, edited by C.R. Moffat, B. Koldehoff, W.M. Cremin, T.J. Martin, M.C. Masulis, and M.R. McCorvie, pp. 279–374. Cultural Resources Management Report No. 186. American Resources Group, Ltd., Carbondale.

Krakker, James K., Michael J. Shott, and Paul D. Welch
1983 Design and Evaluation of Shovel-Test Sampling in Regional Archaeological Survey. *Journal of Field Archaeology* 10:469–480.

Lange, Frederick W., and Shawn B. Carlson
1985 Distributions of European Earthenwares on Plantations on Barbados, West Indies. In *The Archaeology of Slavery and Plantation Life*, edited by T. A. Singleton, pp. 97–120. Academic Press, New York.

Lehner, Lois
1980 *Complete Book of American Kitchen and Dinner Wares*. Wallace-Homestead Books, Des Moines, Iowa.

Leighton, M. M., G. E. Ekblaw, and L. Horborg
1948 Physiographic Divisions of Illinois. *Journal of Geology* 54: 16–53.

Lewis, Griselda
1950 *English Pottery*. Pellegrini and Cudahy, New York.

Lewis, R. Barry
1990 The Late Prehistory of the Ohio-Mississippi Rivers Confluence Region. In *Towns and Temples Along the Mississippi: Late Prehistoric and Early Historic Indians in the Memphis Area*, edited by D. H. Dye, and C. A. Cox, pp. 38–58. The University of Alabama Press, Tuscaloosa.

Lightfoot, Kent G.
1986 Regional Surveys in the Eastern United States: Strengths and Weaknesses of Implementing Subsurface Testing Programs. *American Antiquity* 51(3):484–504.

1989 A Defense of Shovel-Test Sampling: A Reply to Shott. *American Antiquity* 54(2):413–416.

Lindsey, Bill
2008 Historic Glass Bottle Identification and Information. Electronic document, http://www.sha.org/bottle/index.htm, accessed December 4, 2008.

Little, Wilfred L.
1969 *Staffordshire Blue: Underglaze Blue Transfer Printed Earthenware*. Crown Publishers, Inc., New York.

Lockhart, Bill
2006 The Color Purple: Dating Solarized Amethyst Container Glass. *Historical Archaeology* 40(2):45–56.

Lofstrom, Edward U., Jeffrey P. Tordoff, and Douglas C. George
1982 A Seriation of Historic Earthenwares in the Midwest, 1780–1870. *Minnesota Archaeologist* 41(1):3–29.

Lopinot, Neal H., Denise Hutto, and David Braun
1982 *Archaeological Investigations at the Kingfish Site, St. Clair County, Illinois.* Research Paper 25. Center for Archaeological Investigations, Southern Illinois University, Carbondale, Illinois.

McAvoy, Joseph M., and Lynn D. McAvoy
1997 *Archaeological Investigations of Site 44SX202, Cactus Hill, Sussex County, Virginia.* Research Report Series No. 8. Virginia Department of Historic Resources, Richmond.

MacClintock, Paul
1929 *Physiographic Division of the Area Covered by the Illinoisian Drift-Sheet in Southern Illinois II.* Recent Discoveries of the Pre-Illinois Drifts in Southern Illinois. Reports of Investigations 19. Illinois Geological Survey Urbana, Illinois.

MacDonald, George F.
1968 *Debert: a Paleo-Indian Site in Central Nova Scotia.* Anthropology Papers No. 16, National Museum of Canada, Quebec City, Quebec.

Magne, Martin P. R.
1985 *Lithics and Livelihood: Stone Tool Technologies of Central and Southern Interior B.C.* Archaeology Survey of Canada, Mercury Series No. 133, Ottawa.

Majewski, Teresita and Michael J. O'Brien
1984 *An Analysis of Historical Ceramics from the Central Salt River Valley of Northeast Missouri.* Publications in Archaeology, Number 3. American Archaeology Division, Department of Anthropology, University of Missouri, Columbia.

1987 The Use and Misuse of Nineteenth-Century English and American Ceramics in Archaeological Analysis. In *Advances in Archaeological Method and Theory*, Volume 11, edited by Michael J. Shiffer, pp. 97–209. Academic Press, New York.

Mankowitz, Wolf and Reginald G. Haggar

1957 *The Concise Encyclopedia of English Pottery and Porcelain.* Hawthorne Books, New York.

Marion Daily Republican and Marion Weekly Leader
1940 *Plat Book of Williamson County, Illinois, 1940.* Marion, Illinois.

Meikle, Jeffrey L.
1995 *American Plastic: A Culture History.* Rutgers University Press, New Brunswick, New Jersey.

Meltzer, David J.
1989 Why Don't We Know When the First People Came to North America? *American Antiquity* 54:471–490.

Meltzer, David J., Donald K. Grayson, Gerardo Ardilla, Alex W. Barker, Dena F. Dincauze, C. Vance Haynes, Francisco Mena, Lautaro Nuñez, and Dennis J. Stanford
1997 On the Pleistocene Antiquity of Monte Verde, Southern Chile. *American Antiquity* 62:659–663.

Miller, George L., and Catherine Sullivan
1984 Machine-Made Glass Containers and the End of Production for Mouth-Blown Bottles. *Historical Archaeology* 18(2):83–96.

Moffat, Charles R., Brad Koldehoff, William M. Cremin, Terrance J. Martin, Mary Carol Masulis, Mary R. McCorvie
1992 *The Little Muddy Rock Shelter: A Deeply Stratified Prehistoric Site in the Southern Till Plains of Illinois.* Cultural Resources Management Report No. 186, American Resources Group, Ltd., Carbondale.

Moir, Randall W.
1977 Window Glass: A Statistical Perspective. Manuscript on file, Archaeology Research Program, Southern Methodist University, Dallas, Texas.

1987 Socioeconomic and Chronometric Patterning of Window Glass. In *Historic Buildings, Material Culture, and People of the Prairie Margin*, edited by David H. Jurney and Randall W. Moir, pp. 73–81. Richland Creek Technical Series vol. V. Southern Methodist University, Dallas Texas.

Morrow, Julie E.
1995 Clovis Projectile Point Manufacture: A Perspective from the Ready / Lincoln Hills Site, 11Y46, Jersey County, Illinois. *Midcontinental Journal of Archaeology* 20:167–191.

1996 The Organization of Early Paleoindian Lithic Technology in the Confluence Region of the Mississippi, Illinois, and Missouri Rivers. Unpublished PhD. Dissertation, Department of Anthropology, Washington University, St. Louis.

Muller-Beck, Hansjurgen
1966 Paleohunters in America: Origins and Diffusion. *Science* 152:1191–1210.

Musgrave, Jon
2004 Africa, Illinois. Electronic document, http://www.illinoishistory.com/africa.html, accessed May 25, 2006.

Nance, Jack D., and Bruce F. Ball
1986 No Surprises? The Reliability and Validity of Test Pit Sampling. *American Antiquity* 51(3):457–483.

National Park Service
1983 Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines. *Federal Register* 48(190): 44716–44742. National Park Service, United States Department of the Interior, Washington, D.C.

National Resources Conservation Service (NRCS)
2007a Official Soil Series Descriptions (OSD). Electronic document, http://soils.usda.gov/technical/classification/osd/index.html, accessed March 5, 2009.

2007b Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed March 4, 2009.

Nelson, Lee H.

1968 *Nail Chronology as an Aid to Dating Old Buildings*. American Association for State and Local History, Technical Leaflet 15.

Norman-Wilcox, G.
1978 Staffordshire in a Nutshell. In *English Pottery and Porcelain*, edited by P. Atterbury, pp. 166–170. Universe Books, New York.

Ogle, George A., & Co.
1908 *Williamson County Illinois Including a Plat Book of the Villages, Cities, and Townships of the County*. George A. Ogle & Co., Chicago, Illinois.

Orser, Charles E.
1988 *The Material Basis of the Postbellum Tenant Plantation*. The University of Georgia Press, Athens.

Pearson, Georges A.
1999 North American Paleoindian Bi-Beveled Bone and Ivory Rods: A New Interpretation. *North American Archaeologist* 20:81–103.

Price, Cynthia R.
1979 *Nineteenth-Century Ceramics in the Eastern Ozark Escarpment Region of Southeast Missouri*. Paper presented to the 35th Annual Meeting of the Southeast Archaeological Conference, Knoxville, Tennessee.

1981 Early to Mid-Nineteenth Century Refined Earthenwares. In *A Guide for Historical Archaeology in Illinois*, edited by C. E. Orser, Jr., pp. 24–48. Mid-American Research Center Research Paper Number 1. Loyola University of Chicago.

Pullin, Anne G.
1986 *Glass Signatures, Trademarks and Trade Names from the Seventeenth to the Twentieth Century*. Wallace-Homestead Book Company, Lombard, Illinois.

Railey, Jimmy A.
1990 Woodland Period. In *The Archaeology of Kentucky: Past Accomplishments and Future Directions*, Vol. 1, edited by David Pollack, pp. 247–374. State Historic Preservation Comprehensive Plan Report No. 1. Kentucky Heritage Council, Frankfort.

Ramsay, John
1939 *American Potters and Pottery*. Hale, Cushman, and Flint, Boston, Massachusetts.

Raycraft, Don, and Carol Raycraft
1990 *Collector's Guide to Country Stoneware and Pottery*. Second Series. Collector Books, Paducah, Kentucky.

Revi, Albert C.
1964 *American Pressed Glass and Figure Bottles*. Thomas Nelson and Dons, New York.

Riley, John J.
1958 *A History of the American Soft Drink Industry 1807–1957*. American Bottlers of Carbonated Beverages, Washington, D. C.

Ritchie, William A., and Robert E. Funk
1973 *Aboriginal Settlement Patterns in the Northeast*. Memoir No. 20. New York State Museum and Science Service, Albany.

Rock, James T.
1980 American Bottles: A Few Basics. Manuscript on file at the Klamath National Forest, Region B, United States Department of Agriculture.

Roenke, Karl G.
1978 Flat Glass, Its Use as a Dating Tool for Nineteenth Century Archeological Sites in the Pacific Northwest and Elsewhere. Northwest *Anthropological Research Notes*, Memoir No. 4. Moscow, Idaho.

Samford, Patricia M.
1997 Response to a Market: Dating English Underglaze Transfer-Printed Wares. *Historical Archaeology* 3(2):1–30.

Sant, Mark B., Brian M. Butler, Brad Koldehoff, Christy Wells, and Claire F. Martin
1987 The Big Muddy Drainage Basin. In *Cultural Resource Studies at Illinois Department of Conservation State Parks*

and Recreation Areas, Volume One: The 1985 Season, edited by Harold Hassen and Marjorie B. Schroeder, pp. 353–430. Illinois State Museum, Springfield, Illinois.

Schwegman, J. E., G. D. Fell, M. Hutchison, G. Paulson, W. M. Shepherd, and J. White
1986 The Natural Divisions of Illinois. In *Guide to the Vascular Flora of Illinois*, (Revised and Enlarged Edition), by R.H. Mohlenbrock, pp. 1–47. Southern Illinois University Press, Carbondale, Illinois.

Shah, Monica
2001 *Phase I Cultural Resource Survey and Assessment for a Proposed Gas Fathering Pipeline and Gas Plant Location for Illinois Methane, LLC.* American Resources Group, Ltd., Carbondale, Illinois.

Shott, Michael J.
1985 Shovel-Test Sampling as a Site Discovery Technique: A Case Study from Michigan. *Journal of Field Archaeology* 12:458–469.

1989 Shovel-Test Sampling in Archaeological Survey: Comments on Nance and Ball, and Lightfoot. *American Antiquity* 54(2):396–404.

Simon, Mary L.
2000 Regional Variations in Plant Use Strategies in the Midwest during the Late Woodland. In *Late Woodland Societies: Tradition and Transformation Across the Midcontinent*, edited by T.E. Emerson, D.L. McElrath, and A.C. Fortier, pp. 37–76. The University of Nebraska Press, Lincoln.

Smith, Bruce D.
1978 Variation in Mississippian Settlement Patterns. In *Mississippian Settlement Patterns*, edited by B. D. Smith, pp. 479–503. Academic Press, New York.

Snyder, Jeffrey B.
2000 *Historical Staffordshire: American Patriots and Views*. 2nd. Ed. Schiffer, Atglen, Pennsylvania.

South, Stanley
1977 *Method and Theory in Historical Archaeology*. Academic Press, New York.

Sprague, Roderick
1981 A Functional Classification for Artifacts from 19th and 20th Century Historical Sites. *North American Archaeologist* 2(3):251–261.

2002 China or Prosser Button Identification and Dating. *Historical Archaeology* 36(2):111–127.

Stewart Abernathy, Leslie C.
1986 *The Moser Farmstead, Independent But Not Isolated: The Archeology of a Late Nineteenth Century Ozark Farmstead.* Arkansas Archeological Survey Research Series No. 26, Fayetteville.

Stout, Wilber
1923 History of the Clay Industry in Ohio. In *Coal Formation Clays of Ohio* by Wilber Stout, R.T. Stull, William J. McCaughey, and D.J. Demorest, pp. 28–43. Ohio Geological Survey, 4th Series, Bulletin 26, Columbus, Ohio.

Styles, Bonnie W.
1981 *Faunal Exploitation and Resource Selection: Early Late Woodland Subsistence in the Lower Illinois Valley.* Scientific Papers 3. Archaeological Program, Northwestern University, Evanston, Illinois.

Swann, Brenda M.
2002 Material Culture at Presidio Santa Maria de Galve (1698–1722): Combining the Historical and Archaeological Records. *Southeastern Archaeology* 21(1):64–78.

Tankersley, Kenneth B.,
1995 Paleoindian Contexts and Artifact Distribution Patterns at the Bostrom Site, St. Clair County, Illinois, *Midcontinental Journal of Archaeology* (20)1:40–62.

Toulouse, Julian H.

1969a A Primer on Mold Seams: Part 1. *Western Collector* 7(11):526–535.

1969b A Primer on Mold Seams: Part 2. *Western Collector* 7(12):578–587.

1972 Bottle Makers and Their Marks. Thomas Nelson, New York.

1977 *Fruit Jars, A Collector's Manual with Prices*. Everybody's Press, Inc., Hanover, Pennsylvania.

United States Geological Survey (USGS)
1963 Pittsburg, Illinois 7.5 minute series topographic quadrangle. United States Geological Survey, Washington, DC.

University of Illinois Department of Agronomy
1949 Principal Soil Association Areas of Illinois. Agricultural Experiment Station, University of Illinois, Urbana, Illinois.

Vander Leest, Barbara J.
1981 *A Cultural Resource Survey of the Proposed Zeigler #6 Mine in Williamson County, Illinois*. Espey, Huston, & Associates, Inc., Austin, Texas.

Wagner, Mark and Mary McCorvie
1992 *The Archeology of the Old Landmark. Nineteenth Century Taverns Along the St. Louis Vincennes Trace in Southern Illinois*. Illinois Department of Transportation and the Center for American Archeology, Kampsville.

Walker, Renee B., Kandace R. Detwiler, Scott C. Meeks, and Boyce N. Driskell
2001 Berries, Bones, and Blades: Reconstructing Late Paleoindian Subsistence Economy at Dust Cave, Alabama. *Midcontinental Journal of Archaeology* 26:169–198.

Warner & Beers, Proprietors
1972 [1876] *Atlas of the State of Illinois to Which are Added Various General Maps and Illustrations*. Union Atlas Company, Chicago, Illinois. Reprinted 1972. Mayhill Publications, Knightstown, Indiana.

Warren, Robert E., and Michael J. O'Brien
1982 Holocene Dynamics. In *The Cannon Reservoir Human Ecology Project: An Archaeological Study of Cultural Adaptations in the Southern Prairie Peninsula*, edited by Michael J. O'Brien, Robert E. Warren, and Dennis E. Lewarch, pp. 71–84. Academic Press, New York.

Watkins, Lura Woodside
1930 *Cambridge Glass 1818 to 1888: The Story of the New England Glass Company*. Bramhall House, New York.

Wesler, Kit W.
1984 A Spatial Perspective on Artifact Group Patterning Within the Houselot. In *Proceedings of the Symposium on Ohio Valley Urban and Historic Archeology*, vol. II, edited by Donald B. Ball and Phillip J. Diblasi, pp. 37–44. Louisville, Kentucky.

Wetherbee, Jean
1980 *A Look at White Ironstone*. Wallace-Homestead Book Company, Des Moines, Iowa.

Wilcox, J. F.
1905 *Historical Souvenir of Williamson County, Illinois*. The LeCrone Press, Effingham, Illinois.

Williamson County Historical Society
2001 [1920] *Williamson County Illinois Plat Map*. Williamson County Historical Society, Marion, Illinois.

Winters, Howard D.
1967 *An Archaeological Survey of the Wabash Valley in Illinois*. Reports of Investigations No. 10, Illinois State Museum, Springfield.

1969 *The Riverton Culture*. Reports of Investigations No. 10, Illinois State Museum, Springfield.

Appendix A. Scope of Work

Cultural Resource Analysts, Inc.

PROPOSAL FOR CULTURAL RESOURCE STUDY

WILLIAMSON ENERGY, LLC/ALLIANCE CONSULTING
Williamson County, Illinois

Scope of Work

At the request of Claudio Yon of Alliance Consulting on behalf of Williamson Energy, LLC, Cultural Resource Analysts, Inc (CRAI) was asked to submit a proposal for the archaeological survey of a proposed coal operation east of Dwina Road in Williamson County, Illinois. The project area is an expansion of the existing facilities associated with the Pond Creek No. 1 mine to the west of Dwina Road. The project area will encompass approximately 183 acres, the majority of which will need to be shovel tested due to limited ground surface visibility.

Pre-Fieldwork

The initial logistical organization will consist of obtaining detailed project area information from the client concerning project area boundary and property ownership. CRAI will also review historic maps of the area at this time to locate possible historic sites that may be in the project area. Such maps include Government Land Office (GLO) maps, Sanborn Insurance maps, plat maps, and old aerial maps from the 1930s and 1940s.

Also prior to the initiation of fieldwork, a records review of the state file database will be conducted at the Illinois State Museum. This search will inform CRAI on previous archaeological work that had been conducted in the area and whether previously recorded sites are present. If sites are present, then CRAI will receive copies of all site forms, copies of relevant reports, and site location data. This information will be incorporated in the report that CRAI submits once the project is complete.

Field Investigations

The survey will be completed following methodology as outlined in the Illinois Historic Preservation Agency (IHPA) guidelines, including both pedestrian survey and shovel testing of the project area. The IHPA guideline for determining whether pedestrian survey or shovel testing is justified is based on ground visibility. Following the IHPA guidelines, where the ground visibility is greater than 25 percent, a pedestrian survey will be used to locate archaeological sites. Where the ground visibility is less than 25 percent, however, shovel testing must be conducted. Factors affecting ground visibility include vegetation types, soil or sediment types, as well as farming methods. Since the majority of the area is forested or in tall grass pasture, CRAI is assuming that most of the project area will be shovel tested. Shovel tests will be spaced 15 meters apart along transect also spaced 15 meters apart. The shovel tests will be 40 cm in diameter and will be excavated down to archaeologically sterile soil (usually the B horizon). The fill from each shovel test will be screened through one-quarter inch wire mesh. In areas that can be pedestrian surveyed IHPA guidelines indicate a 5 m interval should be used.

When a site is encountered, standard recording methodologies will be employed. If a site is identified in an area with at least 25 percent ground surface visibility, then a controlled surface collection strategy will be used. We will then excavated shovel tests in an iron cross pattern across the site to identify site integrity. Shovel testing interval will be reduced to 5 m to more accurately delineate site boundaries. If a site is identified in an area with less than 25 percent ground surface visibility, then shovel testing will be reduced to a 5 m interval to more accurately delineate site boundaries. Employing these methods will enable the staff at CRAI to make informed decisions concerning the integrity of the site and determine the eligibility to the National Register of Historic Places (NRHP). This procedure will decrease the number of sites recommended for further testing, thus, in turn, decreasing the financial costs associated with archaeological investigations for the project.

Once each site is identified, detailed maps will be drawn of all archaeological sites identified in the project area. Photographs will be taken of all archaeological sites. Each site datum and site boundary will be mapped by Global Positioning System (GPS) hardware. The appropriate Illinois site form will be completed for each site identified or revisited during the proposed phase I survey.

With regard to our cost estimate, we have made the following assumptions:

- The project area is approximately 183 acres in size.
- About 18 acres was previously surveyed by CRAI for a soil storage area and about 8 acres was previously surveyed by ARG for a railroad line. These areas will not have to be resurveyed, this leaves about 416 acres to survey.
- It is anticipated that the entire 183 acres will have to be shovel tested due to less than 25% ground surface visibility (tall grass pasture and forests).

Standing structures over fifty years of age in the project area will be documented in a series of photographs recording all elevations and architectural detail. A site plan will be developed for farm complexes showing the relationship of buildings, roads, fields and property boundaries.

Laboratory Work

Recovered cultural materials from the phase I survey will be returned to the CRAI laboratory at Lexington, KY for cleaning, analysis, and cataloging following standard practices. This phase of the work will also include preparation of site maps and project base maps. CRAI historic architecture staff will review the field documentation of historic structures and prepare structure and site forms. The architectural historians will also complete appropriate site specific archival research.

Report Production

CRAI will prepare two types of reports for this project, including a management summary and final survey report. Combined, these reports will serve to inform the client of the progress of the investigation, our recommendations, and findings. The management summary will be issued in PDF format within 10 working days of completion of the fieldwork. The management summary will consist of a narrative description of the work accomplished, summary of the results and, if appropriate, recommendations for the next phase of the work and will be illustrated with appropriate maps and figures.

After all laboratory and archival research has been completed a detailed survey report will be prepared. The survey report will contain all relevant details of the project, including pertinent

environmental and cultural historical backgrounds, results of records review and archival research, detailed description of each site found, NRHP eligibility assessment of each site, and site specific recommendations for phase II testing, if necessary. We will provide a copy of the report in PDF format to the client for their review and comment. CRAI will make appropriate revisions if necessary. CRAI will provide client with 5 bound copies of the revised report for submittal to appropriate agencies for review. A PDF version of the report will be submitted to the client and IDNR with the final report. Site forms will be submitted by CRAI to ISM.

Curation

The collection of artifacts will be kept at a minimum. CRAI recommends that the curation policy be negotiated with the IHPA. The Illinois State Museum will be used as the curation facility. Original field notes, photographs, artifacts and 2 copies of the final report (1 bound and 1 unbound) will be submitted by CRAI for curation to the ISM.

Schedule

CRAI can initiate work on the project with receipt of notice to proceed. The field survey of the project area will take about 20 working days to complete using an eight person crew, including time for site recording. We will submit by email the management summary of the results of the survey no later than 10 working days from the completion of field work. We will submit our detailed report within 45 working days of the completion of fieldwork.

Appendix B. Vita

CURRICULUM VITAE

Tanya Alexandra Faberson

PERSONAL DATA

Current position: Principal Investigator
Business Address: Cultural Resource Analysts, Inc.
151 Walton Avenue
Lexington, KY 40508
Business phone and contact: Telephone: 859-252-4737; Fax: 859-254-3747; Work cell: 859-221-3038
E-mail: tafaberson@crai-ky.com

Home Address: 315 Creekview Drive
Paris, KY 40361
Cell: 859-489-5883; e-mail: tanyafab@gmail.com
Personal: Born: October 8, 1973; Place of birth: Melbourne, Australia

FIELDS OF SPECIALIZATION

Historical archaeology, industrial archaeology, historic site preservation, Eastern North America, Midwest, social inequality and stratification, domination and resistance, political economy, material culture studies, heritage studies, public archaeology, social theory

EDUCATION

Doctor of Philosophy, Anthropology: Historical Archaeology
University of Tennessee, Knoxville, Tennessee
August 2005
Studied archaeological evidence of social inequality and the political and economic milieu of the 19th- and early 20th-century Southeastern United States. Dissertation: "In the Shadow of Greatness: The Archaeology of Capitalism, Agriculture, and the Informal Economy at Marble Springs, Knox County, Tennessee, 1847–1932."

Master of Arts, Anthropology: Historical Archaeology
University of Tennessee, Knoxville, Tennessee **August 2001**
Studied discipline-wide anthropological theories and practices, as well as field methods, analytic procedures, and theories specific to historic archaeology. Thesis: "Privies, Pigs, Rubbish, and Quacks: The Archaeology of Late Nineteenth and Early Twentieth Century Public Health in Knoxville, Tennessee." Examined the archaeological evidence of resistance to public health reform legislation in the late nineteenth and early twentieth century.

Bachelor of Arts, Anthropology
Illinois State University, Bloomington-Normal, Illinois **May 1998**
Studied anthropology from the traditional four-field perspective, while minoring in biology. Completed extensively researched senior thesis on human skeletal pathology.

ARCHAEOLOGICAL FIELD AND LAB EXPERIENCE

Field Director, Phase I Survey, Proposed Western Kentucky Minerals Mine Expansion, Daviess County, Kentucky, 2008
Field Director, Phase I Survey, Pond Creek 1 Mine expansion, Williamson County, Illinois, 2008
Field Director, Phase I Survey, Daniel Boon National Forest, Estill County, Kentucky, 2008
Field Director, Phase II Testing, Site 15Ck478, Lower Howard's Creek Nature and Heritage Preserve, Clark County, Kentucky, 2008
Field Director, Phase II Testing, Site 15Da229, Daviess County, Kentucky, 2008
Field Director, Phase II Testing, Site 15Js144 Locality B, Jessamine County, Kentucky, 2007
Field Director, Phase I Survey, Lower Howard's Creek Nature and Heritage Preserve, Clark County,

Kentucky, 2007
Field Director, Phase II Testing, Site 11WM115 (Pond Creek 1 Mine), Williamson County, Illinois, 2007
Field Director, Phase II Testing, Sites 15Da241 and 15Da243 (Proposed Western Kentucky Minerals, Inc., Joes Run Mine [Permit 830-0092]), Daviess County, Kentucky, 2007
Field Director, Phase II/III Data Recovery, Sites 15Jf717 and 15Jf718 (LSIORB [Louisville Bridges] I-65 Accelerated), Jefferson County, Kentucky, 2006
Field Director, Phase II Testing, Site 15Gd89 (U.S. 27 road realignment), Garrard County, Kentucky, 2006
Field Director, Phase I Survey, Proposed Saddle Ridge Development Area, Shelby County, Kentucky, 2006
Field Director, Phase III Mitigation, 11WM334 (19th-century historic farmstead), Williamson County, Illinois, 2006
Field Director/ Senior Archaeologist, Phase I Survey and Phase II Testing, Henry's Station Historic Site (40SV161), 2005
Supervisor and Instructor, University of Tennessee, Knoxville, Summer Field School: Marble Springs (40KN125), 2004, 2003, 2002
Archaeological Artifact Analyst, University of Tennessee, Knoxville, Department of Anthropology, 2003–2004
Supervisor and Instructor, University of Tennessee, Knoxville, Summer Field School: Ramsey House (40KN120), 2001
Field technician, Phase III Data Recovery, Marble Springs Historic Site (40KN125), June 2001
Assistant Supervisor, University of Tennessee, Knoxville, Summer Field School: Ramsey House (40KN120), 2000
Archaeological Artifact Analyst, Ramsey House, Knoxville, Tennessee, 2000
Field technician, Phase I Survey and Phase II Testing, McBee House (40JE80), Jefferson County, May 2000
Field technician, Phase I Survey and Phase II Testing, Marble Springs Historic Site (40KN125), April 2000
Field technician, Phase I and II Data Recovery, Uffington House (40MO145), Ruby, TN, February 2000
Field technician, Phase III Data Recovery, Uffington House (40MO145), Rugby, TN, March 2000
Supervisor, Phase III Data Recovery, Greenway Middle School Site (40KN231), Knoxville, TN, Fall 1999
Field Technician, Phase I Survey, Phase II Testing, and Phase III Data Recovery, Cowan House (40KN229), Knoxville, TN, Spring 1999
Osteological analyst, Illinois State University, Normal Illinois. Assisted in verifying University compliance with federal regulations (NAGPRA) concerning various skeletal collections housed at the University and in corresponding with U.S. Department of Interior, 1997–1998.

PUBLICATIONS/ PRESENTATIONS

Faberson, Tanya A. (2009) *A Cultural Resource Survey For The Proposed Western Kentucky Minerals Joes Run Mining Operation, Daviess County, Kentucky (Permit Application Number 830-0092, Amendment 2)*. Contract Publication Series 08-179. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2008) *A Cultural Resource Survey Of Oil Well Locations For The Proposed Refurbishment Of Existing Wells In The Maple And Williams Leases Within The Daniel Boone National Forest, Cumberland Ranger District, Estill County, Kentucky*. Contract Publication Series 08-136. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A., and Jennifer L. Barber (2008) Social Change and Neighborhood Transformations in the Late Nineteenth and Early Twentieth Centuries: The Urban Archaeology of Three Communities in the Ohio Valley. Submitted to *Tennessee Archaeology*, 2008.

Barber, Jennifer L., and Tanya A. Faberson (2008) *Additional Archaeological Investigations at Site 15Ck478 in the Lower Howard's Creek Nature and Heritage Preserve, Clark County, Kentucky*. Contract Publication Series 07-194. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A., Matthew D. McMahan, and Trent Spurlock (2008) *Phase I Cultural Historic and Archaeological Survey for the Lower Howard's Creek Nature and Heritage Preserve, Clark County, Kentucky*. Contract Publication Series 07-167. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2008) *National Register Evaluation of Site 15Js144 Locality B for the Proposed U.S. 68 Construction in Jessamine County, Kentucky (Item Number 7-318.01)*. Contract Publication Series 07-260. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2008) Racial Purity: 1900–1910. In *Encyclopedia of Race and Racism*, 3 vols., John Hartwell Moore, ed. Macmillan Reference USA, Detroit.

Faberson, Tanya A. (2008) Sexuality. In *Encyclopedia of Race and Racism*, 3 vols., John Hartwell Moore, ed. Macmillan Reference USA, Detroit.

Faberson, Tanya A. (2007) *Erstwhile Days along Pearl and Lafayette: Physical Change in a Louisville Neighborhood, 1850–1860. Survey and Data Recovery Results for Sites 15Jf716, 15Jf717, and 15Jf718 in the I-65 Accelerated Section of the Louisville Southern Indiana Ohio River Bridges Project, Louisville, Jefferson County, Kentucky.* Contract Publication Series 06-201. Cultural Resource Analysts, Inc., Lexington.

Faberson, Tanya A., and Jennifer L. Barber (2007, November 2) *Social Change and Neighborhood Transformations in the Late Nineteenth and Early Twentieth Centuries: The Urban Archaeology of Three Communities in the Ohio Valley.* Symposium paper presented at the Southeastern Archaeology Conference, Knoxville, TN.

Faberson, Tanya A. (2007) *National Register Evaluation of Site 11WM115 for the Pond Creek 1 Coal Mine, Williamson County, Illinois*. Contract Publication Series 07-150. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Richard L. Herndon, Tanya A. Faberson, Jennifer M. Faberson, and Brian G. DelCastello (2007) *Phase II National Register Evaluation of Sites 11FK226 and 11FK227 in Franklin County, Illinois*. Contract Publication Series 07-027. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2007, March) *Unlined Cisterns?: Misconceptions of Deep Unlined Pits on Nineteenth-Century Farmstead Sites in Southern Illinois*. Paper presented at the Ohio Valley Urban and Historic Archaeology Conference, Highland Heights, Kentucky.

Anderson, Jason M., and Tanya A. Faberson (2007) *National Register Evaluation of Site 15Gd87 and 15Gd89 for the Proposed Relocation of U.S. 27 in Garrard County, Kentucky (Item No. 7-26.01)*. Contract Publication Series 06-157. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2006) *Phase III Mitigation of Site 11WM334 for the Proposed Pond Creek 1 Coal Mine, Williamson County, Illinois*. Contract Publication Series 06-075. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Herndon, Richard L., and Tanya A. Faberson (2006) *Archaeological Monitoring of Geotechnical Borings for the Proposed Kennedy Bridge Interchange Area of the Ohio River Bridges Project in Jefferson County, Kentucky: Phases 1 through 5 (Item No. 5-118.0)*. Contract Publication Series 06-096, Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2006) *An Archival History of the Proposed Newtown Pike Extension – Small Area Development Plan, City of Lexington, Fayette County, Kentucky (Item No. 7-593): Davis Bottoms: Residential Transformations of a Neighborhood on the Periphery, Vol. 1*. Contract Publication Series 06-040, Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2006) *An Archaeological Survey of the Proposed Saddle Ridge Development Area in Shelby County, Kentucky*. Contract Publication Series 06-097. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Faberson, Tanya A. (2005) *Phase I and Phase II Testing for Cultural Resources at Henry's Station (40SV161) in Kodak, Sevier County, Tennessee*. Report prepared for the Henry's Station Foundation. Archaeological Research Laboratory, Department of Anthropology, University of Tennessee, Knoxville.

Faberson, Tanya A. (2005, November 17) *Method and Theory in Historical Archaeology*. Guest lecture presented in 500-level graduate archaeology course. Gerald Schroedl, professor.

Faberson, Tanya A. and Charles H. Faulkner, eds. (2005) *Archaeological Excavations at Marble Springs, 2003*. Report prepared for the Tennessee Historical Commission. Department of Anthropology, University of Tennessee, Knoxville.

Faberson, Tanya A. (2005, April 14 and 2003, November 14). *Interpreting Material Traces in Sociocultural Contexts*. Guest lecture presented in Appalachian ethnography course at The University of Tennessee, Knoxville. Benita J. Howell, professor.

Faberson, Tanya A. (2004, November 23) *In the Shadow of John Sevier: The Archaeology of Capitalism, Agriculture, and the Informal Economy at Marble Springs, Knox County, Tennessee, 1847–1932.* Guest lecture presented to a 400-level anthropology course at The University of Tennessee, Knoxville. Dr. Andrew Kramer, professor.

Faberson, Tanya A. (2003) Yeoman Farmers in Turn-of-the-Century Knox County: A Ceramic Distribution Comparison Between Marble Springs (40KN125) and Ramsey House (40KN120). In *Archaeological Excavations at Marble Springs, Summer 2002*, Tanya A. Faberson and Charles H. Faulkner, eds., Pp.43–65. Report prepared for the Tennessee Historical Commission. Department of Anthropology, University of Tennessee, Knoxville.

Faberson, Tanya A., and Charles H. Faulkner, eds. (2003) *Archaeological Excavations at Marble Springs, Summer 2002.* Report prepared for the Tennessee Historical Commission. Department of Anthropology, University of Tennessee, Knoxville.

Faberson, Tanya A. (2003, February 12). *The Social Construction of Gender and the Language of Sex in the United States.* Guest lecture presented in introductory cultural anthropology course at The University of Tennessee, Knoxville. Melissa Hargrove, instructor.

Faberson, Tanya A. (2002, January). *Race, Class, and Cleanliness: Progressive Era Sanitation Reform in Knoxville, Tennessee.* Symposium paper presented at the Society for Historical Archaeology Conference, Mobile, AL.

Faberson, Tanya A. (2000, November). *Lost Cows, Free Pigs, and the Knoxville, Tennessee, City Council: Implications for 19th Century Urban Sites.* Paper presented at the Southeastern Archaeological Conference, Macon, GA.

Faberson, Tanya A. (2000). "'A Great Plague and Devastation Awaits These United States of America': Privy Architecture and the Context of Human Waste Disposal in 19th Century Knoxville, Tennessee." *Ohio Valley Historical Archaeology*, 15: 20–29.

Faulkner, Charles, Paul G. Avery, Tanya A. Faberson, Michelle Miller, and Bryan Tate (May 2000). *Preliminary Testing at 40JE80, the McBee House, Jefferson County, Tennessee.* University of Tennessee, Knoxville, Department of Anthropology.

Avery, Paul G., Tanya A. Faberson, Charles H. Faulkner, Michelle Miller, and Bryan Tate (March 2000). *Archaeological Survey and Testing of the Woodlot Area, Marble Springs Historic Site.* University of Tennessee, Knoxville, Department of Anthropology.

Faberson, Tanya A. (Fall 1999). *Preliminary Report on the Greenway Middle School Site (40KN231).* University of Tennessee, Knoxville, Department of Anthropology.

Faberson, Tanya A. (1999). Medicine Bottle Technology: An Analysis of the Golf Range Dump (40KN143), Knoxville, Tennessee. *Ohio Valley Historical Archaeology*, 14: 23–28.

Faberson, Tanya A. (April 1998). *Skeletal Biology of Series 715: A Forensic Analysis.* Paper presented at the Undergraduate Research Symposium, Illinois State University, Normal, IL.

OTHER PROFESSIONAL EXPERIENCE

Specialized training:

Section 106: Principles and Practice, SRI Foundation, January 2007
Geoarchaeology Workshop, Center for American Archeology, Kampsville, Illinois, August 2007
Section 106 Advanced Topics: Consulting on Complex Undertakings, Ohio Historic Preservation Office, October 2007
OSHA Competent Person: Excavation, Trenching, and Shoring
OSHA Health and Safety Compliance Training
Adult CPR, First Aid, and Bloodborne Pathogens

Anthropology courses taught:

Historical Archaeology
Historical Archaeology artifact identification
Urban Archaeology
North American Prehistory
Prehistoric Archaeology
Introduction to Physical Anthropology
Introduction to Cultural Anthropology

Women's Studies Courses taught:

Images of Women in Literature: Biography/ Autobiography
Women in Society

Academic Positions:

Faculty Lecturer, Dept. of Anthropology, University of Tennessee, Knoxville 2005
Graduate Teaching Associate, Dept. of Anthropology, University of Tennessee, Knoxville, 2004–2005
Historical Archaeology Lab Supervisor, Dept. of Anthropology, University of Tennessee, Knoxville, 2003–2004
Graduate Teaching Associate, Dept. of Women's Studies, University of Tennessee, Knoxville, 2001–2003
Graduate Teaching Assistant, Dept. of Women's Studies, University of Tennessee, Knoxville, 2000–2001
Research Assistant, Dept. of Anthropology, University of Tennessee, Knoxville, 1999–2000
Academic Tutor, Men's Athletic Department, University of Tennessee, Knoxville, 1998–1999
Office and Teaching Assistant, Dept. of Sociology and Anthropology, Illinois State University, Normal, 1997–1998

AWARDS AND HONORS

Graduate Student Teaching Award, Office of the Chancellor. The University of Tennessee, Knoxville, 2005
Woman of Achievement Award, Commission for Women. The University of Tennessee, Knoxville, 2002

UNIVERSITY SERVICE

Graduate teaching orientation and instruction, University of Tennessee, Knoxville, 2004 and 2005
Women's Studies committee, University of Tennessee, Knoxville, 2000–2003

PROFESSIONAL SOCIETIES

Kentucky Organization of Professional Archaeologists (KyOPA), Board Member
Register of Professional Archaeologists
Society for Historical Archaeology
Southeastern Archaeological Conference

Appendix C. Historic Materials Recovered

Table C-1. Historic Materials Database.

Site	Cat #	SC	Zone	STP	Bag #	North	East	Upper	Lower	Depth	Group	Class	Type	N	Wt	Vessel code	Vessel part	MinDate	MaxDate	Comments
11WM123	1		I	1	49	999	1000	0	5	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	0.2					
11WM123	2		I	1	49	999	1000	0	5	cm bgs	Architecture	Nails	Wire nail	1						
11WM123	3		II	2	50	999	995	6	16	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	1			1880		
11WM123	4		I	3	51	999	1010	0	35	cm bs	Unidentified	Stone	Sandstone	1	54.1					
11WM123	5		II	4	52	994	1000	7	30	cm bgs	Domestic	BIM	Clear glass	1						
11WM123	6		II	4	52	994	1000	7	30	cm bgs	Architecture	Nails	Wire nail	1		Misc. bottle	Body	1864	1920	
11WM123	7		I	5	53	999	1015	0	17	cm bs	Domestic	Ceramics	Ironstone, plain	1				1880		
11WM123	8		I	5	53	999	1015	0	17	cm bs	Architecture	Construction mat.	Machine-made brick, vit	1	345.1	Saucer	Base	1830		
11WM123	9		I	5	53	999	1015	0	17	cm bs	Architecture	Flat Glass	Window glass, 1.65	1						2.5YR 4/3 reddish brown 2" thick
11WM123	10		I	6	54	999	1025	0	33	cm bgs	Domestic	BIM	Amethyst glass, cup/post, rec panel	1				1852	1852	
11WM123	11		I	6	54	999	1025	0	33	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	5	21.5	Misc. bottle	Body with Base	1870	1920	
11WM123	12		I	6	54	999	1025	0	33	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	1						
11WM123	13		I	6	54	999	1025	0	33	cm bgs	Architecture	Nails	Wire nail	1				1830	1890	
11WM123	14		I	6	54	999	1025	0	33	cm bgs	Architecture	Flat Glass	Window glass, 1.94	1				1880		
11WM123	15		I	6	54	999	1025	0	33	cm bgs	Unidentified	Metal	Iron/steel, flat, thick	1	11.7			1876	1876	
11WM123	16		I-III	7	55	1004	995	0	16	cm bs	Domestic	Ceramics	Ironstone, plain	1						
11WM123	17		I	8	56	989	995	0	16	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM123	18		I	8	56	989	995	0	16	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Body	1830		
11WM123	19		I	8	56	989	995	0	16	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	4.4		Body	1830		
11WM123	20		I	10	58	999	1030	0	35	cm bs	Architecture	Nails	Wire nail	1						
11WM123	21		I	11	59	989	1030	0	20	cm bgs	Domestic	ABM	Light green glass	1				1880		
11WM123	22		I	11	59	989	1030	0	20	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	3	9.2		Body	1903		
11WM123	23		I	11	59	989	1030	0	20	cm bgs	Architecture	Flat Glass	Window glass, 1.74	1						
11WM123	23.5		I	12	60	989	990	0	18	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	1.3			1859	1859	
11WM123	24		I	13	61	989	1040	0	34	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	4	16.6					
11WM123	25		I	13	61	989	1040	0	34	cm bgs	Architecture	Nails	Wire nail	1						
11WM123	26		I	13	61	989	1040	0	34	cm bgs	Architecture	Flat Glass	Window glass, 1.83	1				1880		
11WM123	27		I	14	62	989	1015	0	22	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	3	3.1			1867	1867	
11WM123	28		I	14	62	989	1015	0	22	cm bs	Architecture	Flat Glass	Window glass, 1.73	1						
11WM123	29		I	15	63	984	995	0	17	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	0.7			1858	1858	
11WM123	30		I	15	63	984	995	0	17	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	1						
11WM123	31		I	15	63	984	995	0	17	cm bgs	Unidentified	Metal	Lead, amorphous	1	2.4			1830	1890	
11WM123	32		II	15	64	984	995	17	28	cm bgs	Unidentified	Metal	Iron/steel, amorphous	1	6.9					
11WM123	33		I	16	65	979	1015	0	23	cm bs	Furnishings	Furniture	Handle, metal	1						
11WM123	34		I	16	65	979	1015	0	23	cm bs	Unidentified	Metal	Iron/steel, item/part	1	199.2					
11WM123	35		I	17	66	979	1025	0	15	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	1.5					
11WM123	36		I	18	67	979	1005	0	15	cm bs	Domestic	Ceramics	Whiteware, plain	1		Cup	Body	1830		
11WM123	36		I	18	67	979	1005	0	15	cm bs	Domestic	Ceramics	Whiteware, plain	4			Body	1830		
11WM123	36		I	18	67	979	1005	0	15	cm bs	Domestic	Ceramics	Whiteware, transfer print, blue	1			Body	1830	1859	
11WM123	37		I	18	67	979	1005	0	15	cm bs	Domestic	BIM	Aqua glass	1		Misc. bottle	Body		1920	
11WM123	38		I	18	67	979	1005	0	15	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	4	3.5					
11WM123	39		I	18	67	979	1005	0	15	cm bs	Architecture	Nails	Cut nail, late fully machine cut	2						
11WM123	40		I	18	67	979	1005	0	15	cm bs	Clothing	Buttons	Sew-through, flat/1-piece, porcelain	1				1830	1890	
11WM123	41		I	19	68	969	1005	0	35	cm bs	Domestic	Ceramics	Yellowware, Rockingham	1				1840	1955	Broken
11WM123	42		I	20	69	969	1025	0	26	cm bgs	Architecture	Construction mat.	Hand-made brick, vit	1	195.5		Body	1830	1925	
11WM123	43		I	21	70	959	1025	0	20	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	0.2					10R 5/4 weak red 2 1/4" thick
11WM123	44		I	22	71	964	1005	0	26	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	1						
11WM364	1		I	1	1	1001	1000	0	26	cm bgs	Domestic	ABM	Aqua glass	2				1830	1890	
11WM364	1		I	1	1	1001	1000	0	26	cm bgs	Domestic	ABM	Clear glass	3			Body	1903		
11WM364	2		I	1	1	1001	1000	0	26	cm bgs	Domestic	Container closures	Mason zinc lid liner	1			Body	1903		
11WM364	3		I	2	2	1001	1005	0	15	cm bs	Domestic	Ceramics	Ironstone, plain	1				1869	1950	
11WM364	4		I	2	2	1001	1005	0	15	cm bs	Domestic	BIM	Aqua glass, late app ground	1		Saucer	Footring with Base	1830		
11WM364	4		I	2	2	1001	1005	0	15	cm bs	Domestic	BIM	Aqua glass, cup/post	1		Canning Jar	Rim	1881	1927	
11WM364	4		I	2	2	1001	1005	0	15	cm bs	Domestic	BIM	Aqua glass, emb	1		Canning Jar	Base	1850	1920	
11WM364	5		I	2	2	1001	1005	0	15	cm bs	Domestic	BIM	Aqua glass	1		Canning Jar	Body	1850	1920	
11WM364	5		I	2	2	1001	1005	0	15	cm bs	Domestic	ABM	Clear glass	1		Canning Jar	Body		1920	
11WM364	5		I	2	2	1001	1005	0	15	cm bs	Domestic	ABM	Aqua glass	2			Body	1903		
11WM364	6		I	2	2	1001	1005	0	15	cm bs	Domestic	ABM	Aqua glass, emb	1			Body	1903		
11WM364	6		I	2	2	1001	1005	0	15	cm bs	Domestic	Glass Tableware	Press mold, clear	2			Body	1903		'A..."
11WM364	7		I	3	3	1006	1000	0	22	cm bgs	Domestic	Glass Tableware	Press mold, amethyst	1		Other utility vessel	Body	1864		Refrigerator box fragments
11WM364	8		I	3	3	1006	1000	0	22	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1870	1920	
11WM364	9		I	3	3	1006	1000	0	22	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Body	1830		
11WM364	9		I	3	3	1006	1000	0	22	cm bgs	Domestic	BIM	Amethyst glass, emb rec panel	1			Base	1830		
11WM364	10		I	3	3	1006	1000	0	22	cm bgs	Domestic	BIM	Clear glass	1		Medicine: Patent and Pharmacy	Body	1870	1920	'...Co..."
												ABM	Clear glass	1			Body	1864	1920	
																	Body	1903		

Site	Cat #	SC	Zone	STP	Bag #	North	East	Upper	Lower	Depth	Group	Class	Type	N	Wt	Vessel code	Vessel part	MinDate	MaxDate	Comments
11WM364	10		I	3	3	1006	1000	0	22	cm bgs	Domestic	ABM	Amber glass	1			Body	1903		
11WM364	10		I	3	3	1006	1000	0	22	cm bgs	Domestic	ABM	Aqua glass	1			Body	1903		
11WM364	11		I	3	3	1006	1000	0	22	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	1.2					
11WM364	12		I	3	3	1006	1000	0	22	cm bgs	Architecture	Construction mat.	Indeterminate brick, vit	1	6					
11WM364	13		I	3	3	1006	1000	0	22	cm bgs	Architecture	Flat Glass	Window glass, 1.76	1				1861	1861	
11WM364	14		I	3	3	1006	1000	0	22	cm bgs	Maint./Subsist.	Fuels	Coal	2	1.3					
11WM364	15		I	3	3	1006	1000	0	22	cm bgs	Unidentified	Metal	Iron/steel, amorphous	2	3.6					
11WM364	16		I	4	4	986	1000	0	18	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM364	17		I	4	4	986	1000	0	18	cm bgs	Architecture	Construction mat.	Machine-made brick, non-vit	1	29.9					2.5YR light reddish brown
11WM364	18		I	5	5	986	995	0	16	cm bgs	Domestic	ABM	Clear glass	1			Body	1903		
11WM364	19		I	5	5	986	995	0	16	cm bgs	Architecture	Construction mat.	Machine-made brick, vit	1	28.4					2.5YR 5/4 reddish brown
11WM364	20		I	5	5	986	995	0	16	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	1				1830	1890	
11WM364	21		I	5	5	986	995	0	16	cm bgs	Maint./Subsist.	Gen. hardware	Fence staple, iron/steel	1						
11WM364	22		I	5	5	986	995	0	16	cm bgs	Maint./Subsist.	Fuels	Cinder / slag	2	0.8					
11WM364	23		I-II	6	6	986	1005	0	24	cm bgs	Domestic	ABM	Aqua glass	1		Misc. bottle	Body	1903		
11WM364	24		I-II	8	24	986	1010	0	20	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM364	25		I	9	9	1001	1010	0	20	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Rim	1830		Eroded
11WM364	26		I	9	9	1001	1010	0	20	cm bgs	Domestic	BIM	Clear glass	1			Body	1864	1920	
11WM364	27		I	9	9	1001	1010	0	20	cm bgs	Domestic	ABM	Light green glass	1			Body	1903		
11WM364	27		I	9	9	1001	1010	0	20	cm bgs	Domestic	ABM	Aqua glass	2			Body	1903		
11WM364	28		I	9	9	1001	1010	0	20	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	6	14.4					
11WM364	29		I	10	10	1011	1000	0	36	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Rim	1860		
11WM364	29		I	10	10	1011	1000	0	36	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Body	1830		
11WM364	30		I	10	10	1011	1000	0	36	cm bgs	Domestic	BIM	Amber glass	1			Body	1860	1920	
11WM364	30		I	10	10	1011	1000	0	36	cm bgs	Domestic	BIM	Clear glass	1			Body	1864	1920	
11WM364	31		I	10	10	1011	1000	0	36	cm bgs	Domestic	ABM	Clear glass	3			Body	1903		
11WM364	31		I	10	10	1011	1000	0	36	cm bgs	Domestic	ABM	Amethyst glass	2			Body	1903	1920	
11WM364	32		I	10	10	1011	1000	0	36	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	2.3					
11WM364	33		I	10	10	1011	1000	0	36	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	2				1830	1890	
11WM364	34		I	10	10	1011	1000	0	36	cm bgs	Architecture	Flat Glass	Window glass, 1.91	1				1874	1874	
11WM364	34		I	10	10	1011	1000	0	36	cm bgs	Architecture	Flat Glass	Window glass, 1.91	1				1874	1874	
11WM364	34		I	10	10	1011	1000	0	36	cm bgs	Architecture	Flat Glass	Window glass, 2.33	1				1909	1909	
11WM364	35		I	10	10	1011	1000	0	36	cm bgs	Architecture	Flat Glass	Plate glass	2				1917		
11WM364	36		I	10	10	1011	1000	0	36	cm bgs	Arms	Projectiles	Rimfire, .22 caliber, brass	1				1857		
11WM364	37		I	10	10	1011	1000	0	36	cm bgs	Unidentified	Stone	Slate	2	1.3					
11WM364	38		I	11	11	1001	995	0	25	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	39		I	11	11	1001	995	0	25	cm bgs	Domestic	Ceramics	Ironstone, molded design	1			Body	1860		
11WM364	40		I	11	11	1001	995	0	25	cm bgs	Domestic	BIM	Amethyst glass	1		Misc. bottle	Body	1870	1920	
11WM364	40		I	11	11	1001	995	0	25	cm bgs	Domestic	BIM	Clear glass	1		Misc. bottle	Body	1864	1920	
11WM364	40		I	11	11	1001	995	0	25	cm bgs	Domestic	BIM	Aqua glass, emb rec panel	1		Medicine: Patent and Pharmacy	Body	1850	1920	'...A..."
11WM364	40		I	11	11	1001	995	0	25	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM364	41		I	11	11	1001	995	0	25	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	0.7					
11WM364	42		I	11	11	1001	995	0	25	cm bgs	Architecture	Flat Glass	Window glass, 2.34	1				1910	1910	
11WM364	43		I	13	13	1006	1010	0	26	cm bs	Domestic	ABM	Clear glass	3			Body	1903		
11WM364	43		I	13	13	1006	1010	0	26	cm bs	Domestic	ABM	Aqua glass	1			Body	1903		
11WM364	44		I	13	13	1006	1010	0	26	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	2.9					
11WM364	45		I	13	13	1006	1010	0	26	cm bs	Architecture	Nails	Cut nail, late fully machine cut	1				1830	1890	
11WM364	46		I	13	13	1006	1010	0	26	cm bs	Architecture	Nails	Wire nail	1				1880		
11WM364	47		I	13	13	1006	1010	0	26	cm bs	Unidentified	Metal	Iron/steel, amorphous	1	27.8					
11WM364	48		I	12	12	981	1000	0	10	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	49		I	12	12	981	1000	0	10	cm bgs	Domestic	Ceramics	Ironstone, plain	3		Cup	Body	1830		
11WM364	50		I	13	13	1006	1010	0	26	cm bgs	Domestic	Ceramics	Stoneware, Bristol/Bristol	1			Body	1880	1925	
11WM364	51		I	14	14	1001	990	0	27	cm bgs	Domestic	Ceramics	Stoneware, Bristol/Bristol	1			Body	1880	1925	
11WM364	52		I	14	14	1001	990	0	27	cm bgs	Domestic	ABM	Aqua glass	2		Canning Jar	Body	1903		
11WM364	53		I	14	14	1001	990	0	27	cm bgs	Architecture	Construction mat.	Hand-made brick, non-vit	1	372.1					2.5YR 6/6 light red
11WM364	54		I	14	14	1001	990	0	27	cm bgs	Architecture	Construction mat.	Hand-made brick, vit	1	1192.3					2.5YR 5/3 reddish brown 3 1/2" wide x 2" thick
11WM364	55		I	14	14	1001	990	0	27	cm bgs	Architecture	Flat Glass	Plate glass	1				1917		
11WM364	56		I	15	15	1011	1010	0	22	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	57		I	15	15	1011	1010	0	22	cm bgs	Domestic	BIM	Amber glass	2		Misc. bottle	Body	1860	1920	
11WM364	57		I	15	15	1011	1010	0	22	cm bgs	Domestic	BIM	Aqua glass	2			Body		1920	
11WM364	57		I	15	15	1011	1010	0	22	cm bgs	Domestic	BIM	Clear glass	1			Body	1864	1920	
11WM364	58		I	15	15	1011	1010	0	22	cm bgs	Domestic	ABM	Clear glass, ext thread	1		Misc. jar	Rim	1903		
11WM364	58		I	15	15	1011	1010	0	22	cm bgs	Domestic	ABM	Clear glass	8			Body	1903		
11WM364	58		I	15	15	1011	1010	0	22	cm bgs	Domestic	ABM	Aqua glass	1		Canning Jar	Body	1903		
11WM364	58		I	15	15	1011	1010	0	22	cm bgs	Domestic	ABM	Light green glass	1			Body	1903		
11WM364	59		I	15	15	1011	1010	0	22	cm bgs	Domestic	Container closures	Mason zinc lid liner	1				1869	1950	
11WM364	60		I	15	15	1011	1010	0	22	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	4	19.9					

Site	Cat #	SC	Zone	STP	Bag #	North	East	Upper	Lower	Depth	Group	Class	Type	N	Wt	Vessel code	Vessel part	MinDate	MaxDate	Comments
11WM364	61		I	15	15	1011	1010	0	22	cm bgs	Architecture	Flat Glass	Window glass, 2.13	1				1892	1892	
11WM364	61		I	15	15	1011	1010	0	22	cm bgs	Architecture	Flat Glass	Window glass, 2.4	1				1915	1915	
11WM364	62		I	15	15	1011	1010	0	22	cm bgs	Architecture	Flat Glass	Plate glass	3				1917		
11WM364	63		II	16	16	976	995	13	22	cm bgs	Domestic	Ceramics	Whiteware, plain	1				1830		
11WM364	64		I	17	17	991	990	0	17	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	61.4		Body			
11WM364	65		I	18	18	1006	995	0	32	cm bgs	Domestic	ABM	Amethyst glass, emb	1		Misc. bottle		1903	1920	'...LL QU..."
11WM364	65		I	18	18	1006	995	0	32	cm bgs	Domestic	ABM	Aqua glass	1			Body	1903		
11WM364	66		I	19	19	1011	995	0	29	cm bs	Architecture	Construction mat.	Machine-made brick, non-vit	1	153.7					2.5YR 5/4 reddish brown
11WM364	67		I	20	20	1021	1010	0	23	cm bs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	68		I	20	20	1021	1010	0	23	cm bs	Domestic	BIM	Clear glass	1		Misc. bottle	Body	1864	1920	
11WM364	68		I	20	20	1021	1010	0	23	cm bs	Domestic	BIM	Amethyst glass	1			Body	1870	1920	
11WM364	68		I	20	20	1021	1010	0	23	cm bs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM364	69		I	20	20	1021	1010	0	23	cm bs	Domestic	ABM	Clear glass	2			Body	1903		
11WM364	69		I	20	20	1021	1010	0	23	cm bs	Domestic	ABM	Light green glass	1			Body	1903		
11WM364	70		I	20	20	1021	1010	0	23	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	2.5					
11WM364	71		I	20	20	1021	1010	0	23	cm bs	Architecture	Nails	Cut nail, late fully machine cut	1						
11WM364	72		I	20	20	1021	1010	0	23	cm bs	Architecture	Flat Glass	Window glass, 2.31	1				1830	1890	
11WM364	72		I	20	20	1021	1010	0	23	cm bs	Architecture	Flat Glass	Window glass, 2.14	1				1907	1907	
11WM364	72		I	20	20	1021	1010	0	23	cm bs	Architecture	Flat Glass	Window glass, 2.12	1				1893	1893	
11WM364	73		I	20	20	1021	1010	0	23	cm bs	Architecture	Flat Glass	Window glass, 2.4	1				1891	1891	
11WM364	74		I	21	21	1021	995	0	24	cm bs	Furnishings	Lighting	Lamp chimney glass	1				1915	1915	
11WM364	75		I	21	21	1021	995	0	24	cm bs	Domestic	Ceramics	Ironstone, molded design	1				1854	1940	
11WM364	76		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Ceramics	Stoneware, salt/brown slip	1			Body	1860		
11WM364	77		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Ceramics	Whiteware, plain	3			Body	1780	1925	
11WM364	78		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	78		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Ceramics	Stoneware, Albany/brown slip	1			Body	1830		
11WM364	79		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Ceramics	Stoneware, salt/Albany	1			Body	1830	1925	
11WM364	79		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	BIM	Aqua glass, cup/post	1			Body	1830	1925	
11WM364	79		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	BIM	Aqua glass, emb	1		Misc. bottle	Body with Base	1850	1920	
11WM364	80		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	BIM	Aqua glass	1		Misc. bottle	Body	1750	1920	'...ER.../...L..."
11WM364	80		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	ABM	Clear glass	10			Body		1920	
11WM364	80		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	ABM	Light green glass	1			Body	1903		
11WM364	81		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	ABM	Aqua glass	1			Body	1903		
11WM364	82		I-II	22	22	1006	1005	0	34	cm bgs	Domestic	Container closures	Mason zinc lid liner	3			Body	1903		
11WM364	83		I-II	22	22	1006	1005	0	34	cm bgs	Architecture	Construction mat.	Machine-made brick, non-vit	1	16.5			1869	1950	
11WM364	84		I-II	22	22	1006	1005	0	34	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	34.7					2.5YR 4/3 reddish brown
11WM364	85		I-II	22	22	1006	1005	0	34	cm bgs	Architecture	Nails	Cut nail, late fully machine cut	3						
11WM364	86		I-II	22	22	1006	1005	0	34	cm bgs	Architecture	Flat Glass	Window glass, 1.55	1				1830	1890	
11WM364	87		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Plate glass	1				1843	1843	
11WM364	87		I	23	23	1010	1005	0	23	cm bgs	Domestic	BIM	Aqua glass, emb rec panel	1				1917		
11WM364	87		I	23	23	1010	1005	0	23	cm bgs	Domestic	BIM	Aqua glass, emb	1		Misc. bottle	Body	1850	1920	'...OR..."
11WM364	87		I	23	23	1010	1005	0	23	cm bgs	Domestic	BIM	Aqua glass	1		Canning Jar	Body	1850	1920	'...T"
11WM364	87		I	23	23	1010	1005	0	23	cm bgs	Domestic	BIM	Amber glass	1			Body		1920	
11WM364	88		I	23	23	1010	1005	0	23	cm bgs	Domestic	BIM	Clear glass	2			Body	1860	1920	
11WM364	88		I	23	23	1010	1005	0	23	cm bgs	Domestic	ABM	Clear glass	6		Misc. bottle	Body	1864	1920	
11WM364	88		I	23	23	1010	1005	0	23	cm bgs	Domestic	ABM	Cobalt glass	1		Misc. bottle	Body	1903		
11WM364	89		I	23	23	1010	1005	0	23	cm bgs	Domestic	ABM	Aqua glass	2			Body	1903		
11WM364	90		I	23	23	1010	1005	0	23	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	2	30		Body	1903		
11WM364	91		I	23	23	1010	1005	0	23	cm bgs	Architecture	Nails	Wire nail	1						
11WM364	91		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Window glass, 2.28	1				1880		
11WM364	91		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Window glass, 2.35	1				1905	1905	
11WM364	91		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Window glass, 1.39	1				1911	1911	
11WM364	92		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Window glass, 2.23	1				1830	1830	
11WM364	93		I	23	23	1010	1005	0	23	cm bgs	Architecture	Flat Glass	Plate glass	4				1901	1901	
11WM364	94		I	23	23	1010	1005	0	23	cm bgs	Furnishings	Lighting	Lamp chimney glass	4				1917		
11WM364	95		I	23	23	1010	1005	0	23	cm bgs	Maint./Subsist.	Gen. hardware	Smooth wire, brass	1				1854	1940	
11WM364	96		I	24	24	1021	1005	0	18	cm bs	Unidentified	Metal	Iron/steel, amorphous	4	29.5					
11WM364	97		I	24	24	1021	1005	0	18	cm bs	Domestic	Ceramics	Porcelain, h.p. mono, brown, modern	1						
11WM364	97		I	24	24	1021	1005	0	18	cm bs	Domestic	BIM	Aqua glass	1			Body	1880	1940	
11WM364	98		I	24	24	1021	1005	0	18	cm bs	Domestic	BIM	Amethyst glass	1			Body		1920	
11WM364	99		I	24	24	1021	1005	0	18	cm bs	Domestic	Undiag cont frag	Opaque white glass	2		Misc. bottle	Body	1870	1920	
11WM364	99		I	24	24	1021	1005	0	18	cm bs	Domestic	Glass Tableware	Press mold, amethyst	1			Body	1830	1960	
11WM364	100		I	24	24	1021	1005	0	18	cm bs	Domestic	Glass Tableware	Press mold, clear	1		Tumbler	Base	1870	1920	
11WM364	101		I	24	24	1021	1005	0	18	cm bs	Domestic	Container closures	Mason zinc lid liner	1			Body	1864		
11WM364	102		I	24	24	1021	1005	0	18	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	3	8.8			1869	1950	
11WM364	103		I	25	25	996	995	0	10	cm bgs	Domestic	Toys and Games	Doll/doll part, bisque porcelain, head	1						
												BIM	Clear glass, rec panel	1		Misc. bottle	Body	1860	1925	
																		1864	1920	

Site	Cat #	SC	Zone	STP	Bag #	North	East	Upper	Lower	Depth	Group	Class	Type	N	Wt	Vessel code	Vessel part	MinDate	MaxDate	Comments
11WM364	104		I	26	26	1006	990	0	20	cm bs	Domestic	Ceramics	Ironstone, plain	1		Cup	Rim	1830		
11WM364	104		I	26	26	1006	990	0	20	cm bs	Domestic	Ceramics	Ironstone, flow dec, blue	1			Footring with Base	1839	1908	
11WM364	105		I	26	26	1006	990	0	20	cm bs	Domestic	Ceramics	Stoneware, Albany/brown slip	1			Body	1830	1925	
11WM364	106		I	26	26	1006	990	0	20	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	5.7					
11WM364	107		I	27	27	1011	990	0	26	cm bs	Domestic	Glass Tableware	Press mold, clear	1			Body	1864		
11WM364	108			28	28	1011	985	0	36	cm bgs	Domestic	Ceramics	Stoneware, Albany/brown slip	1			Body	1830	1925	
11WM364	109			28	28	1011	985	0	36	cm bgs	Domestic	ABM	Clear glass	1			Body	1903		
11WM364	109			28	28	1011	985	0	36	cm bgs	Domestic	ABM	Amethyst glass	1			Body	1903	1920	
11WM364	110		I	29	29	1006	985	0	20	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM364	110		I	29	29	1006	985	0	20	cm bgs	Domestic	Ceramics	Whiteware, flow dec, blue	1			Body	1839	1908	
11WM364	111		I	29	29	1006	985	0	20	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	2.2					
11WM364	112		I	30	30	1016	990	0	23	cm bs	Domestic	Ceramics	Ironstone, plain	1		Cup	Rim	1830		
11WM364	113		I	30	30	1016	990	0	23	cm bs	Domestic	BIM	Clear glass	2		Misc. bottle	Body	1864	1920	
11WM364	113		I	30	30	1016	990	0	23	cm bs	Domestic	BIM	Amethyst glass, cup/post	1		Misc. bottle	Base	1870	1920	
11WM364	113		I	30	30	1016	990	0	23	cm bs	Domestic	BIM	Amber glass, emb rec panel	1		Misc. bottle	Body	1860	1920	
11WM364	114		I	30	30	1016	990	0	23	cm bs	Domestic	Glass Tableware	Press mold, amethyst	1			Rim	1870	1920	
11WM364	115		I	30	30	1016	990	0	23	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	5.9					
11WM364	116		I	32	31	1016	985	0	27	cm bgs	Domestic	Ceramics	Porcelain, plain	1			Body	1800		
11WM365	1		I	1	32	1001	1000	0	25	cm bgs	Domestic	Ceramics	Ironstone, plain	1			Body	1830		
11WM365	2		I	1	32	1001	1000	0	25	cm bgs	Domestic	Ceramics	Porcelain, decal	3			Body	1880	1940	
11WM365	3		I	1	32	1001	1000	0	25	cm bgs	Domestic	BIM	Clear glass	1		Misc. bottle	Body	1864	1920	
11WM365	3		I	1	32	1001	1000	0	25	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	4		I	1	32	1001	1000	0	25	cm bgs	Domestic	ABM	Amethyst glass, ext thread	1		Canning Jar	Rim	1903	1920	
11WM365	4		I	1	32	1001	1000	0	25	cm bgs	Domestic	ABM	Aqua glass, ext thread	1		Canning Jar	Rim	1903		
11WM365	4		I	1	32	1001	1000	0	25	cm bgs	Domestic	ABM	Aqua glass, cup/post	1		Canning Jar	Base	1903		
11WM365	4		I	1	32	1001	1000	0	25	cm bgs	Domestic	ABM	Aqua glass	2			Body	1903		
11WM365	5		I	2	33	1001	990	0	23	cm bs	Domestic	BIM	Aqua glass, emb	1		Canning Jar	Body	1850	1920	'...8..."
11WM365	5		I	2	33	1001	990	0	23	cm bs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	5		I	2	33	1001	990	0	23	cm bs	Domestic	BIM	Amethyst glass	2		Misc. bottle	Body	1870	1920	
11WM365	6		I	3	34	1011	1000	0	16	cm bs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	6		I	3	34	1011	1000	0	16	cm bs	Domestic	BIM	Clear glass	1			Body	1864	1920	
11WM365	7		I	3	34	1011	1000	0	16	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	5.6					
11WM365	8		I	3	34	1011	1000	0	16	cm bs	Architecture	Nails	Cut nail, late fully machine cut	1				1830	1890	
11WM365	9		I	3	34	1011	1000	0	16	cm bs	Architecture	Flat Glass	Window glass, 2.25	1				1902	1902	
11WM365	10		I	4	35	1001	1010	0	35	cm bgs	Architecture	Construction mat.	Hand-made brick, non-vit	1	88.6					2.5YR 5/4 reddish brown
11WM365	11		I	5	36	991	1000	0	21	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	11		I	5	36	991	1000	0	21	cm bgs	Domestic	BIM	Clear glass	1				1864	1920	
11WM365	11		I	5	36	991	1000	0	21	cm bgs	Domestic	BIM	Amber glass	1			Body	1860	1920	
11WM365	12		I	5	36	991	1000	0	21	cm bgs	Domestic	ABM	Clear glass	1		Misc. bottle	Body	1903		
11WM365	13		I	5	36	991	1000	0	21	cm bgs	Domestic	Glass Tableware	Press mold, amethyst	1			Rim	1870	1920	
11WM365	14		I	5	36	991	1000	0	21	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	4.2					
11WM365	15		I	5	36	991	1000	0	21	cm bgs	Architecture	Nails	Wire nail	1				1880		
11WM365	16		I	5	36	991	1000	0	21	cm bgs	Architecture	Flat Glass	Window glass, 2.34	1				1910	1910	
11WM365	17		I	6	37	1021	1000	0	20	cm bgs	Domestic	BIM	Clear glass	1		Misc. bottle	Body	1864	1920	
11WM365	18		I	7	38	981	1000	0	22	cm bgs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	19		I	7	38	981	1000	0	22	cm bgs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	25.2					
11WM365	20		I	8	39	991	990	0	23	cm bs	Architecture	Nails	Wire nail	1				1880		
11WM365	21		I	8	39	991	990	0	23	cm bs	Maint./Subsist.	Gen. hardware	Unid bolt, iron/steel	1						Large
11WM365	22		I	9	40	1011	990	0	19	cm bgs	Domestic	Ceramics	Whiteware, plain	1			Body	1830		
11WM365	23		I	9	40	1011	990	0	19	cm bgs	Domestic	Container closures	Mason zinc lid liner	1				1869	1950	
11WM365	24		I	10	41	1001	1015	0	35	cm bgs	Domestic	Undiag cont frag	Aqua glass	1			Body			
11WM365	25		I	11	42	1011	1005	0	20	cm bs	Domestic	ABM	Aqua glass	1			Body	1903		
11WM365	25		I	11	42	1011	1005	0	20	cm bs	Domestic	ABM	Clear glass, unknown lip	1		Misc. jar	Rim	1903		
11WM365	26		I	11	42	1011	1005	0	20	cm bs	Unidentified	Metal	Iron/steel, amorphous	1	99.2					
11WM365	27		I	12	43	981	990	0	23	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	16.7					
11WM365	28		I	12	43	981	990	0	23	cm bs	Architecture	Nails	Wire nail	1				1880		
11WM365	29		I	13	44	1016	990	0	27	cm bgs	Domestic	ABM	Light green glass	1			Body	1903		
11WM365	30		I	14	45	971	990	0	18	cm bs	Domestic	Ceramics	Ironstone, plain	1		Saucer	Rim	1830		
11WM365	31		I	14	45	971	990	0	18	cm bs	Architecture	Construction mat.	Indeterminate brick, non-vit	1	1.1					
11WM365	32		I	15	46	991	1015	0	30	cm bgs	Domestic	ABM	Clear glass	1		Misc. bottle	Body	1903		
11WM365	33		I	15	46	991	1015	0	30	cm bgs	Domestic	Glass Tableware	Press mold, clear	1			Body	1864		
11WM365	34		I	16	47	971	1000	0	20	cm bs	Domestic	BIM	Aqua glass	1			Body		1920	
11WM365	35		I	17	48	991	1020	0	29	cm bgs	Domestic	BIM	Amber glass	1		Misc. bottle	Body	1860	1920	

Appendix D. Site Forms

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson
Field 11WM123
Quadrangle (7.5'): Pittsburgh

Site

Revisit: Y
State Site No.: 123
Date 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE **1/4s:** NWSESW
Align: **1/4s:**
Align: **1/4s:**
Align: **1/4s:**

Section: 7 **Township:** 8 S **Range:** 4 E
Section: **Township:** **Range:**
Section: **Township:** **Range:**
Section: **Township:** **Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189114 **UTM East:** 340643 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Upland Ridge
Nearest Water Supply: intermittent **Drainage:** Big Muddy **Elevation (in meters):** 158.5
Soil Association: Ava-Bluford-Wynoose
Description: Upland ridge setting approximately 300 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey
Ground Cover (List up to 3): Forest Brush
Survey Methods (List up to 2): Shovel Test
Site Type (List up to 2): Habitation

Site Area (square meters): 5031
Visibility (%): 0
Standing Structures: N

SITE CONDITION

Extent of Severe
Main Cause of Damage: Development

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0
Prehistoric Diagnostic Artifacts: N
Prehistoric Surface Features: N

Number of Historic Artifacts (count or estimate): 69
Historic Diagnostic Artifacts: Y
Historic Surface N

Description: 47 architecture group (brick, window glass, nails), 1 clothing group (button), 15 domestic group (ceramics, container glass), 1 furnishings group (furniture handle), 5 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmstead/residence site that dates primarily to the turn-of-the-twentieth century based on recovered historic material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/09/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/22/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance
NRHP Listing: N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** N
Field FS 1 **State Site No.:** 364
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE	**1/4s:** NENWNW	**Section:** 7	**Township:** 8	S	**Range:** 4	E
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4190325 **UTM East:** 340414 **NAD27**

Ownership: Private

ENVIRONMENT

Topography: Floodplain **Elevation (in meters):** 140.1
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 150 m SW of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 4689
Ground Cover (List up to 3): Grass Weeds **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 1 **Number of Historic Artifacts (count or estimate):** 249
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 1 undiag prehist lithic; historic: 72 arch group (window glass, nails, bricks), 1 arms group (.22-cal cartridge), 155 domestic group (glass, ceramics), 5 furnishings group, 6 maint./subsistence group, 1 personal group, and 9 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	Y	**Late**		**Mississippian:**		**Colonial (1673-1780):**	
Paleoindian		**Woodland**		**Upper Mississippian:**		**Pioneer (1781-1840):**	
Archaic:		**Early**		**Protohistoric:**		**Frontier (1841-1870):**	
Early Archaic:		**Middle Woodland:**		**Historic Native**		**Early Industrial (1871-1900):**	Y
Middle		**Late Woodland:**		**Historic (generic):**		**Urban Industrial (1901-1945):**	Y
						Post-War (1946-present):	

Description: Multicomp. site. Prehistoric component was temp. undiagnostic. Historic farmstead/ res component dates to the turn-of-the-20th century based on recovered material culture. No features observed. House shown on the 1908 plat map of Williamson County.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/05/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** N
Field FS 2 **State Site No.:** 365
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE **1/4s:** NWSWNW **Section:** 7 **Township:** 8 S **Range:** 4 E
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189870 **UTM East:** 340148 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain **Elevation (in meters):** 139.6
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 50 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 2878
Ground Cover (List up to 3): Grass Weeds **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0 **Number of Historic Artifacts (count or estimate):** 49
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 12 architecture group (nails, window glass, bricks), 35 domestic group (ceramics, container glass, container closures, glass tableware), 1 maint./subsistence group (steel bolt), 1 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Colonial (1673-1780):

Prehistoric	**Late**	**Mississippian:**	**Pioneer (1781-1840):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Frontier (1841-1870):**
Archaic:	**Early**	**Protohistoric:**	**Early Industrial (1871-1900):** Y
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Urban Industrial (1901-1945):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Post-War (1946-present):**

Description: Historic farmstead/residence site that dates to the turn-of-the-20th century based on recovered material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/07/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

Appendix E. Archaeological Short Survey Report (ASSR)

ARCHAEOLOGICAL SURVEY SHORT REPORT
Illinois Historic Preservation Agency
Old State Capital Building
Springfield, Illinois 62701 (217/785-4997)

REVIEWER _____
Date: _____
_____Accepted _____Rejected
IHPA USE ONLY (Form ASSR0886)

IHPA Log #_____

Locational Information and Survey Conditions

County: Williamson County, Illinois

Quadrangle: Pittsburgh, IL 7.5 min

Project Type/Title: *A Cultural Resource Survey for a Proposed Williamson Energy Pond Creek 1 Coal Mine Operation in Section Township 8 South, Range 4 East in Williamson County, Illinois (Permit Application No. 375).* Contract Publication Series 08-1 Cultural Resource Analysts, Inc., Lexington, Kentucky

Funding and/or Permitting Federal/State Agencies: Illinois Department of Natural Resources (IDNR)
(i.e., CoE, HUD, IEPA, FmHA, etc.)

Sec: 7 T.: 8 South R.: 4 East Natural Division (No.): 9B

U.T.M.: NAD 27 Zone 16; NE corner of project area (m): N4190311.3 E340401.3; SE corner of project area (m): N4189174.4 E340950.

Project Description: Phase I survey conducted for a proposed coal mining operation

Topography: Dissected Uplands (Southern Till Plains of the Central Lowland Province)

(Soils) Ava, Belknap, Bluford, Creal, Hickory

Drainage: Big Muddy River Drainage (Pond Creek - a tributary of the Middle Fork of the Big Muddy River)

Land Use/Ground Cover (Include % Visibility): Project area consisted of primarily agricultural fields (row crop)along with minor amounts of pastures and wooded lots. The wooded areas tended to be situated along existing waterways.

Survey Limitations: Current project area (coal mining permit area - permit application no. 375)

Archaeological and Historical Information

Historic Plats/Atlases/Sources: *1830 and 1857 Government Land Office; 1854 Rail Road and County Map of Illinois Showing its Internal Improvements; 1876 Franklin County Map. Atlas of the State of Illinois; 1908 Galatia, Illinois 15-minute topo; 1909 West Frankfort, Illinois 15-minute topo; 1917 Franklin County, Illinois Plat Book; 1918 Eastern Township Map, Atlas of Franklin County, Illinois; 1941 West Frankfort, Illinois 15-minute topo; 1963 Akin, Illinois 7.5-minute series topo; 1963 Thompsonville, Illinois 7.5-minute topo; 1974 Ewing, Illinois 7.5-minute topo*
(see attachment below for relevant historic maps)

Previously Reported Sites: Sites 11WM121, 11WM122, and 11WM123 were previously documented by Barbara Vander Leest of Esp Huston, and Associates, Austin, Texas, in 1981

Previous Surveys: Barbara Vander Leest (1981) *A Cultural Resource Survey of the Proposed Zeigler #6 Mine in Williamson Coun Illinois.* Espey, Huston, and Associates, Austin, Texas. 1,130 acres.

Regional Archaeologists Contacted:

Investigation Techniques: Shovel Testing

Time Expended: 240 person-hours

Sites/Find Spots Located: Two previously undocumented archaeological sites as well as one previously documented site; report referenced below.

Tanya A. Faberson (2009) *A Cultural Resource Survey for a Proposed Williamson Energy Pond Creek 1 Coal Mine Operation in Section Township 8 South, Range 4 East in Williamson County, Illinois (Permit Application No. 375).* Contract Publication Series 08-1 Cultural Resource Analysts, Inc., Lexington, Kentucky

Cultural Material: See site descriptions provided in the archaeological report (see above comment for complete citation)
(Curated at) ISM

Collection Techniques: Survey was conducted by systematic screened shovel testing (0.25 inch screen)

Area Surveyed (Acres & Square Meters): 183.3 acres (74.2 hectares)

(OVER)

Results Of Investigation And Recommendations: *(Check One)*

☐ Phase I Archaeological Reconnaissance Has Located No Archaeological Material; Project Clearance Is Recommended.

☒ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) Does (Do) Not Meet Requirement National Register Eligibility; Project Clearance Is Recommended.

☐ Phase I Archaeological Reconnaissance Has Located Archaeological Materials; Site(s) May Meet Requirements for Natior Register Eligibility; Phase II Testing Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Does (Do) Not Meet Requirements For National Regist Eligibility; Project Clearance Is Recommended.

☐ Phase II Archaeological Investigation Has Indicated That Site(s) Meet Requirements For National Register Eligibilit Formal Report Is Pending And A Determination Of Eligibility Is Recommended.

Comments: CRAI recommended no additional archaeological work for the two newly identified archaeological sites: 11WM364 a 11WM365, as well as previously documented Site 11WM123

Archaeological Contractor Information:

Archaeological Contractor: Cultural Resource Analysts, Inc.

Address/Phone: 151 Walton Avenue Lexington, Kentucky 40508

Surveyor(s): Tanya A. Faberson Survey Dates(s): 5-14, 19-26 November 2008

Report Completed By: Tanya A. Faberson Date: March 2009

Submitted By (Signature And Title): Tanya A. Faberson, Ph. D., Principal Investigator

Attachment Check List: *(#1 Through #4 Are MANDATORY)*

X 1) Relevant Portion Of USGS 7.5' Topographic Quadrangle Map(s) Showing Project Location And Any Recorded Sites;

X 2) Project Map(s) Depicting Survey Limits And, When Applicable, Approximate Site Limits, And Concentrations Cultural Materials;

X 3) Site Form(s): Two Copies Of Each Form;

X 4) All Relevant Project Correspondence;

____ 5) Additional Information Sheets As Necessary.

Address Of Owner/Agent/Agency To Whom SHPO Comment Should Be Mailed:

LEAD AGENCY: IDNR - Hal Hassen, PhD., Cultural Resources (Planning and Analysis Section), One Natural Resources Way, Springfield, IL 62702-1271 CLIENT: Williamson Energy, LLC. - James Plumley, Williamson Energy, LLC. P.O. Box 99, Johnston Ci Illinois 62951

Contact Person: Hal Hassen (IDNR) and James Plumley (Williamson Energy, LLC) Phone Number: Hal Hassen - (217) 524-3759; James Plumley (618)694-3739

Reviewers Comments:

11/03/93

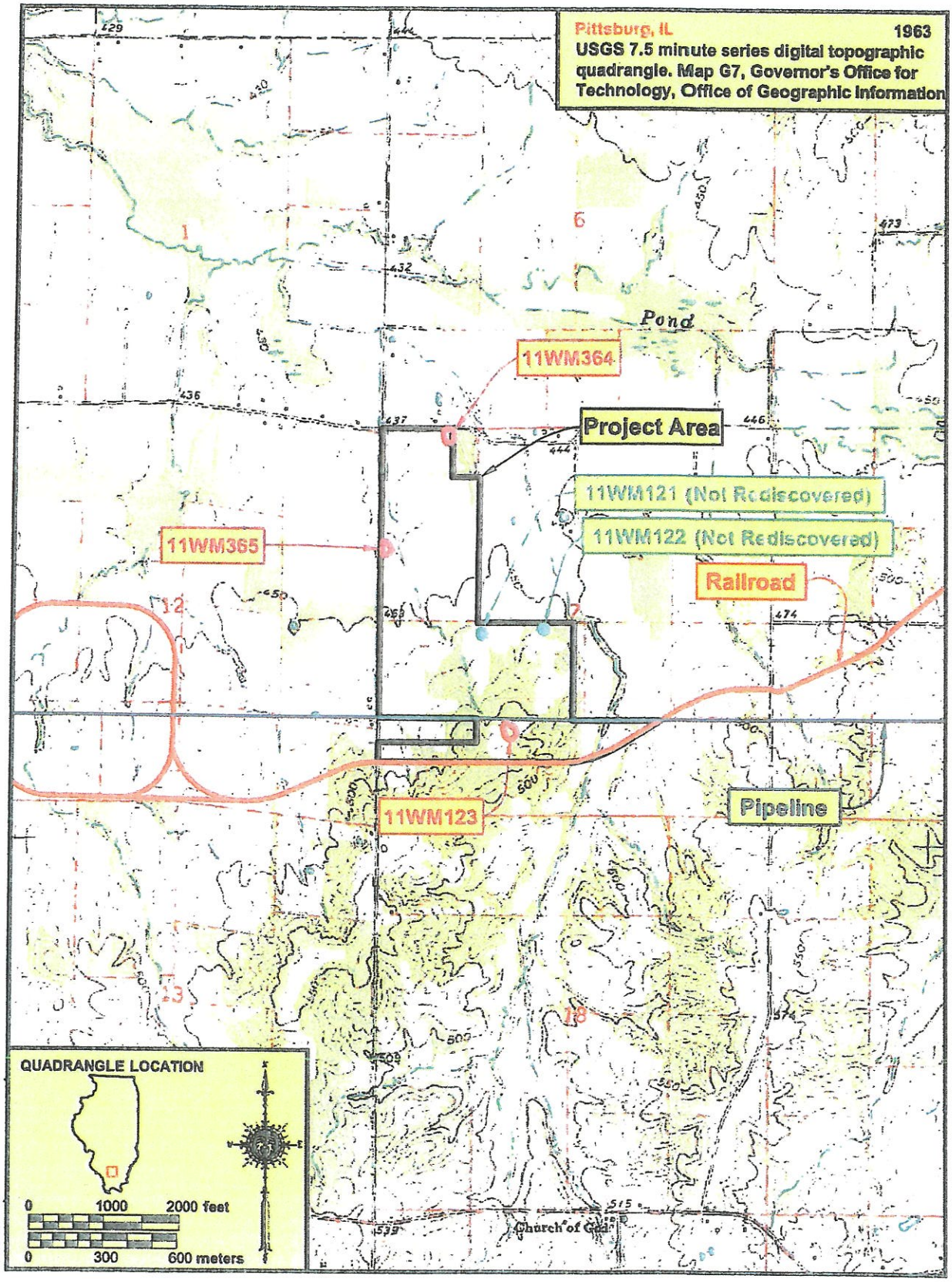


Figure 1. Project area on Pittsburg 7.5-minute series topographic quadrangle.

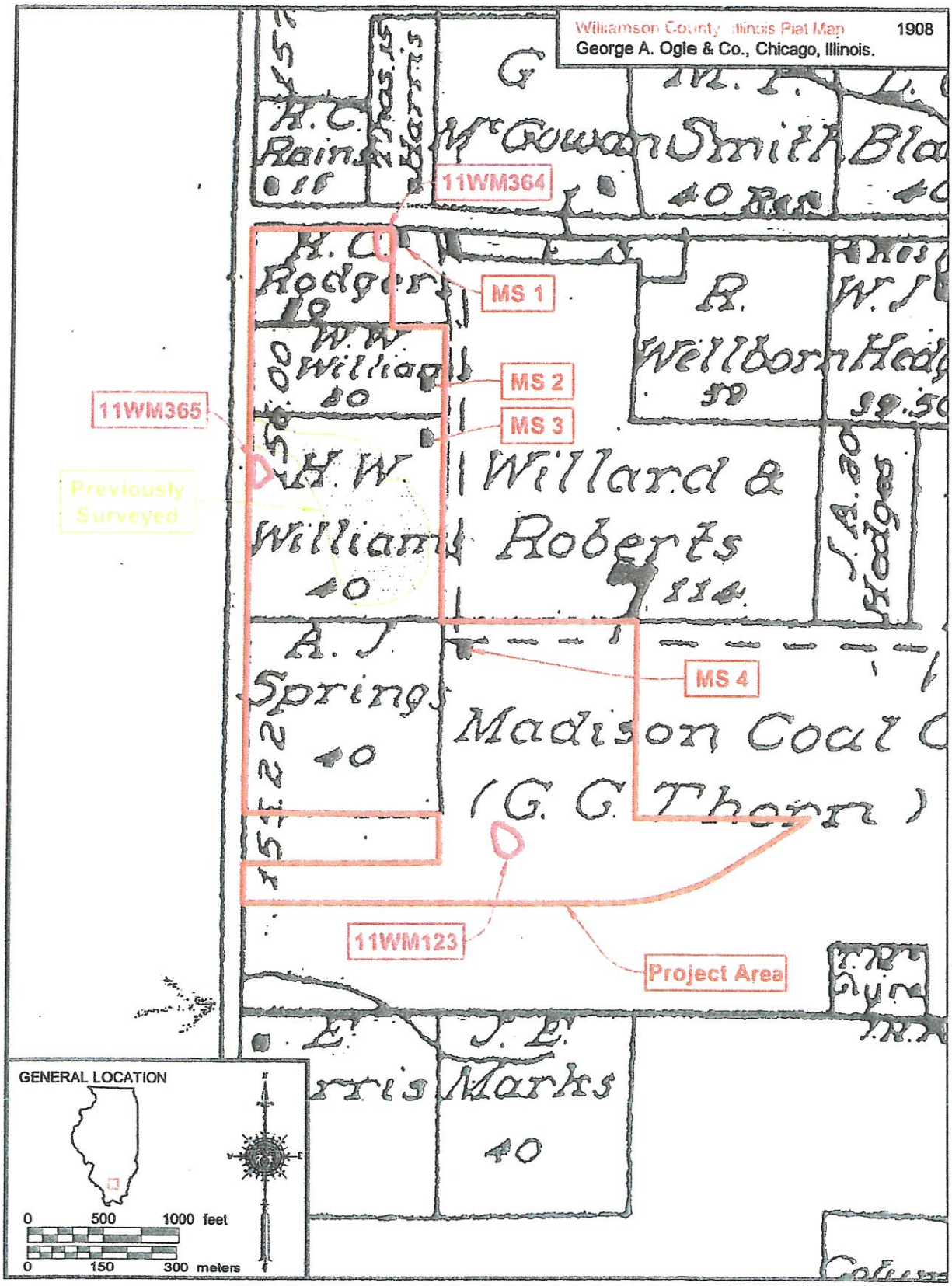


Figure 2. 1908 Williamson County plat map showing site and map structure locations.

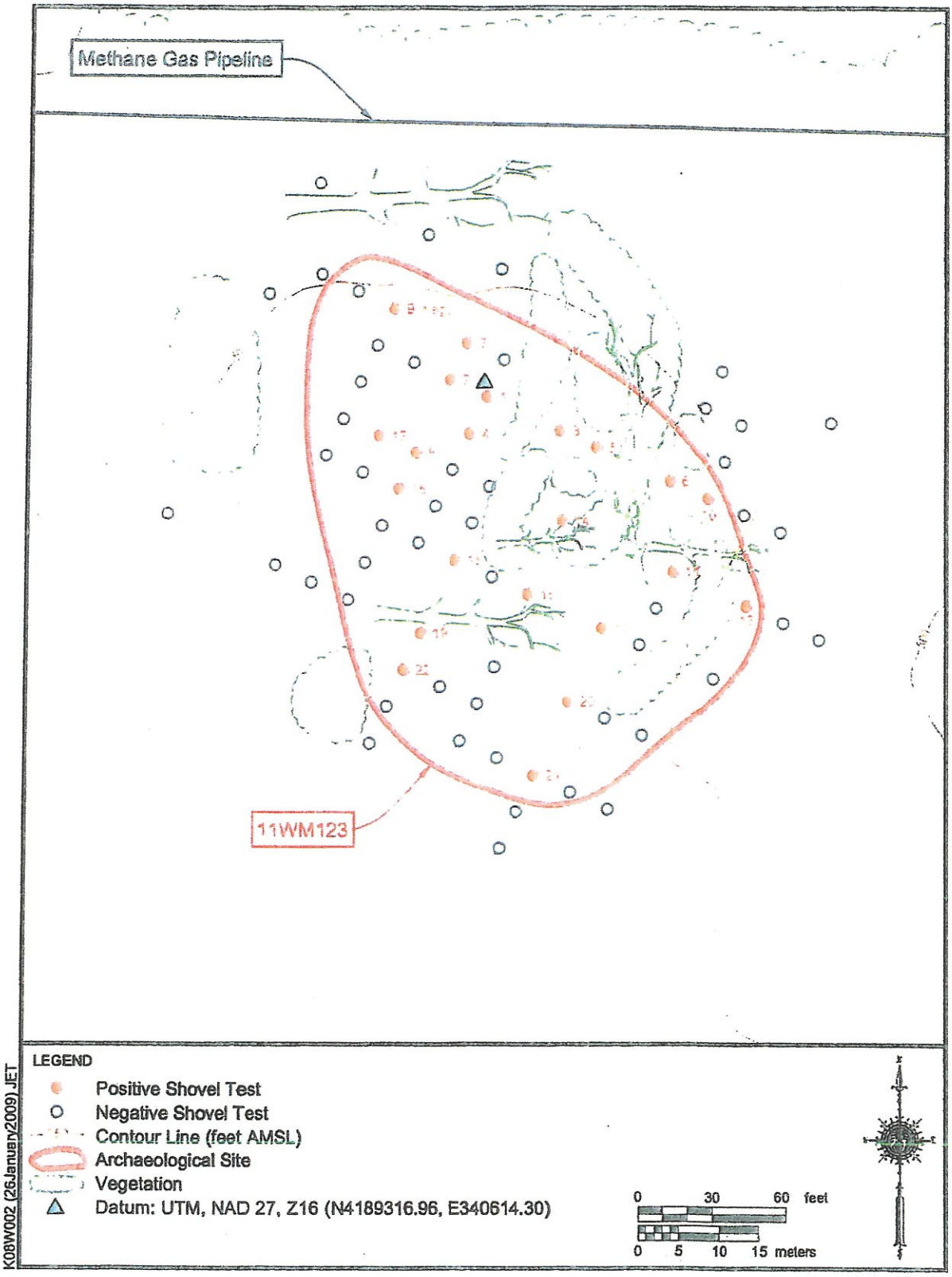


Figure 3. Site 11WM123 plan map.

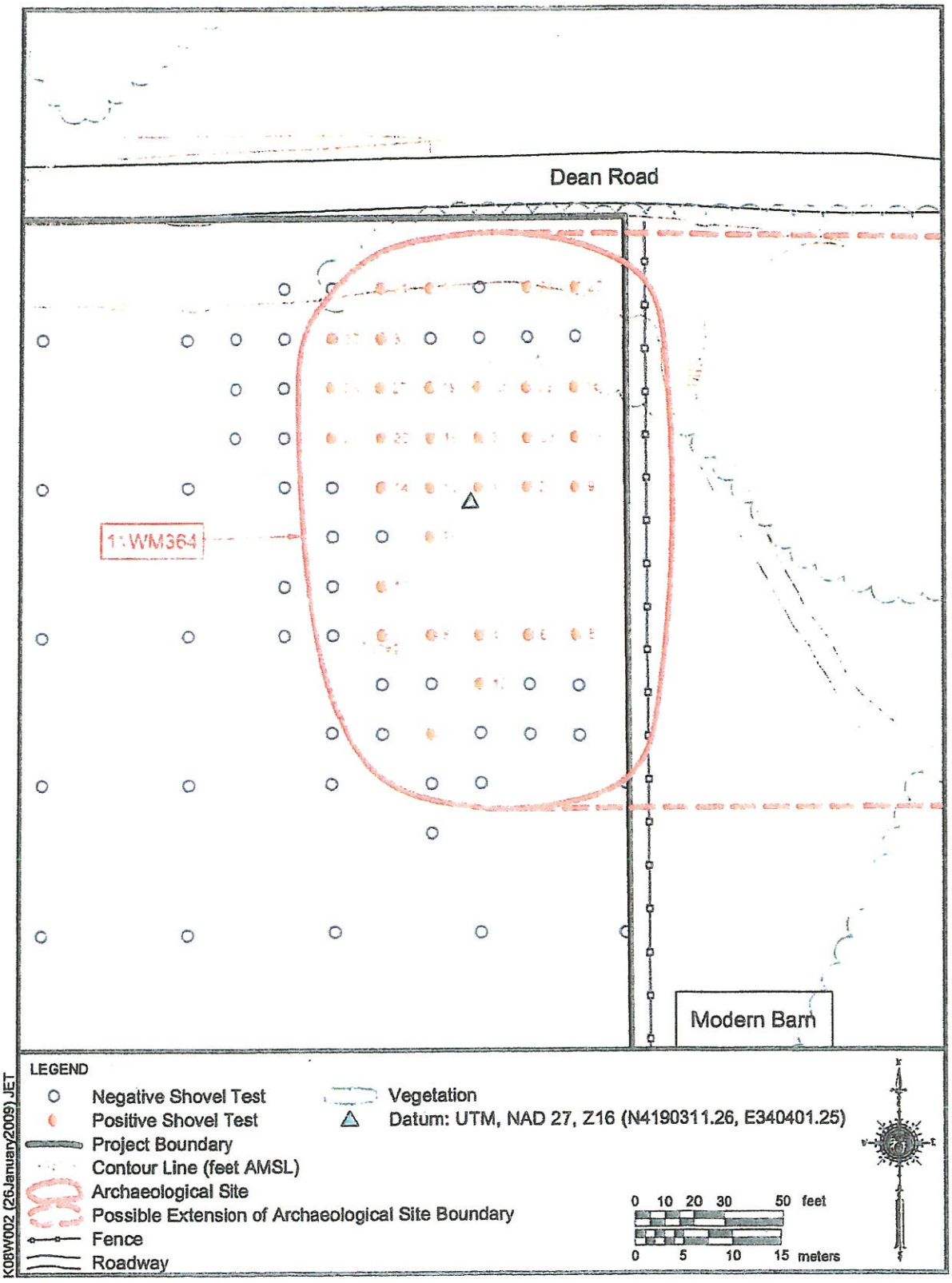


Figure 4. Site 11WM364 plan map.

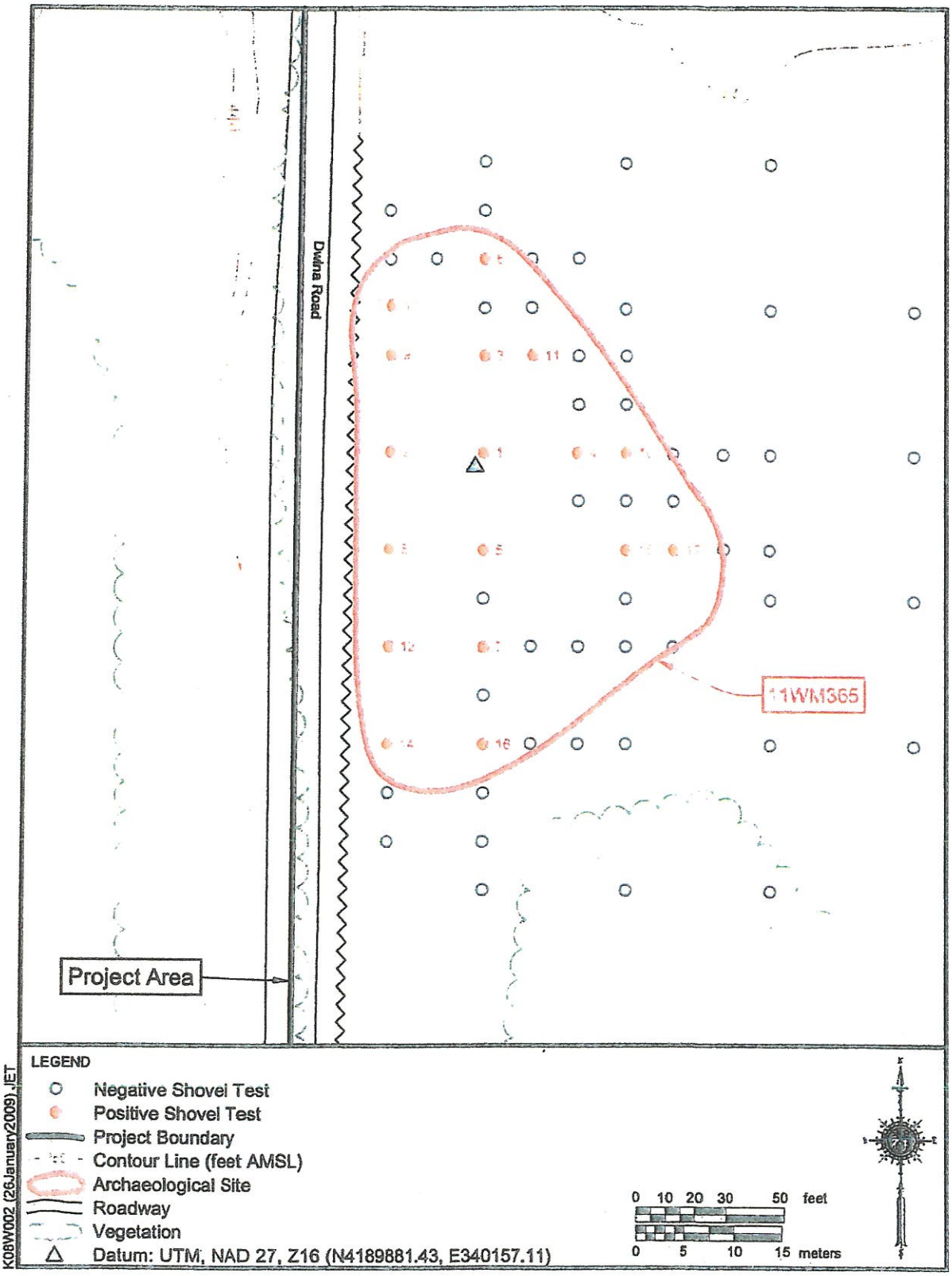


Figure 5. Site 11WM365 plan map.

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** Y
Field 11WM123 **State Site No.:** 123
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE	**1/4s:** NWSESW	**Section:** 7	**Township:** 8	S	**Range:** 4	E
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**	**Section:**	**Township:**		**Range:**	

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189114 **UTM East:** 340643 **NAD27**

Ownership: Private

ENVIRONMENT

Topography: Upland Ridge **Elevation (in meters):** 158.5
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Upland ridge setting approximately 300 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 5031
Ground Cover (List up to 3): Forest Brush **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Development

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0 **Number of Historic Artifacts (count or estimate):** 69
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 47 architecture group (brick, window glass, nails), 1 clothing group (button), 15 domestic group (ceramics, container glass), 1 furnishings group (furniture handle), 5 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmstead/residence site that dates primarily to the turn-of-the-twentieth century based on recovered historic material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/09/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/22/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** Y
Field 11WM123 **State Site No.:** 123
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE **1/4s:** NWSESW **Section:** 7 **Township:** 8 S **Range:** 4 E
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189114 **UTM East:** 340643 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Upland Ridge **Elevation (in meters):** 158.5
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Upland ridge setting approximately 300 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 5031
Ground Cover (List up to 3): Forest Brush **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Development

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0 **Number of Historic Artifacts (count or estimate):** 69
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 47 architecture group (brick, window glass, nails), 1 clothing group (button), 15 domestic group (ceramics, container glass), 1 furnishings group (furniture handle), 5 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmstead/residence site that dates primarily to the turn-of-the-twentieth century based on recovered historic material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/09/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/22/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** N
Field FS 1 **State Site No.:** 364
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE	**1/4s:** NENWNW	**Section:** 7	**Township:** 8 S	**Range:** 4 E
Align:	**1/4s:**	**Section:**	**Township:**	**Range:**
Align:	**1/4s:**	**Section:**	**Township:**	**Range:**
Align:	**1/4s:**	**Section:**	**Township:**	**Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4190325 **UTM East:** 340414 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain **Elevation (in meters):** 140.1
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 150 m SW of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 4689
Ground Cover (List up to 3): Grass Weeds **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 1 **Number of Historic Artifacts (count or estimate):** 249
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 1 undiag prehist lithic; historic: 72 arch group (window glass, nails, bricks), 1 arms group (.22-cal cartridge), 155 domestic group (glass, ceramics), 5 furnishings group, 6 maint./subsistence group, 1 personal group, and 9 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	Y	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian		**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:		**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:		**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle		**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
				Post-War (1946-present):

Description: Multicomp. site. Prehistoric component was temp. undiagnostic. Historic farmstead/ res component dates to the turn-of-the-20th century based on recovered material culture. No features observed. House shown on the 1908 plat map of Williamson County.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/05/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site**
Field FS 1
Quadrangle (7.5'): Pittsburgh

Revisit: N
State Site No.: 364
Date 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE **1/4s:** NENWNW **Section:** 7 **Township:** 8 S **Range:** 4 E
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4190325 **UTM East:** 340414 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain
Nearest Water Supply: intermittent **Drainage:** Big Muddy **Elevation (in meters):** 140.1
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 150 m SW of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey
Ground Cover (List up to 3): Grass Weeds **Site Area (square meters):** 4689
Survey Methods (List up to 2): Shovel Test **Visibility (%):** 0
Site Type (List up to 2): Habitation **Standing Structures:** N

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 1 **Number of Historic Artifacts (count or estimate):** 249
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 1 undiag prehist lithic; historic: 72 arch group (window glass, nails, bricks), 1 arms group (.22-cal cartridge), 155 domestic group (glass, ceramics), 5 furnishings group, 6 maint./subsistence group, 1 personal group, and 9 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	Y	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian		**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:		**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:		**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle		**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
				Post-War (1946-present):

Description: Multicomp. site. Prehistoric component was temp. undiagnostic. Historic farmstead/ res component dates to the turn-of-the-20th century based on recovered material culture. No features observed. House shown on the 1908 plat map of Williamson County.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/05/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** N
Field FS 2 **State Site No.:** 365
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE	**1/4s:** NWSWNW		**Section:** 7	**Township:** 8	S	**Range:** 4	E
Align:	**1/4s:**		**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**		**Section:**	**Township:**		**Range:**	
Align:	**1/4s:**		**Section:**	**Township:**		**Range:**	

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189870 **UTM East:** 340148 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain **Elevation (in meters):** 139.6
Nearest Water Supply: intermittent **Drainage:** Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 50 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey **Site Area (square meters):** 2878
Ground Cover (List up to 3): Grass Weeds **Visibility (%):** 0
Survey Methods (List up to 2): Shovel Test **Standing Structures:** N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0 **Number of Historic Artifacts (count or estimate):** 49
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 12 architecture group (nails, window glass, bricks), 35 domestic group (ceramics, container glass, container closures, glass tableware), 1 maint./subsistence group (steel bolt), 1 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmstead/residence site that dates to the turn-of-the-20th century based on recovered material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/07/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson **Site** **Revisit:** N
Field FS 2 **State Site No.:** 365
Quadrangle (7.5'): Pittsburgh **Date** 01/28/2009

LEGAL DESCRIPTION (to quarter quarter quarter

Align: SE **1/4s:** NWSWNW **Section:** 7 **Township:** 8 S **Range:** 4 E
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**
Align: **1/4s:** **Section:** **Township:** **Range:**

UTM Coordinates (by **UTM Zone:** 16 **UTM North:** 4189870 **UTM East:** 340148 **NAD27**
Ownership: Private

ENVIRONMENT

Topography: Floodplain
Nearest Water Supply: intermittent **Drainage:** Big Muddy **Elevation (in meters):** 139.6
Soil Association: Ava-Bluford-Wynoose
Description: Floodplain setting approximately 50 m W of unknown tributary of Pond Creek

SURVEY

Project WE ph I 74.2 ha (183.3-acre) survey
Ground Cover (List up to 3): Grass Weeds **Site Area (square meters):** 2878
Survey Methods (List up to 2): Shovel Test **Visibility (%):** 0
Site Type (List up to 2): Habitation **Standing Structures:** N

SITE CONDITION

Extent of Severe
Main Cause of Damage: Agriculture

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or 0 **Number of Historic Artifacts (count or estimate):** 49
Prehistoric Diagnostic Artifacts: N **Historic Diagnostic Artifacts:** Y
Prehistoric Surface Features: N **Historic Surface** N
Description: 12 architecture group (nails, window glass, bricks), 35 domestic group (ceramics, container glass, container closures, glass tableware), 1 maint./subsistence group (steel bolt), 1 unidentified group

TEMPORAL AFFILIATION (check all that apply)

Prehistoric	**Late**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian	**Woodland**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native**	**Early Industrial (1871-1900):** Y
Middle	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Historic farmstead/residence site that dates to the turn-of-the-20th century based on recovered material culture. No features observed.

Surveyor: Tanya Faberson **Institution:** CRA **Survey Date:** 11/07/2008 **Curation Facility:** ISM
Site Report by: Tanya Faberson **Institution:** CRA **Date:** 01/21/2009
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance **NRHP Listing:** N

PART II ATTACHMENT II.13.A – SOIL RESOURCE REPORT

United States Department of Agriculture

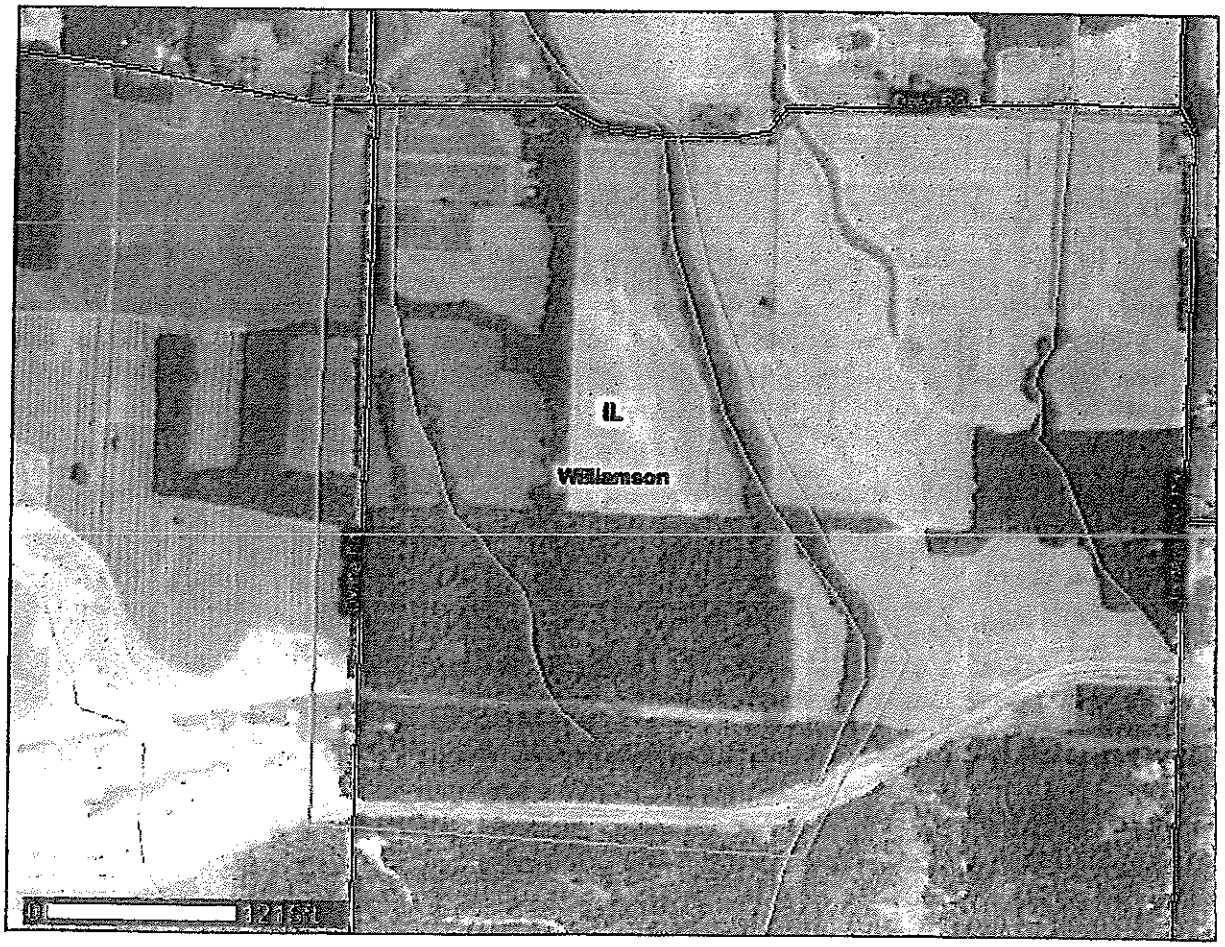
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Williamson County, Illinois

Permit No. 417



June 7, 2012

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map.....8
Legend.....9
Map Unit Legend.....10
Map Unit Descriptions.....10
Williamson County, Illinois.....12
13A—Bluford silt loam, 0 to 2 percent slopes.....12
13B2—Bluford silt loam, 2 to 5 percent slopes, eroded.....12
14B—Ava silt loam, 2 to 5 percent slopes.....13
14C2—Ava silt loam, 5 to 10 percent slopes, eroded.....14
301B—Grantsburg silt loam, 2 to 5 percent slopes.....15
340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded.....16
518C3—Rend silty clay loam, 5 to 10 percent slopes, severely eroded.....17
640A—Bluford silt loam, bench, 0 to 2 percent slopes.....17
640B2—Bluford silt loam, bench, 2 to 5 percent slopes, eroded.....18
908D3—Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded.....19
3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded.....20
3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded.....21
Soil Information for All Uses.....23
Suitabilities and Limitations for Use.....23
Land Classifications.....23
Farmland Classification.....23
Soil Reports.....27
Vegetative Productivity.....27
Nonirrigated Yields by Map Unit.....27
References.....31

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:9,030 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Date(s) aerial images were photographed: 6/13/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R09663

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13A	Bluford silt loam, 0 to 2 percent slopes	44.1	13.6%
13B2	Bluford silt loam, 2 to 5 percent slopes, eroded	43.5	13.5%
14B	Ava silt loam, 2 to 5 percent slopes	11.7	3.6%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	31.2	9.7%
301B	Grantsburg silt loam, 2 to 5 percent slopes	2.6	0.8%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	1.2	0.4%
518C3	Rend silty clay loam, 5 to 10 percent slopes, severely eroded	10.5	3.3%
640A	Bluford silt loam, bench, 0 to 2 percent slopes	33.4	10.4%
640B2	Bluford silt loam, bench, 2 to 5 percent slopes, eroded	28.0	8.7%
908D3	Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded	15.5	4.8%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	32.1	9.9%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	69.2	21.4%
Totals for Area of Interest		**323.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Williamson County, Illinois

13A—Bluford silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Bluford and similar soils: 90 percent

Description of Bluford

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 7 to 24 inches to abrupt textural change; 21 to 55 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 3.9 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 7 inches: Silt loam
7 to 20 inches: Silt loam
20 to 35 inches: Silty clay
35 to 60 inches: Silty clay loam

13B2—Bluford silt loam, 2 to 5 percent slopes, eroded

Map Unit Setting

Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 46 inches

Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Bluford, eroded, and similar soils: 90 percent

Description of Bluford, Eroded

Setting
Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: 7 to 24 inches to abrupt textural change; 21 to 55 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 3.5 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile
0 to 7 inches: Silt loam
7 to 27 inches: Silty clay
27 to 60 inches: Silty clay loam

14B—Ava silt loam, 2 to 5 percent slopes

Map Unit Setting
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Ava and similar soils: 90 percent

Description of Ava

Setting
Landform: Till plains

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 6.3 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Silt loam
8 to 18 inches: Silt loam
18 to 36 inches: Silty clay loam
36 to 53 inches: Silt loam
53 to 80 inches: Silt loam

14C2—Ava silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, eroded, and similar soils: 90 percent

Description of Ava, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan

Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 5.2 inches)

Interpretive groups
Land capability (nonirrigated): 3e

Typical profile
0 to 9 inches: Silt loam
9 to 28 inches: Silty clay loam
28 to 64 inches: Silt loam
64 to 78 inches: Silt loam

301B—Grantsburg silt loam, 2 to 5 percent slopes

Map Unit Setting
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Grantsburg and similar soils: 90 percent

Description of Grantsburg

Setting
Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over residuum

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile

0 to 11 inches: Silt loam
11 to 24 inches: Silt loam
24 to 38 inches: Silty clay loam
38 to 61 inches: Silt loam
61 to 80 inches: Silt loam

340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Zanesville, severely eroded, and similar soils: 90 percent

Description of Zanesville, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over residuum

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 19 to 32 inches to fragipan; 40 to 80 inches to paralithic bedrock; 40 to 80 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 2 inches: Silty clay loam
2 to 19 inches: Silty clay loam
19 to 37 inches: Silt loam
37 to 55 inches: Channery silt loam
55 to 65 inches: Bedrock

518C3—Rend silty clay loam, 5 to 10 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Rend, severely eroded, and similar soils: 90 percent

Description of Rend, Severely Eroded

Setting

Landform: Structural benches
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 3.0
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 8 inches: Silty clay loam
8 to 23 inches: Silty clay loam
23 to 77 inches: Silt loam
77 to 80 inches: Silt loam

640A—Bluford silt loam, bench, 0 to 2 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F

Frost-free period: 175 to 195 days

Map Unit Composition
Bluford, bench, and similar soils: 90 percent

Description of Bluford, Bench

Setting
Landform: Structural benches
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Peoria and roxana loess over outwash or basin fill

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: 7 to 24 inches to abrupt textural change; 21 to 55 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 3.9 inches)

Interpretive groups
Land capability (nonirrigated): 2w

Typical profile
0 to 7 inches: Silt loam
7 to 20 inches: Silt loam
20 to 35 inches: Silty clay
35 to 60 inches: Silty clay loam

640B2—Bluford silt loam, bench, 2 to 5 percent slopes, eroded

Map Unit Setting
Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Bluford, bench, eroded, and similar soils: 90 percent

Description of Bluford, Bench, Eroded

Setting
Landform: Structural benches
Landform position (two-dimensional): Shoulder, backslope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over outwash or basin fill

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: 7 to 24 inches to abrupt textural change; 21 to 55 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 3.5 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile
0 to 7 inches: Silt loam
7 to 27 inches: Silty clay
27 to 60 inches: Silty clay loam

908D3—Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded

Map Unit Setting
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Hickory, severely eroded, and similar soils: 50 percent
Kell, severely eroded, and similar soils: 40 percent

Description of Hickory, Severely Eroded

Setting
Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities
Slope: 10 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Sodium adsorption ratio, maximum: 2.0
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 8 inches: Clay loam
8 to 46 inches: Clay loam
46 to 58 inches: Clay loam
58 to 80 inches: Loam

Description of Kell, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 7 inches: Clay loam
7 to 13 inches: Clay loam
13 to 35 inches: Very channery silt loam
35 to 60 inches: Bedrock

3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Sharon, frequently flooded, and similar soils: 90 percent

Description of Sharon, Frequently Flooded

Setting
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Very high (about 12.4 inches)

Interpretive groups
Land capability (nonirrigated): 2w

Typical profile
0 to 13 inches: Silt loam
13 to 40 inches: Silt loam
40 to 80 inches: Silt loam

3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting
Elevation: 340 to 490 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition
Belknap, frequently flooded, and similar soils: 90 percent

Description of Belknap, Frequently Flooded

Setting
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Very high (about 12.7 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 7 inches: Silt loam
7 to 59 inches: Silt loam
59 to 80 inches: Silt loam

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

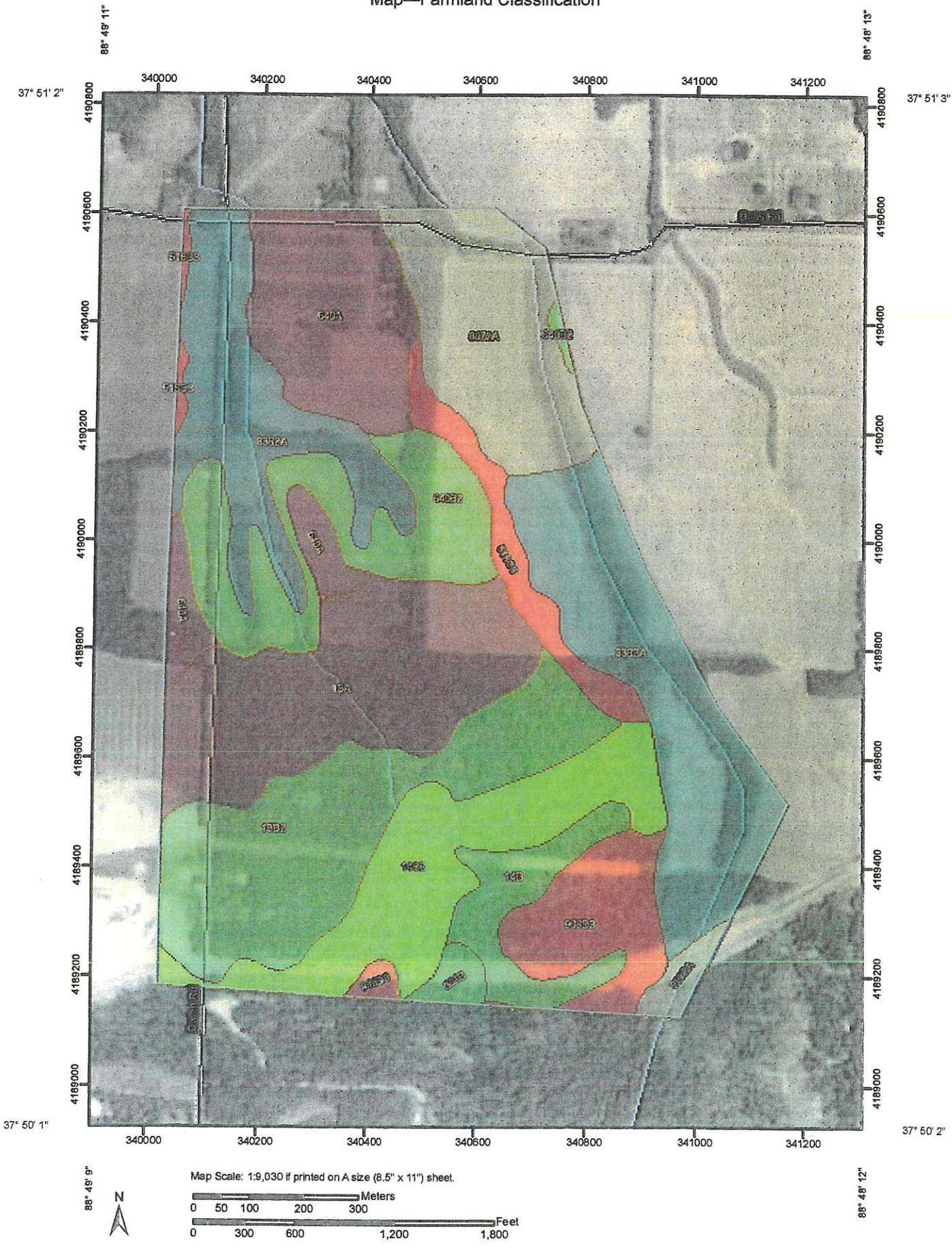
Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Farmland Classification

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Custom Soil Resource Report
Map—Farmland Classification



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:9,030 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Date(s) aerial images were photographed: 6/13/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Farmland Classification

Farmland Classification—Summary by Map Unit—Williamson County, Illinois (IL199)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
13A	Bluford silt loam, 0 to 2 percent slopes	Prime farmland if drained	44.1	13.6%
13B2	Bluford silt loam, 2 to 5 percent slopes, eroded	All areas are prime farmland	43.5	13.5%
14B	Ava silt loam, 2 to 5 percent slopes	All areas are prime farmland	11.7	3.6%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	Farmland of statewide importance	31.2	9.7%
301B	Grantsburg silt loam, 2 to 5 percent slopes	All areas are prime farmland	2.6	0.8%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	Not prime farmland	1.2	0.4%
518C3	Rend silty clay loam, 5 to 10 percent slopes, severely eroded	Not prime farmland	10.5	3.3%
640A	Bluford silt loam, bench, 0 to 2 percent slopes	Prime farmland if drained	33.4	10.4%
640B2	Bluford silt loam, bench, 2 to 5 percent slopes, eroded	All areas are prime farmland	28.0	8.7%
908D3	Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded	Not prime farmland	15.5	4.8%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	Prime farmland if protected from flooding or not frequently flooded during the growing season	32.1	9.9%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	69.2	21.4%
Totals for Area of Interest			**323.1**	**100.0%**

Rating Options—Farmland Classification

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Vegetative Productivity

This folder contains a collection of tabular reports that present vegetative productivity data. The reports (tables) include all selected map units and components for each map unit. Vegetative productivity includes estimates of potential vegetative production for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture and rangeland. In the underlying database, some states maintain crop yield data by individual map unit component. Other states maintain the data at the map unit level. Attributes are included for both, although only one or the other is likely to contain data for any given geographic area. For other land uses, productivity data is shown only at the map unit component level. Examples include potential crop yields under irrigated and nonirrigated conditions, forest productivity, forest site index, and total rangeland production under of normal, favorable and unfavorable conditions.

Nonirrigated Yields by Map Unit

The average yields per acre that can be expected of the principal crops under a high level of management are shown in this table. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

If yields of irrigated crops are given, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

Pasture yields are expressed in terms of animal unit months. An animal unit month (AUM) is the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

The land capability classification of map units in the survey area is shown in this table. This classification shows, in a general way, the suitability of soils for most kinds of field crops (United States Department of Agriculture, Soil Conservation Service, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

Reference:
United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Report—Nonirrigated Yields by Map Unit

Nonirrigated Yields by Map Unit– Williamson County, Illinois					
Map symbol and soil name	Land capability	Corn	Grass-legume hay	Soybeans	Winter wheat
		Bu	*Tons*	*Bu*	*Bu*
13A—Bluford silt loam, 0 to 2 percent slopes		122	3.05	40	50
Bluford	2w				
13B2—Bluford silt loam, 2 to 5 percent slopes, eroded		116	2.91	38	48
Bluford, eroded	2e				
14B—Ava silt loam, 2 to 5 percent slopes		120	2.91	39	50
Ava	2e				
14C2—Ava silt loam, 5 to 10 percent slopes, eroded		109	2.65	35	45
Ava, eroded	3e				
301B—Grantsburg silt loam, 2 to 5 percent slopes		119	2.91	41	50
Grantsburg	2e				
340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded		—	2.35	—	—
Zanesville, severely eroded	6e				
518C3—Rend silty clay loam, 5 to 10 percent slopes, severely eroded		95	2.50	30	37
Rend, severely eroded	4e				
640A—Bluford silt loam, bench, 0 to 2 percent slopes		122	3.05	40	50
Bluford, bench	2w				
640B2—Bluford silt loam, bench, 2 to 5 percent slopes, eroded		116	2.91	38	48
Bluford, bench, eroded	2e				
908D3—Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded		79	2.60	26	33
Hickory, severely eroded	4e				
Kell, severely eroded	4e				
3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded		133	3.86	43	—
Sharon, frequently flooded	2w				
3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded		127	3.96	42	—
Belknap, frequently flooded	3w				

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Nonirrigated Yields by Map Unit– Williamson County, Illinois					
Map symbol and soil name	Land capability	Corn	Grass-legume hay	Soybeans	Winter wheat
		Bu	*Tons*	*Bu*	*Bu*
13A—Bluford silt loam, 0 to 2 percent slopes		122	3.05	40	50
Bluford	2w				
13B2—Bluford silt loam, 2 to 5 percent slopes, eroded		116	2.91	38	48
Bluford, eroded	2e				
14B—Ava silt loam, 2 to 5 percent slopes		120	2.91	39	50
Ava	2e				
14C2—Ava silt loam, 5 to 10 percent slopes, eroded		109	2.65	35	45
Ava, eroded	3e				
301B—Grantsburg silt loam, 2 to 5 percent slopes		119	2.91	41	50
Grantsburg	2e				
349D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded			2.85		
Zanesville, severely eroded	6e				
518C3—Rend silty clay loam, 5 to 10 percent slopes, severely eroded		95	2.50	30	37
Rend, severely eroded	4e				
640A—Bluford silt loam, bench, 0 to 2 percent slopes		122	3.05	40	50
Bluford, bench	2w				
640B2—Bluford silt loam, bench, 2 to 5 percent slopes, eroded		116	2.91	38	48
Bluford, bench, eroded	2e				
663D3—Hickory silty clay loam, 10 to 18 percent slopes, severely eroded		79	2.00	26	31
Hickory, severely eroded	6e				
Kell, severely eroded	6e				
3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded		133	3.86	43	—
Sharon, frequently flooded	2w				
3083A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded		127	3.95	42	
Belknap, frequently flooded	6w				

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

ATTACHMENT II.13.D.

TOPSOIL THICKNESS MEASUREMENTS

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

November 12, 2014

Williamson Energy
PO Box 99
Johnston City, IL 62951

Attention: Mr. Josh Phillips

Re: Topsoil Thickness Measurements
Pond Creek Mine #1
Williamson County, Illinois
HFE File H-14179

Dear Sir:

On November 11, 2014, we measured the topsoil thickness at 12 locations at Pond Creek Mine in Williamson County, Illinois. The topsoil was measured using a post-hole digger to excavate a hole through the topsoil and measuring the thickness with a tape measure. Results of the thickness measurements and test locations are enclosed. If you should have any questions, or if we can be of further assistance, please feel free to contact us at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING INC.

Timothy J. Holcomb, P.E.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY J.
HOLCOMB
062-042149
Exp 11-30-15
ILLINOIS

HOLCOMB FOUNDATION ENGINEERING CO.

Topsoil Thickness Measurements

Pond Creek Mine No. 1

Project No. H-14179
Date: 11/11/2014
Client: Williamson Energy

Area Number	GPS Location		Topsoil Thickness (In.)
	Lattitude	Longitude	
1	37.83840	88.80780	4
2	37.83839	88.81097	7
3	37.83839	88.81615	4
4	37.84177	88.81665	6
5	37.84172	88.81248	9
6	37.84175	88.80857	9
7	37.84497	88.80990	7
8	37.84500	88.81257	7
9	37.84497	88.81697	6
10	37.84841	88.81626	9
11	37.84861	88.91402	7
12	37.84787	88.81069	8

83 ÷ 12 = 6.9 inches

3001-/15
R09693

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

RESPONSE TO IDNR COMPLETENESS REVIEW DATED OCTOBER 24, 2014

PROPOSED PERMIT NO. 417

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

AUG 02 2019

REVIEWER: SAB

VOLUME 1 OF 2
(PROPOSED PERMIT NO. 417, PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 – PARTS III THROUGH V AND DRAWINGS)

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B12-271-1413
NOVEMBER 2014

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Dr., Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: SAB

Part III

HYDROGEOLOGIC INFORMATION

1) Regional Hydrogeologic Characteristics
As described in Illinois State Geological Survey Circulars 192, 198, 207, 212, 222, 225, 232, 248, Coop 1, etc., other sources or personal knowledge provide the following required hydrogeologic information.

A) Describe the major and minor surficial aquifers of the permit area and adjacent areas.

RESPONSE: **Major surficial aquifers – None**
Minor surficial aquifers - Scattered sand and gravel in the Saline River and Big Muddy River valleys and their larger tributaries.

B) List the major and minor drift, bedrock valley, and buried bedrock valley aquifers of the area.

RESPONSE: **Major drift aquifers - None.**
Minor drift aquifers - Drift filled valleys associated with the Saline River and Big Muddy Rivers and their larger tributaries; and isolated sand and gravel lenses contained within glacial till.
Major bedrock valley aquifers - None.
Minor bedrock valley aquifers – None.
Major buried bedrock valley aquifers – None.
Minor buried bedrock valley aquifers - Big Muddy River Buried Valley system.

C) List the major and minor bedrock aquifers in the area.

RESPONSE: **Major bedrock aquifers - None.**
Minor bedrock aquifers - Pennsylvanian age coal seams, limestones and sandstones; and Mississippian age limestones.

D) List the generalized water yield, supply, and potential use of these aquifers.

RESPONSE: **Proposed Coal Refuse Disposal Facility No. 3 is located in the glaciated upland area of northern Williamson County. It is situated at the headwaters of the major drainage systems of the region. In this area, no specific geologic unit has been identified as a major surficial aquifer. According to Illinois State Geological Survey (ISGS) Circular 212, "the best potential sources of large supplies of water are sand and gravel deposits in the major valley systems. Unfavorable conditions generally prevail elsewhere because water yielding sand and gravel is absent, the bedrock formations are tight, or the available groundwater is of poor quality". No major aquifers exist in the permit or adjacent area. However, minor surficial aquifers associated with a few drift-filled valleys north and west of the permit area may, in some instances, be capable of supplying enough water for relatively small commercial, industrial, municipal or irrigation purposes. Sand and gravel aquifers, where present, generally yield 20 gallons per minute or more. The Pennsylvanian and Mississippian age bedrock aquifers can usually provide only enough water for individual domestic supplies. Yields from wells completed in these formations are usually less than 10 gallons per minute with yields less than 5 gallons per minute common. The low permeabilities of the Pennsylvanian System rocks cause the water in the deeper formations to be highly mineralized. Therefore, some deeper bedrock aquifers may contain water whose quality is unsatisfactory without expensive treatment and, generally, are not developed. Recharge to these bedrock aquifers is primarily from precipitation which percolates into and through the overlying unconsolidated materials. Recharge primarily takes place at outcrop areas for the various bedrock units.**

2) Area Specific Hydrogeologic Characteristics

A) 1) Provide a description of the areal and structural geology of the permit, shadow area and adjacent areas for the deeper of either the stratum immediately below the lowest coal seam to be mined, or any aquifer below the lowest coal seam to be mined which may be adversely impacted by mining. Provide logs showing the lithologic characteristics including physical properties and thickness of each stratum and the location of groundwater where encountered. Provide location and elevations of test borings or core samplings on pre-mining land use map or other designated map.

RESPONSE: **A network of twenty (20) borings, some of which were associated with the installation of groundwater monitoring wells, have been completed at the Proposed Coal Refuse Disposal Facility No. 3 and used for characterizing the horizontal and vertical distribution of the clay till at that location. These borings are denoted as BH-4, BH-5, BH-6, GW-7A, GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14, GW-28, B-1, B-2, B-3, B-4, B-5, B-7, C-1, C-2, and D-1. This cumulative network of 20 borings/wells has been used to develop a series of six (6) geologic cross sections, denoted as sections I - I′ through N - N′ (Drawing Nos. B12-271-M17 through B12-271-M22). The location of each well/boring and also the specific locations of the aforementioned geologic cross sections are illustrated on the Geologic Cross Sections Location Map (Drawing No. B12-271-E1).**

As depicted on the Geologic Cross Sections Location Map, the Proposed Coal Refuse Disposal Facility No. 3 area is proposed to be constructed by adding on to the existing refuse facility. The floor elevations have been illustrated upon the geologic cross sections at pertinent locations. This methodology allows a visual depiction of the subsurface geology relative to the proposed cuts and facility floor elevations.

Upon reviewing the geologic cross sections, it is readily apparent that the deposit of thick clay till earlier identified beneath the site of nearby Coal Refuse Disposal Facility No. 2 also immediately underlies the Proposed Coal Refuse Disposal Facility No. 3 area. All six (6) of the geologic cross sections demonstrate this clay till unit to be laterally continuous across the entire expanse of the proposed permit area. The north end (floor El. 430) of the propose refuse area is transected by geologic cross sections J - J′, L - L′, M - M′ and N - N′. The south end of the Proposed Coal Refuse Disposal Facility No. 3 area is transected by geologic cross sections K - K′, L - L′ and M - M′. Geologic cross sections M - M′, N - N′ and L - L′, have had floor elevations projected into those sections.

In order to evaluate the clay till unit's permeability at the Proposed Coal Refuse Disposal Facility No. 3 area, samples of this material were recently tested by Holcomb Foundation Engineering Co., Inc. (Holcomb). In addition to the permeability data already existing from earlier testing of this unit at boring/well GW-7A located at the site containing Coal Refuse Disposal Facility Nos. 1 and 2 on Permit 375, an additional four (4) samples were tested by Holcomb during July 2009. These till samples originated from Shelby tube samples obtained during recent drilling of borings/wells BH-4, BH-5, BH-6, GW-12, GW-13 and GW-14 at the Proposed Coal Refuse Disposal Facility No. 3 area.

The Shelby tube samples tested are all from the clay till, at depths which are equal to or lower than the proposed floor cut elevations at the facility. The specific locations/depths from which these Shelby tube samples were collected are delineated on the geologic cross sections. For purposes of comparing the in-situ (undisturbed Shelby tube sample) material's permeability values to those acquired through remolding the clay till at 95%

Standard Proctor dry density, two (2) samples by each of these methodologies were tested by Holcomb. The representative in-situ samples came from borings BH-5 and BH-4. Holcomb reported the permeability testing results as 3 x 10^{-8} cm./sec. and 2 x 10^{-7} cm./sec. respectively for those samples.

Composite samples were generated for the remolded material testing, and one composite was made by combining one Shelby tube sample from GW-12 with two (2) Shelby tube sample intervals from GW-13. Holcomb reported the permeability test value as 1 x 10^{-7} cm./sec. for this sample, which had been remolded at 95% Standard Proctor dry density. The second composite was prepared by combining one Shelby tube sample from each of GW-14 and BH-6, and then remolding at 95% Standard Proctor dry density. Holcomb reported the permeability test value for this sample as 1 x 10^{-7} cm./sec. as well.

2) Provide chemical analyses of each stratum down to and including the deeper of either the stratum immediately below the lowest coal seam to be mined or any aquifer below the lowest coal seam to be mined which may be adversely impacted by mining.

The analyses shall identify those strata that may contain acid or toxic-forming or alkalinity-producing materials and determine their content.

RESPONSE: Acid base accounting has been provided in Attachment III.2.A.2.

3) Provide coal seam(s) name and number and an analysis of the coal seam(s) as to total sulfur and pyritic sulfur. On the pre-mining land use, operation, or other designated map show all coal crop lines and the strike and dip of the coal to be mined.

RESPONSE: The sulfur forms for the Herrin No. 6 coal seam are contained in Attachment No. III.2.A.3. The strike and dip are shown on Drawing No. B12-271-E1.

4) For room and pillar mining operations, the thickness and engineering properties of clay or soft rocks such as clayshale, if any, in the stratum immediately above and below each coal seam to be mined.

RESPONSE: N/A

5) Applicants may request that the Department waive in whole or in part the information required under questions 2 thru 4 above. Waiver requests should be submitted to the Department for review prior to submission of an application. Applications containing unapproved waiver requests may result in prolonging the application review or in application denial.

RESPONSE: N/A

B) Ground Water Information

1) Provide the location on the hydrologic map or other designated map, and ownership of existing wells, springs, and other ground water resources for the permit area and adjacent area.

RESPONSE: **Refer to Map 2 – Identification of Interests (Drawing No. B12-271-E7) and Map 4 – Hydrogeologic Map (Drawing No. B12-271-M23). Hydrologic Information for information regarding the location and ownership of existing wells and other ground water supplies.**

2) Provide a description of seasonal ground water quality including at a minimum the following:

pH
total dissolved solids
hardness
alkalinity
acidity
sulfates
total iron
total manganese
total chlorides

RESPONSE: **Refer to Attachment III.2.B.2 for the ground water quality data. Groundwater quality sampling and laboratory analysis has been performed for seven (7) groundwater monitoring wells (GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28) located at/near proposed RDA No. 3. The location of each of these wells is presented upon the Geologic Cross Sections Location Map (Drawing No. B12-271-E1). Submitted are laboratory analytical reports for these samples, which were collected on a quarterly basis spanning the third and fourth calendar quarters of 2013 and the first and second quarters of 2014. Excepting only GW-8R which was dry during the third and fourth quarter 2013 sampling events, all other wells were recorded as having water present for sampling during the year.**

Based upon this suite of groundwater analyses, the pH of these wells was characteristically circum-neutral, with the highest pH in the data set measuring 7.5 and the lowest 6.6. As would be expected from that pH range, the groundwater has considerably higher alkalinity in comparison to acidity. Alkalinity ranged from a high of 800 to a low of 190 mg/L; and, acidity spanned from < 10 up to 150 mg/L. Hardness is very high in all samples, with a low of 292 and high of 3800 mg/L. Total dissolved solids (TDS) and sulfates were also characteristically high to very high, with TDS spanning between a low of 638 and high of 5736 mg/L and sulfates between a low of 284 and high of 3730 mg/L. Total iron was variable even on an intrawell basis, with same-well concentration ranging from below the method detection limit to a high of 3.072 mg/L in GW-14 during the year. Other wells too exhibited notable iron concentration fluctuations. Total manganese likewise exhibited variable intrawell concentration, along with considerable variability between wells. Both the sampling events where water was present in well GW-8R exhibited high total manganese, with reporting of 7.107 and 9.124 mg/L. In the other wells, total manganese values spanned from below the method detection limit up to 8.630 mg/L. In collective consideration of the aforementioned parameters and concentrations, the existing shallow groundwater quality on/near proposed RDA No. 3 is regarded to be poor.

3) Provide a description of seasonal ground water quantity including at a minimum the appropriate rates of discharge or usage and the elevation of potentiometric surface of the coal to be mined, and in each water-bearing stratum above the coal to be mined, and in each water-bearing stratum below the coal to be mined which may be potentially impacted.

RESPONSE: **Groundwater usage and rates of discharge are regarded as nominal on/near RDA No. 3. No domestic groundwater users have been identified in the area. Surface watercourses in this local area characteristically exhibit significant periods of no flow, which is indicative of no to only very limited timeline groundwater contribution to surface water flow at/near RDA No. 3. Clayey till is deposited across the RDA No. 3 area, and the till is characteristically underlain by shale. This geologic setting impedes productive groundwater recharge, and inherently provides a hydrogeologic setting where both horizontal and vertical permeabilities are low/very low. To further demonstrate the geology and hydrogeology of this area, Geologic Cross Section AA - AA' (Drawing No. B12-271-E15) has been prepared. That drawing exhibits the available field sampling and corresponding laboratory testing of the till across the currently permitted RDA Nos. 1 and 2, as well as proposed RDA No. 3. The drawing also exhibits permeability data acquired during slug testing of some of the groundwater monitoring wells in the area, along with the monitoring (i.e. screened) interval within those wells. As evident on the drawing, the monitoring interval within some of the slug tested wells includes the top of bedrock underlying the till. Regardless, all results from both slug testing as well as laboratory testing of till consistently demonstrate remarkably low permeability values, which documents that there is nominal to no potential for any appreciable quantity of groundwater to be transported by these hydrostratigraphic horizons across the proposed RDA No. 3 area. As an added measure of hydrogeologic evaluation, the same sandstone unit that was reviewed on the RDA Nos. 1 and 2 locations was also reviewed at the proposed RDA No. 3 site. The drawing titled Sandstone Unit Isopach Map (Drawing No. B12-271-E14) depicts this sandstone's thickness as well as the layout/location of Geologic Cross Section AA-AA'. As evident upon viewing the isopach map, this sandstone unit is laterally discontinuous and the vast majority of RDA Nos. 1, 2 and 3 either have the unit absent beneath them or else it characteristically is at a thickness of 3 feet or less.**

Groundwater elevation measurements recorded on February 27, 2014 for monitoring wells GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28 were used to generate a Potentiometric Surface/Water Table Map (Drawing No. B12-271-E17) for the shallow water bearing zone. The groundwater surface contours were constructed on a 5-foot elevation contour interval. The map illustrates that the groundwater flow direction is in a northerly direction across the site. The calculated hydraulic gradient based on those contours is 0.007 ft./ft.

C) Surface Water Information

1) Provide the name, location, ownership, and description of all surface water bodies, lakes, streams, impoundments, and springs within and adjacent to the proposed permit and shadow areas. Provide the location of any discharge or drainage into any surface water bodies listed above.

RESPONSE: **There are no surface water bodies, lakes or impoundments or springs within or adjacent to the permit area. There are six surface water sampling points designated as PC 1, PC 2, PC 3, PC4 , C 1 and C 2. PC 1 is Pond Creek Below Unnamed Tributary PC 1. PC 2 is PC 2 Pond Creek Below Unnamed Tributary from Plan Area. PC 3 is PC 3 Pond Creek Above Unnamed Tributary PC 4. PC 4 is PC 4 Unnamed Southeast Corner Upstream of RR Spur. C 1 is C 1 – East Unnamed Tributary Upstream of Corinth Road. C 2 is C 2 – West Unnamed Tributary Upstream of Corinth Road. The project area will directly impact two stream channels that were identified as intermittent with the Corps of Engineers; however, neither of these channels meets the definition found in IL 62 1701 which defines an intermittent stream as ""Intermittent stream" A stream or reach of a**

stream that drains a watershed of at least one square mile; or a stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge." These two channels have a drainage area of approximately 40.58 acres (cumulatively) or 0.06 square miles at the downstream end. Additionally, no groundwater influence can be observed within these channels. One area of affect will occur within the buffer zone of an intermittent or perennial stream along the north portion of the project area. The stream resources within the project area are shown on Drawing No. B08-467-E20 contained within Attachment II.9 and riparian buffer zone with areas of encroachment has been shown on Map 6 SF. This area of intrusion into the buffer zone must occur in order to allow for drainage from Pond No. 9 into offsite drainage features.

The surface water sampling sites are the approved NPDES outfalls for the NPDES Permit No. IL0077666. This NPDES permit is for the adjacent permit which is used to dispose of the same refuse which is proposed to be disposed of at this site. Therefore, the water quality is assumed to be similar to that which will occur at this site.

2) Provide for surface water bodies listed under 2)(c)(1) above information on surface water quality and quantity sufficient to demonstrate seasonal variation and water usage.

a) Water quality description shall include at a minimum, baseline information as follows:

pH
total suspended solids
total dissolved solids
alkalinity
acidity
sulfates
total iron
total manganese
total chlorides

RESPONSE: **See Attachment III.2.C.2. for baseline monitoring information of surface water streams in the permit area.**

b) Water quantity description shall include at a minimum base information on seasonal flow rates.

RESPONSE: **See Attachment III.2.C.2. for information on flow rates during the monitoring period. The data reflect significant periods of "no flow" that are typical of ephemeral headwater steams in the area. Most of the streams only flow in direct response to rainfall. Thus, the flow rates vary depending on the size of the watershed, antecedent moisture conditions and the amount of precipitation.**

D) Protection of Hydrologic Balance

1) The applicant shall provide a determination of the probable hydrologic consequences, (PHC) on the proposed permit area, proposed shadow area, and adjacent areas with respect to the hydrologic regime and water quality and quantity in surface and ground

water systems under all seasonal conditions. The determination of PHC shall include findings on the following:

a) Will the proposed operation have adverse impacts to the hydrologic balance;

RESPONSE: **Construction of the proposed Coal Refuse Disposal Facility No. 3 will disturb the land surface and will inevitably result in some changes to the surface water and ground water systems due to changes in drainage patterns and storm water runoff characteristics. However, the proposed surface facility has been designed to minimize potential changes to the prevailing hydrologic balance within the permit and adjacent area.**

Existing surface water runoff from the permit area is primarily in a northerly direction through unnamed tributaries of Pond Creek and then westwardly to the Big Muddy River. Surface water will be directed through a constructed sedimentation structure which surrounds the refuse facility to an unnamed tributary of Pond Creek. This structure is designed to provide stormwater and sediment control for the entire refuse disposal facility.

The effects on surface water quality are expected to be negligible in part because the impoundment comprises a large portion of the permit area and provides additional stormwater and sediment control during its operation (approximately 86 acres of the 263.44 permitted acres or 32.6%). This will minimize the contribution of suspended solids into surface water. The remaining area, which is primarily the outslopes of the dam will be directed to the sedimentation structure prior to off-site discharge. Impoundment construction activities will expose coal refuse to oxygen and surface water, which may increase the total dissolved solids in surface runoff. However, the coarse coal refuse is continuously being deposited and is being compacted as it is placed which minimizes the contact time with oxygen and water. During site reclamation, coal refuse is to be covered with soil to minimize contact with precipitation, surface water runoff and oxygen. Should runoff from the refuse disposal area develop acidic characteristics, the runoff will be neutralized to meet water quality standards prior to discharge from the sediment control system.

The potential development of acidic conditions is to be monitored through the routine sampling and analyses of discharge from Outlet 009 in accordance with the facility's NPDES permit. Should a trend indicating declining pH values become apparent, a treatment plan will be developed which may include one or a combination of the following actions:

- **Addition of alkalinity to coarse refuse by application and incorporation of agricultural or ground limestone or hydrated lime at an appropriate rate to neutralize the acidity.**

- **Addition of sodium hydroxide or hydrated lime to the sediment control structure at appropriate rates sufficient to neutralize the acidity.**

During refuse disposal and reclamation activities, erosion and sediment control measures are to be utilized in disturbed areas in order to minimize potential contamination of surface water runoff. During refuse disposal operations, sediment loading could improve over pre-mining conditions as a result of utilizing best management practices such as establishing and maintaining vegetative cover in areas that are currently cropland, construction of sedimentation structures, and decreasing peak flows and velocities by

retaining storm water runoff in the impoundment. As a result of the increased mineralization discussed above, which tends to cause fine suspended particles to coalesce and settle, suspended solids may be lowered as a result of the proposed activities. Flocculants or coagulants may be used if necessary. Runoff from within the permit area which has the potential to come into contact with coal refuse will pass through the approved sedimentation control structure prior to release from the permit area.

Surface Facility Impacts to Groundwater

Facility design includes the construction of maintaining a minimum of 4 feet of in situ clay in the coal refuse disposal area and the sedimentation control structure that receives runoff from the coal refuse disposal area. This clay will minimize vertical percolation of precipitation and surface water which comes into contact with coal refuse and consequently minimize impacts to groundwater. The thickness of the clay, proposed grades for construction of Refuse Area No. 3, and permeability of the in situ clays are shown on Drawing No. B12-271-E15 entitled, "Geologic Cross Section AA-AA'", Drawing No. B12-271-M17 entitled, "Geologic Cross Section I-I'", Drawing No. B12-271-M18 entitled, Geologic Cross Section J-J'", and Drawing No. B12-271-M19 entitled, "Geologic Cross Section K-K'". Although sandstone exists in the permit area, it is discontinuous and generally less than 10 feet in thickness in areas where it exists. Drawing No. B12-271-E14 entitled, "Sandstone Unit Isopach Map" exhibits that unit's thickness. Groundwater in the permit area flows primarily to the north as shown on Drawing No. B12-271-E17 entitled, "Potentiometric Surface/Water Table Map for Groundwater Levels Recorded on February 27, 2014".

During final reclamation of the site, coal refuse is to be covered with clean soil which will minimize infiltration and consequently minimize impacts to groundwater resources (refer to Part V for details).

Existing Groundwater Quality

Groundwater quality sampling and laboratory analysis has been performed for seven (7) groundwater monitoring wells (GW-8R, GW-10, GW-11, GW-12, GW-13, GW-14 and GW-28) located at/near proposed RDA No. 1. The location of each of these wells is presented upon the Geologic Cross Sections Location Map (Drawing No. B12-271-E1). Submitted are laboratory analytical reports for these samples, which were collected on a quarterly basis spanning the third and fourth calendar quarters of 2013 and the first and second quarters of 2014. Excepting only GW-8R which was dry during the third and fourth quarter 2013 sampling events, all other wells were recorded as having water present for sampling during the year.

Based upon this suite of groundwater analyses, the pH of these wells was characteristically circum-neutral, with the highest pH in the data set measuring 7.5 and the lowest 6.6. As would be expected from that pH range, the groundwater has considerably higher alkalinity in comparison to acidity. Alkalinity ranged from a high of 800 to a low of 190 mg/L; and, acidity spanned from <10 up to 150 mg/L. Hardness is very high in all samples, with a low of 292 and high of 3800 mg/L. Total dissolved solids (TDS) and sulfates were also characteristically high to very high, with TDS spanning between a low of 638 and high of 5736 mg/L and sulfates between a low of 284 and high of 3730 mg/L. Total iron was variable even on an intrawell basis, with same-well concentration ranging from below the method detection limit to a high of 3.072 mg/L in GW-14 during the year. Other wells too exhibited notable iron concentration fluctuations. Total manganese likewise exhibited variable intrawell concentration, along with considerable variability between wells. Both the sampling events where water was present in well GW-8R

exhibited high total manganese, with reporting of 7.107 and 9.124 mg/L. In the other wells, total manganese values spanned from below the method detection limit up to 8.630 mg/L. In collective consideration of the aforementioned parameters and concentrations, the existing shallow groundwater quality on/near proposed RDA No. 3 is regarded to be poor.

A groundwater monitoring program will be in place during facility operations and following closure of the facility. This system of monitoring wells is intended to detect facility impacts on the uppermost aquifer. Detection and confirmation of potential facility impact will promulgate an investigation and assessment of the impact. If facility operations are confirmed to be the cause of the impact, operations are to be modified and/or remediation is to occur, if warranted.

Cumulative Hydrogeologic Impact Areas – The cumulative impact area (CIA) is defined as the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface and groundwater systems. The cumulative impact areas as described below have been identified on a topographic map presented on Drawing No. B12-271-E16.

The receiving streams for the proposed permit area and adjacent, currently permitted area are unnamed tributaries of Pond Creek.

Discharge into the Pond Creek is approximately 0.5 miles downstream of the permit area. The drainage basin for Pond Creek is estimated to be approximately 8,036.34 acres above the confluence of the unnamed tributary containing the discharge of Outlet 009. Considering a total proposed permit area of 679.49 acres, the permit area represents approximately 11.2% of the Pond Creek drainage basin to the point of discharge, and less than 1% of the entire Pond Creek drainage area (65,475 acres) to the Big Muddy River. The sediment control structure outlet and the drainage areas have been shown on Drawing No. B12-271-E16 entitled, "Cumulative Impact Areas".

Groundwater recharge for the shallow aquifer within the permit area is primarily through surface water percolation. Piezometric mapping suggests groundwater flow within the upper aquifer generally conforms to topographic conditions, and as such shallow groundwater flow in the permit area, and adjacent areas is expected to generally conform to surface drainage conditions. Accordingly, the groundwater CIA for the Pond Creek Mine permit area is established to coincide with the drainage area associated with the watersheds of the unnamed tributaries associated with the permit areas.

No other active mining operations are known to exist within the CIA, and no future mining operations within the CIA are known to be proposed.

Descriptions of hydrogeologic and hydrologic conditions within the cumulative impact areas, characterization of surface water and groundwater systems, material damage criteria, and discussions of designs to prevent material damage have been presented in other sections of this permit application.

b) Are acid forming or toxic forming materials present that could result in contamination of surface and/or ground water supplies;

RESPONSE: Potentially acid-forming strata consist of the refuse produced as a result of the coal cleaning process. Results of acid base accounting for the coarse and fine coal refuse are

contained in Attachment III.2.A.2. The coarse coal refuse has a slight deficiency and the fine coal refuse has an excess calcium carbonate equivalency. The fine coal refuse has a high pH and the coarse coal refuse has a slight deficiency.

c) Will the proposed operation result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for legitimate purposes; and

RESPONSE: As stated in Part III.2.D.1.a. and b. above, the proposed operation is not expected to contaminate, reduce, or interrupt any underground or surface source of water of anyone within the permit or adjacent areas.

d) What impact(s) will the proposed operation have on including, but not limited to the following parameters:

RESPONSE: The following discussions generally address impacts associated with the proposed coal refuse disposal facility.

i) Sediment yield from the disturbed area;

RESPONSE: Sediment yield will increase somewhat from the disturbed area during construction of the facilities and during the ongoing mining and reclamation activities. However, sediment control structure will limit the off-site sediment movement to an acceptable amount. The sediment control structure will be constructed and maintained to insure the effluent standards will be met. Within a few years after the operation has ceased and reclamation is completed, sediment yield is expected to return to approximate pre-mining levels.

ii) Acidity;

RESPONSE: Acidity levels are expected to be only slightly increased by the proposed mining operation.

iii) Total suspended solids;

RESPONSE: Total suspended solids, like sediment yields, will increase somewhat during mining and early reclamation activities. However, drainage from disturbed areas will be passed through a sediment control structure to insure effluent standards will be met. Within a few years after mining has ceased and reclamation is completed, total suspended solids should return to approximate pre-mining levels. Post-mining suspended solids concentrations may actually be lower due to the conversion of some pre-mining cropland areas to other land uses that are less susceptible to erosion.

iv) Total dissolved solids;

RESPONSE: Total dissolved solids will increase in both groundwater and surface water. Major ions will be calcium, magnesium, bicarbonate and sulfate. While slight increases may be experienced, the water quality is expected to meet the applicable surface and/or groundwater quality standards.

v) Flooding or stream flow alterations;

RESPONSE: Proposed activities should not cause or aggravate downstream flooding. A relatively small portion of the total Unnamed Tributary of Pond Creek watershed will be affected. The

facility has been laid out and designed to minimize impacts to stream flows.

vi) Availability of surface and ground water; and

RESPONSE: The proposed operation is not expected to alter the availability of surface or ground water.

2) The Department will review permit revision applications to determine whether a new or updated PHC determination will be needed. Prior to submission of a permit revision application, applicants must contact the Department for this determination. Sufficient information on the proposed revision must be submitted with the request for the PHC determination to allow the Department to make its determination.

RESPONSE: This application is for a revision of an existing permit.

3) Surface Water Monitoring Program

a) Has an N.P.D.E.S. permit been applied for? Yes __X__ No _____

RESPONSE: NPDES permit application will be submitted to IEPA for review.

b) 1) Has an N.P.D.E.S. permit been obtained? Yes_____ No _X_____

If yes, give the permit number, the date issued, the expiration date, and the number of discharge points monitored. If additional discharge points are proposed by this application, list discharge numbers. Locate on the Water Monitoring Map and number all discharge points for the proposed permit area.

2) In accordance with 35 Ill. Adm. Code 406.101(b), is the applicant requesting that monitoring and reporting be on the basis of grab samples?

Yes __X_____ No _____

c) Are N.P.D.E.S. reports to be submitted to satisfy the reporting requirements?

Yes __X_____ No _____

If yes, provide the NPDES monitoring program including sampling method, sampling frequency and parameters to be analyzed. If not, submit a proposed monitoring and reporting program. Discharge information sheet is given in Schedule A and/or form 2C or 2D. Schedule A should be completed for all proposed discharge points. An estimate of the expected discharge concentration for each listed parameter must be indicated (or marked N/A) and a basis for that estimation provided.

RESPONSE: Refer to Schedule A for the expected discharge concentrations for each listed parameter.

If ammonia is to be utilized in wastewater treatment, indicate the discharge(s) resulting from this treatment and provide an estimate of the expected concentration (mg/1) of ammonia nitrogen (as N) from the discharge(s).

RESPONSE: N/A. Ammonia will not be used for the treatment of wastewater.

d) Give a brief description of the water sampling and flow measurement equipment which will be used to monitor the discharges.

RESPONSE: **Water samples will be grab samples. Discharge rates will be estimated from observations of flow depth and velocity at the discharge tubes, outflow channels, or other structures at the time of sampling.**

e) List the name and address of the laboratories which will perform the effluent and ground water sampling analyses.

RESPONSE: **Summit Environmental Services, Inc.**
17650 Route 37
West Frankfort, IL 62896

f) Discuss the expected impact this mining operation will have on surface water flows and quality and the effect this will have on downstream water uses.

RESPONSE: **There are no known downstream water users on Pond Creek. However, during construction of the refuse facility, the operation is expected to have an attenuating effect on the peak discharges of surface water flows in streams downstream of the mine due to the retention of surface water runoff in sedimentation ditches. The effects on water quality will be negligible because the percentage of the watershed to be disturbed by the mining operation is small compared to the total watershed of receiving stream. Erosion and sediment control measures will be applied to minimize contamination of surface runoff. Sediment loading in wet weather may actually improve over pre-mining conditions as a result of good management practices by establishing and maintaining vegetative cover in areas that are currently cropland, construction of sedimentation ditches, and decreasing peak flows and velocities by intercepting and retaining storm water runoff. Runoff from disturbed areas will pass through properly designed and approved sediment ditches before release and will meet appropriate quality criteria (NPDES). Therefore, downstream water uses should not be adversely impacted.**

g) Is this proposed mining area covered by existing IEPA Subtitle D permits?
Yes _____ No _X_____

If yes,
1) List the permit number(s)

_____

_____

_____

2) Do the proposed mining boundaries exactly coincide with IEPA permitted boundaries?

Yes _____ No _____

(If no, delineate the IEPA Subtitle D permitted boundaries on the Water Monitoring Map).

h) Are the TDS related conditions requested under 35 Ill. Adm. Code 406.203 (from water quality requirements of Subtitle 3 for the discharge of total dissolved solids, chloride, sulfate, iron and manganese)?

Yes __X__ No _____

If yes, provide the following:

1) Show that the discharge(s) will not cause an adverse effect on the environment in and around the receiving stream, by either:

RESPONSE: Information and demonstrations will be submitted as required by IEPA.

a) Demonstrating that the discharge will contain a concentration less than or equal to 3,500 mg/1 sulfate and 1,000 mg/1 chloride; or,

RESPONSE: By utilizing sound engineering and mining practices, no adverse effects on the environment or in the vicinity of the receiving stream should occur. There are no public water supplies near the proposed Coal Refuse Disposal Facility No. 3; therefore no adverse effects are anticipated. By complying with the effluent limitations, the minimization of total dissolved solids, chloride, sulfate, iron and manganese will be achieved.

b) through actual stream studies.

2) Show that the discharge(s) will not adversely affect any public water supply.

RESPONSE: There no known public water supplies located near the refuse disposal facility. The public water supply for this area originates from Rend Lake, over 10 miles to the northwest.

3) Provide a detailed discussion of how you intend to comply with the good mining practices of 35 Ill. Adm. Code 406.204.

RESPONSE: The Proposed Coal Refuse Disposal Facility No. 3 has been designed so that all surface runoff from the refuse area will be collected and routed to a sediment control structure for treatment prior to release. Water quality will be monitored to insure that all discharges from the refuse area comply with the NPDES effluent limitations prior to discharge. Covering the refuse disposal area with soil material will protect the refuse material from the effects of oxidation and erosion, which will minimize the potential for impacts to surface and ground water resources.

DISCHARGE LOCATION AND CHARACTERISTICS FOR NEW AND EXISTING MINES
SCHEDULE A *

Discharge # **	009				
Quarter Section	NW				
SECTION	7				
Township	T8S				
Range	R4E				
County	Williamson				
Average Flow (gpd) if discharge does not result from precipitation.	Precipitation				
Max Flow (gpd) if discharge does not result from precipitation.	Precipitation				
Source of Discharge (e.g. pit pumpage, processing plant circuit, surface runoff, etc.)	Surface Runoff				
Sampling Method (24 hr. composite, grab, est., etc.)	Grab				
Acidity (mg/l)	30-905				
Alkalinity (mg/l)	200				
Lead (mg/l)	0.5				
Iron (mg/l)	3 - 6				
Manganese (mg/l)	4				
pH (range)	6 - 9				
Zinc (mg/l)	0.5 – 1.0				
Fluoride (mg/l)	1.0				
Total Suspended Solids (mg/l)	35 - 70				
Sulfate (mg/l)	2100				
Total Dissolved Solids (mg/l)	3500				
Chloride (mg/l)	1000				
Receiving Stream	Unnamed				
Tributary to	Pond Creek				
Tributary to	Big Muddy River				
Tributary to	Mississippi River				

* If application is for NPDES permit USEPA form 2C or 2D may also be required.

** Discharge # should correspond with NPDES discharge number and shall be shown on the mine operations map.

4) Ground Water Monitoring Program

a) Describe in detail a proposed monitoring plan that will measure the amount and duration of any changes to the ground water system resulting from the mining operation. Parameters to be monitored are given in Schedule B. Monitoring should be on a quarterly basis with reports due within one month of the end of each quarter as follows:

Quarter	Report Due
January, February, March	May 1
April, May, June	August 1
July, August, September	November 1
October, November, December	February 1

RESPONSE: Five (5) monitoring wells (GW-8R, GW-12, GW-13, GW-14, and GW-28) have been installed at the perimeter of the surface effects area to gather baseline information about the shallow ground water resources in the permit area. During construction of the proposed coal refuse facility, GW-14 will be capped and sealed and subsequently covered with refuse. Additional information is provided in Schedule B.

Additional wells may be installed in the future if necessary to demonstrate compliance with the established ground water quality standards. Future wells will be located and installed at prescribed distances from regulated activities. Samples will be collected and preserved in accordance with IEPA standards and delivered to the laboratory for analysis. Quarterly water quality reports will be prepared and submitted to the Department within one month of the end of each calendar quarter in accordance with the prescribed reporting period.

As discussed extensively in prior permits, additional drilling has been performed to verify the presence of a band of sandstone approximately 10 foot thick, which according to the Regulation 620.210 a) 3) may indicate a potential potable resource groundwater aquifer. The sandstone was logged in Drill Hole 8312CG located near the mouth of the slope entry. Using a thin band of coal located beneath the sandstone as a geologic marker, the additional drill holes have been drilled within the boundary of the Proposed Coal Refuse Disposal Facility No. 3. The new boreholes have been mapped and connected to the previous geologic sections located on Permit 375.

Refer to Attachment IV.3.A.3. for the boring logs, permeability test results, pictures of the rock cores, general notes, and the unified soil classifications.

b) Provide a drilling log and completion information and/or a diagram of each well proposed as a monitoring well.

RESPONSE: Refer to Attachment IV.3.A.3

c) Locate wells and springs, on or within 1/2 mile of the permit area and shadow area on a hydrologic map. If any of these wells are to be employed for monitoring, designate on hydrologic map and complete Schedule B.

RESPONSE: **Refer to Map 4 SF, Hydrogeologic Map (Drawing No. B12-271-M23)**

d) Discuss any reported problems of maintenance, or ground water quantity and quality which have occurred at the wells and springs listed above.

RESPONSE: **There are no known or reported water quality problems that have occurred.**

e) Will this operation have any discharges to, or pump water from abandoned underground mines?

Yes _____ No **X**

If yes, submit a detailed discussion.

SCHEDULE B

Designated # (Shown on Map)	GW-12	GW-13	GW-14	GW-8R	GW-28
Ownership: Name & Address	Williamson Energy LLC P.O. Box 99, Johnston City, IL 62951	Williamson Energy LLC P.O. Box 99, Johnston City, IL 62951	Williamson Energy LLC P.O. Box 99, Johnston City, IL	Williamson Energy LLC P.O. Box 99, Johnston City, IL 62951	Williamson Energy LLC P.O. Box 99, Johnston City, IL
Legal Location	NW,NW Sec. 12, T.8S, R.3E	NW,NE Sec. 12, T.8S, R.3E	NW,NW Sec. 12, T.8S, R.3E	NW,NE Sec. 12, T.8S, R.3E	NW,NE Sec. 12, T.8S, R.3E
Ground Elevation (MSL)	435.25	441.57	455.56	482.5	467.73
Water Elevation (MSL)	431.34	424.07	450.12	462.73	459.85
Water Bearing Strata	Shallow Unconsolidated	Shallow Unconsolidated	Shallow Unconsolidated	Shallow Unconsolidated	Shallow Unconsolidated
Type & Size of Casing	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Type & Capacity of Pump	N/A	N/A	N/A	N/A	N/A
Pumping Rate (gpm) /drawdown (ft)	N/A	N/A	N/A	N/A	N/A
Type of Pipe	N/A	N/A	N/A	N/A	N/A
Point of Sampling	Bailer	Bailer	Bailer	Bailer	Bailer
Water Quality:	Average	Average	Average	Average	Average
Calcium (mg/l)	N/A	N/A	N/A	N/A	N/A
Iron (mg/l)	<0.148	<0.126	<0.167	0.46	1.037
Magnesium (mg/l)	N/A	N/A	N/A	N/A	N/A
Manganese (mg/l)	<0.375	<2.49	<0.955	4.55	4.015
Sodium (mg/l)	N/A	N/A	N/A	N/A	N/A
Zinc (mg/l)	<0.005	<0.003	<0.072	<0.34	0.020
Chloride (mg/l)	73.12	70.34	118.308	59.90	78.5
Fluoride (mg/l)	<0.44	<0.53	1.45	0.86	0.97
Nitrate (mg/l)	N/A	N/A	N/A	N/A	N/A
Sulfate (mg/l)	191.67	567.50	1983.00	2225.00	2416.40
Acidity (mg/l)	<38.96	<15.67	23.13	184.00	83.90
Alkalinity (mg/l)	319.17	348.88	406.13	544.00	478.60
Total Hardness (mg/l as $CaCO_3$)	391.04	<423.45	2167.71	2488.00	899.11
Total Dissolved Solids (ROE)	700.75	1010.92	3875.50	3209.50	2957.00
Conductivity	N/A	N/A	N/A	N/A	N/A
Field pH	6.90	7.21	7.05	6.70	6.97
Field Temperature (deg. F)	N/A	N/A	N/A	N/A	N/A

5) Identify the general land uses of the watersheds upstream of the proposed permit area and any potential pollution sources which could significantly affect the stream quality at the mine area.

RESPONSE: The upstream and adjacent land uses include pasture, forest, cropland and rural residential. There are no known sources of pollution that could significantly affect stream quality. Runoff from agricultural fields could contain herbicides and pesticides used using in the farming operations. There is an existing coal refuse.

6) Provide names and addresses of all public water supplies within ten miles of the proposed permit boundaries.

Name	Location	Distance from Mine Boundary	Type (surface or well)
Corinth Water District	**21551 Corinth Rd. Thompsonville, IL 62890**	**0.25 miles**	**Surface**

RESPONSE: The permit area is served with public utility water by the Corinth Water District. The source of the water supply for Corinth Water District is Rend Lake, which is more than 10 miles from the permit area. There are no other known public water supply sources within ten miles of the permit boundary.

7) Discuss the possible effects that this mining operation will have on the above-listed public water supplies and explain what precautions will be taken to prevent an adverse impact from occurring.

RESPONSE: No impacts are expected since Rend Lake is not located within the direct watershed of Pond Creek and the Saline River.

8) Locate on the hydrologic map or other designated map all private water supplies and private water wells within 1/2 mile of permit area and within the permit and shadow areas itself.

RESPONSE: Refer to Map 4 S.F. Hydrogeologic Map (Drawing No. B12-271-M23).

9) Locate on the hydrologic map existing surface and ground water discharges into underground mines.

RESPONSE: There are no known discharges into underground mines.

10) Provide the locations of water supply intakes for current users of surface water flowing into, out of, and within a hydrologic area defined by the Department.

RESPONSE: There are no known water supply intakes for current users of surface water flowing into, out of, and within a hydrologic area defined by the Department. Area domestic water use through the Public Service Districts is sourced from the Rend Lake watershed.

ATTACHMENT III.2.A.2

ACID BASE ACCOUNTING

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

August 19, 2014

Project No. B06-328-1444

Mr. Scott K. Fowler, Supervisor
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
One Natural Resources Way
Springfield, IL 62702-1271

Transmittal
Dam ID No. DS2008111
Pond Creek Mine Complex
Phase 2
Williamson Energy, LLC
Johnston City, Illinois

Dear Mr. Fowler:

Pursuant to your request, please find enclosed the lab analyses for the coarse and fine coal waste sampled for the Pond Creek Mine Complex, Permit 375.

Thank you for your cooperation.

Sincerely,

WILLIAMSON ENERGY, LLC

James Plumley
Authorized Agent

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy

Mach Coarse Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15526	#1	5yr/7/1	moderate	2.0305*	63.4531	50.0000	13.4531	-0-	6.94

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base (1) B06-328-1444,6-26-14

Respectively Submitted: John A. Brown

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8877
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

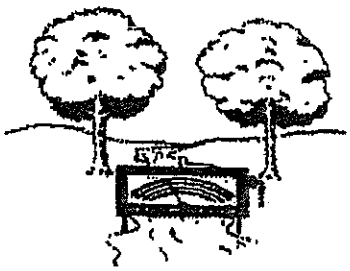
Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy
Mach Coarse Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15526	#1	2.0305	0.3954	0.0975	2.5234

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form(1) B06-328-1444,8-26-14

Respectively Submitted: John a. Brum



Appalachian Laboratories, Inc.

P.O. BOX 592
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

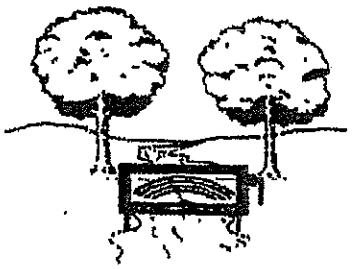
Williamson Energy

Mach Coarse Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15529	#4	5yr/7/2	slight	0.4809*	15.0281	3.2500	11.7781	-0-	4.44

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base (4) B06-328-1444,8-26-14

Respectively Submitted: John A. Brown



Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

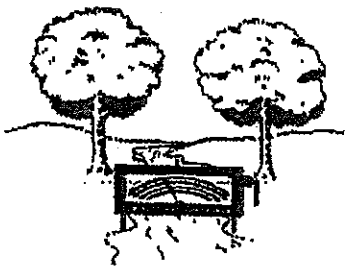
Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy
Mach Coarse Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15629	#4	0.4809	0.4235	2.5479	3.4523

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form (4) B06-328-1444,6-26-14

Respectively Submitted: John A. Brown



Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy

Mach Coarse Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15530	# 6	10yr/5/1	slight	1.6210*	50.6563	17.5000	33.1563	-0-	5.11

*Calculated from the Pyritic Sulfur Content
See Attachment

Acid base (5) B06-328-1444,6-26-14

Respectively Submitted: John A. Brum

Appalachian Laboratories, Inc.

P.O. BOX 382
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-6677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

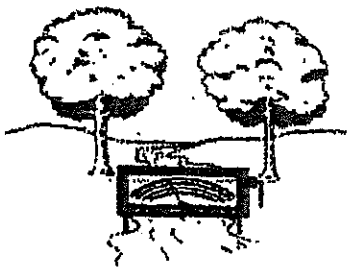
Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy
Mach Coarse Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15530	# 5	1.6210	0.6258	1.3276	3.5744

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form (6) B06-328-1444,6-26-14

Respectively Submitted: John A. Brum



Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy

Mach Coarse Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15531	#6	10yr/5/1	slight	3.6059*	112.6844	22.2500	90.4344	-0-	5.70

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base (6) B06-328-1444,6-26-14

Respectively Submitted: John A. Brown

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8877
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 6/26/2014
Date Received: 7/8/2014
Date Analyzed: 7/14/2014

Williamson Energy
Mach Coarse Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15531	#6	3.6059	0.7824	1.4470	5.8353

*Calculated from the Pyritic Sulfur Content
See Attachment

Respectively Submitted: John a. Brown

Appalachian Laboratories, Inc.

P.O. BOX 592
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5

Fine Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15539	# 1	7.5yr/3/1	moderate	1.4517*	46.3656	65.0000	-0-	19.6344	7.71

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base B06-328-1444 (1),7-14-14

Respectively Submitted: John A. Brum

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5
Fine Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15539	#1	1.4517	0.5330	<0.0001	1.9847

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form B06-328-1444 (1),7-14-14

Respectively Submitted: John a. Brown

R09724

Appalachian Laboratories, Inc.

P.O. BOX 982
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5

Fine Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15540	# 2	7.5yr/3/1	moderate	1.1990*	37.4688	58.7500	-0-	21.2812	7.61

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base B06-328-1444 (2),7-14-14

Respectively Submitted: John A. Brum

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5
Fine Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
16540	#2	1.1990	0.4715	0.0786	1.7491

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form B06-328-1444 (2),7-14-14

Respectively Submitted: John a. Brun

R09726

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8877
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5

Fine Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
16541	# 3	7.5yr/3/1	moderate	1.5271	47.7219	62.5000	-0-	14.7781	7.63

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base B06-328-1444 (3),7-14-14

Respectively Submitted: John A. Brown

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5
Fine Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
16541	# 3	1.5271	0.5128	0.0362	2.0761

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form B06-328-1444 (3),7-14-14

Respectively Submitted: John A. Brum

R09728

Appalachian Laboratories, Inc.

P.O. BOX 382
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5

Fine Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15542	# 4	7.5yr/3/1	moderate	0.9282*	29.0063	55.0000	-0-	25.9937	7.84

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base B06-328-1444 (4),7-14-14

Respectively Submitted: John A. Brown

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5
Fine Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15542	#4	0.9282	0.3626	0.1775	1.4683

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form B06-328-1444 (4),7-14-14

Respectively Submitted: John G. Brum

Appalachian Laboratories, Inc.

P.O. BOX 382
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5
Fine Coal Refuse
B06-328-1444
%
SULFUR FORMS

Lab No.	I.D. No.	% Pyritic Sulfur	% Organic Sulfur	% Sulfate Sulfur	% Total Sulfur
15543	# 5	1.0279	0.4302	0.0264	1.4845

*Calculated from the Pyritic Sulfur Content
See Attachment
sulfur form B06-328-1444 (5),7-14-14

Respectively Submitted: John a. Brin

R09731

Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Alliance Consulting
124 Philpott Lane
Beaver, WV 25813

Date Sampled: 7/14/2014
Date Received: 7/29/2014
Date Analyzed: 7/30/2014

Mach Mining 5

Fine Coal Refuse
B06-328-1444
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

Lab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
15543	# 5	7.5yr/3/1	moderate	1.0279*	32.1219	55.0000	-0-	22.8781	7.79

*Calculated from the Pyritic Sulfur Content
See Attachment
Acid base B06-328-1444 (5),7-14-14

Respectively Submitted: John a. Brown

PART III ATTACHMENT III.2.A.3 – SULFUR FORMS

PRECISION Testing Laboratory
COAL ANALYSIS, INSPECTION AND SAMPLING

P.O. BOX 1985, BECKLEY, WV 25802
1313 RITTER DRIVE, DANIELS, WV 25832

PHONE: (304) 252-2539
FAX: (304) 253-9425

COMPANY:	Steelhead Development Co., LLC	SAMPLE MARKED:
ADDRESS:	106 Lockheed Road Beaver, WV 25813	Core Sample Total Core No. 6
KIND OF COAL:	Raw Sample Composite	453.4' 461.1'
MINE:		
SAMPLED BY:	Steelhead Development Co., LLC	
DATE RECEIVED:	October 20, 2004	
DATE ANALYZED:	October 20, 2004	

COAL ANALYSIS -- LABORATORY NUMBER 215359

Sulfur Forms

% Total Sulfur	3.67
% Pyritic Sulfur	0.93
% Sulfate Sulfur	0.27
% Organic Sulfur	2.47

QUALITY ASSURANCE
Precision Testing Laboratory
ISO - 9001
Analytical Services To the Coal Industry

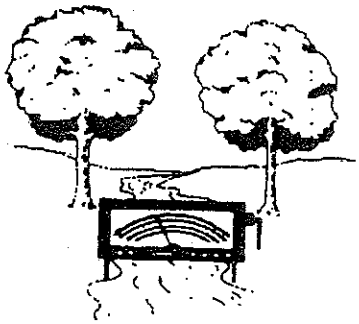
PRECISION TESTING LABORATORY

Steven H. Lilly, Laboratory Manager

This report shall not be reproduced in whole or in part without the Approval of Precision Testing Laboratory, Inc.

Attachment III.2.A.2

R09736



Appalachian Laboratories, Inc.

P.O. BOX 392
BECKLEY, WEST VIRGINIA 25802

PHONE 304-253-8677
FAX 304-253-4157
E-mail: applabs@charter.net

Client: Precision Testing
P.O. Box 1985
Beckley, WV 25802

Date Sampled: N/A
Date Received: 10/25/2004
Date Analyzed: 10/26/2004

STEELHEAD
CORE SAMPLE # 6 (Total Core)
ACID BASE ACCOUNTABILITY
CAC03 Equiv. (Tons/1000 Tons of Material)

ab No.	SAMPLE ID	Color	Fizz	% Sulfur	Max. From % Sulfur	Amount Present	Max. Needed pH 7	Excess	Paste pH
8640	#215359 Raw Composite	2.5/	none	0.9300*	29.0625	-14.5000	43.5625	-0-	6.98

*Calculated from the Pyritic Sulfur Content
See Attachment
ACID2,10-25-2004.xls

Respectively Submitted: John A. Brum

ATTACHMENT III.2.B.2

GROUND WATER MONITORING DATA

Groundwater Data Collection

1. Name of persons/organizations that collected groundwater well data:
   Tim Garland with Delta Engineering & Associates Inc. in Marion Illinois

2. Name of persons/organizations that analyzed groundwater well data:
   Data has consistently been analyzed by Summit Environmental Services, Inc. in Marion, Illinois.

3. Dates of collection of the data:
   See the attached spreadsheets

4. Dates of the analysis of the groundwater well data:
   See the attached spreadsheets

5. Description of the methodology used to collect the data:
   Samples have been consistently collected using the grab method.

6. Description of the methodology used to analyze the data:
   The samples have been analyzed using the EPA Method – see the attached lab data sheets for code for each sample.

Groundwater Well GW-8R

Sample Date	UNITS	8/15/2013	11/7/2013	2/27/2014	5/30/2014
TDS	mg/L	n/a	n/a	5712	5736
Ph	unit	n/a	n/a	6.8	6.9
ACIDITY	mg/L	n/a	n/a	150	150
ALKALINITY	mg/L	n/a	n/a	800	710
SULFATE	mg/L	n/a	n/a	3390	3500
CHLORIDE	mg/L	n/a	n/a	72	69
TOTAL HARDNESS	mg/L	n/a	n/a	3800	3800
IRON	mg/L	n/a	n/a	1.141	0.683
MANGANESE	mg/L	n/a	n/a	9.124	7.107

Groundwater Well GW-10

Sample Date	UNITS	8/15/2013	11/7/2013	2/27/2014	5/30/2014
TDS	mg/L	1404	1400	2636	2252
Ph	unit	7.2	7.2	7.3	7.3
ACIDITY	mg/L	23	16	54	12
ALKALINITY	mg/L	402	386	460	400
SULFATE	mg/L	850	608	944	850
CHLORIDE	mg/L	286	312	680	540
TOTAL HARDNESS	mg/L	995	760	1530	1250
IRON	mg/L	0.343	1.966	0.649	1.026
MANGANESE	mg/L	0.027	0.131	0.127	0.197

Groundwater Well GW-11

Sample Date	UNITS	8/15/2013	11/7/2013	2/27/2014	5/30/2014
TDS	mg/L	684	714	696	832
Ph	unit	7	7.3	7.4	7.3
ACIDITY	mg/L	23	<0.10	32	<0.10
ALKALINITY	mg/L	351	356	412	390
SULFATE	mg/L	362	346	284	300
CHLORIDE	mg/L	104	92	92	82
TOTAL HARDNESS	mg/L	350	292	336	336
IRON	mg/L	<0.006	0.05	0.042	0.073
MANGANESE	mg/L	<0.002	<0.002	0.023	<0.002

Groundwater Well GW-12

Sample Date	UNITS	8/15/2013	11/7/2014	2/27/2014	5/30/2014
TDS	mg/L	728	638	772	728
Ph	unit	6.7	7	7.1	6.8
ACIDITY	mg/L	25	30	16	50
ALKALINITY	mg/L	293	344	278	290
SULFATE	mg/L	352	353	402	340
CHLORIDE	mg/L	58	60	80	65
TOTAL HARDNESS	mg/L	500	404	424	460
IRON	mg/L	<0.006	0.06	0.06	0.08
MANGANESE	mg/L	1.21	0.28	0.14	1.58

Groundwater Well GW-13

Sample Date	UNITS	8/15/2013	11/7/2014	2/27/2014	5/30/2014
TDS	mg/L	926	836	972	1028
Ph	unit	7	7.1	7.3	7.1
ACIDITY	mg/L	21	48	24	36
ALKALINITY	mg/L	394	374	370	344
SULFATE	mg/L	574	499	561	540
CHLORIDE	mg/L	57	40	76	64
TOTAL HARDNESS	mg/L	854	650	656	700
IRON	mg/L	<0.006	0.06	0.35	1.48
MANGANESE	mg/L	2.63	4.48	1.05	0.71

Groundwater Well GW-14

Sample Date	UNITS	8/15/2013	11/7/2013	2/27/2014	5/30/2014
TDS	mg/L	3424	3350	3728	2664
Ph	unit	7	6.9	7.5	7.3
ACIDITY	mg/L	21	88	20	<10
ALKALINITY	mg/L	297	464	236	202
SULFATE	mg/L	3730	3260	2685	1800
CHLORIDE	mg/L	71	36	96	63
TOTAL HARDNESS	mg/L	1820	2300	1420	1000
IRON	mg/L	<0.006	3.07	1.29	0.10
MANGANESE	mg/L	0.18	1.38	0.05	<0.002

Groundwater Well GW-28

Sample Date	UNITS	8/15/2013	11/7/2013	2/27/2014	5/30/2014
TDS	mg/L	2328	1550	1516	5188
Ph	unit	6.6	6.7	7.3	7.3
ACIDITY	mg/L	43	40	20	90
ALKALINITY	mg/L	238	190	228	594
SULFATE	mg/L	2600	2020	1198	3350
CHLORIDE	mg/L	60	40	68	55
TOTAL HARDNESS	mg/L	2233	920	960	3600
IRON	mg/L	0.03	0.12	0.20	0.20
MANGANESE	mg/L	3.43	6.42	5.59	8.63

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15716-5
SAMPLE ID: GW 8R
DATE SAMPLED: 08/15/13

REPORT DATE: 08/27/13
COMMENT: DRY
SAMPLED BY: Client
DATE RECEIVED: 08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	*	mg/L	1	160.1	*
Total Suspended Solids	*	mg/L	1	160.2	*
pH	*	Unit		150.1	*
Acidity	*	mg/L	10	305.1	*
Alkalinity	*	mg/L	10	310.1	*
Chlorides	*	mg/L	1	325.3	*
Sulfates	*	mg/L	1	375.4	*
Hardness	*	mg/L	1	130.2	*
Fluoride	*	mg/L	0.01	340.2	*
Cyanide	*	mg/L	0.002	335.4	*
Phenols, Total Recoverable	*	mg/L	0.002	420.4	*
Aluminum	*	mg/L	0.030	202.1	*
Antimony	*	mg/L	0.040	204.1	*
Arsenic	*	mg/L	0.002	206.4	*
Barium	*	mg/L	0.020	208.1	*
Beryllium	*	mg/L	0.001	210.1	*
Boron	*	mg/L	0.500	212.3	*
Cadmium	*	mg/L	0.002	213.1	*
Chromium	*	mg/L	0.006	218.1	*
Cobalt	*	mg/L	0.005	219.1	*
Copper	*	mg/L	0.003	220.1	*
Iron, Total	*	mg/L	0.006	236.1	*
Iron, Dissolved	*	mg/L	0.006	236.1	*
Lead	*	mg/L	0.0075	239.1	*
Manganese, Total	*	mg/L	0.002	243.1	*
Manganese, Dissolved	*	mg/L	0.002	243.1	*
Mercury	*	mg/L	0.002	245.1	*
Molybdenum	*	mg/L	0.020	246.1	*
Nickel	*	mg/L	0.010	249.1	*
Selenium	*	mg/L	0.002	270.2	*
Silver	*	mg/L	0.002	272.1	*
Thallium	*	mg/L	0.020	279.1	*
Vanadium	*	mg/L	0.100	286.1	*
Zinc	*	mg/L	0.001	289.1	*

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-5
SAMPLE ID: GW 8R
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: DRY
SAMPLED BY: Client-TG
DATE RECEIVED: 11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	*	mg/L	1	160.1	*
Total Suspended Solids	*	mg/L	1	160.2	*
pH	*	Unit		150.1	*
Acidity	*	mg/L	10	305.1	*
Alkalinity	*	mg/L	10	310.1	*
Chlorides	*	mg/L	1	325.3	*
Sulfates	*	mg/L	1	375.4	*
Hardness	*	mg/L	1	130.2	*
Fluoride	*	mg/L	0.01	340.2	*
Cyanide	*	mg/L	0.002	335.4	*
Phenols, Total Recoverable	*	mg/L	0.01	420.4	*
Aluminum	*	mg/L	0.030	202.1	*
Antimony	*	mg/L	0.040	204.1	*
Arsenic	*	mg/L	0.002	206.4	*
Barium	*	mg/L	0.020	208.1	*
Beryllium	*	mg/L	0.001	210.1	*
Boron	*	mg/L	0.500	212.3	*
Cadmium	*	mg/L	0.002	213.1	*
Chromium	*	mg/L	0.006	218.1	*
Cobalt	*	mg/L	0.005	219.1	*
Copper	*	mg/L	0.003	220.1	*
Iron, Total	*	mg/L	0.006	236.1	*
Iron, Dissolved	*	mg/L	0.006	236.1	*
Lead	*	mg/L	0.0075	239.1	*
Manganese, Total	*	mg/L	0.002	243.1	*
Manganese, Dissolved	*	mg/L	0.002	243.1	*
Mercury	*	mg/L	0.002	245.1	*
Molybdenum	*	mg/L	0.020	246.1	*
Nickel	*	mg/L	0.010	249.1	*
Selenium	*	mg/L	0.002	270.2	*
Silver	*	mg/L	0.002	272.1	*
Thallium	*	mg/L	0.020	279.1	*
Vanadium	*	mg/L	0.100	286.1	*
Zinc	*	mg/L	0.001	289.1	*

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-5
SAMPLE ID: GW 8R
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 19.45'
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	6.8	Unit		150.1	2/27/14 TG
Acidity	150	mg/L	10	305.1	3/10/14 KE
Alkalinity	800	mg/L	10	310.1	3/10/14 KE
Chlorides	72	mg/L	1	325.3	3/10/14 KE
Sulfates	3,390	mg/L	1	375.4	3/7/14 KE
Hardness	3,800	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	5,712	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	46	mg/L	1	160.2	3/6/14 KE
Fluoride	2.36	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	1.141	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.287	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	9.124	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	6.599	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-5
SAMPLE ID: GW 8R
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 14.82'
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	6.9	Unit		150.1	5/30/14 TG
Acidity	150	mg/L	10	305.1	6/12/14 KE
Alkalinity	710	mg/L	10	310.1	6/12/14 KE
Chlorides	69	mg/L	5	325.3	6/9/14 AK
Sulfates	3,500	mg/L	5	375.4	6/12/14 AK
Hardness	3,800	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	5,736	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	205	mg/L	5	160.2	6/19/14 KE
Fluoride	1.19	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	0.060	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	0.683	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.077	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	7.107	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	2.261	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15716-7
SAMPLE ID: GW 10
DATE SAMPLED: 08/15/13

REPORT DATE: 08/27/13
COMMENT: 0.00'
SAMPLED BY: Client
DATE RECEIVED: 08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1,404	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	16	mg/L	1	160.2	08/19/13 KE
pH	7.2	Unit		150.1	08/15/13 TG
Acidity	23	mg/L	10	305.1	08/16/13 KE
Alkalinity	402	mg/L	10	310.1	08/16/13 KE
Chlorides	286	mg/L	1	325.3	08/19/13 KE
Sulfates	850	mg/L	1	375.4	08/19/13 KE
Hardness	995	mg/L	1	130.2	08/16/13 KE
Fluoride	0.74	mg/L	0.01	340.2	08/19/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	08/19/13 KE
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	08/21/19 KE
Aluminum	< 0.030	mg/L	0.030	202.1	08/27/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	08/27/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	08/27/13 JB
Barium	< 0.020	mg/L	0.020	208.1	08/27/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	08/27/13 JB
Boron	< 0.500	mg/L	0.500	212.3	08/27/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	08/27/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	08/27/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	08/27/13 JB
Copper	< 0.003	mg/L	0.003	220.1	08/27/13 JB
Iron, Total	0.343	mg/L	0.006	236.1	08/27/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	08/27/13 JB
Manganese, Total	0.027	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	08/27/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	08/27/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	08/27/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	08/27/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	08/27/13 JB
Silver	< 0.002	mg/L	0.002	272.1	08/27/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	08/27/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	08/27/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-7
SAMPLE ID: GW 10
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: 0.00'
SAMPLED BY: Client-TG
DATE RECEIVED: 11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1400	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	17	mg/L	1	160.2	11/11/13 KE
pH	7.2	Unit		150.1	11/7/13 TG
Acidity	16	mg/L	10	305.1	11/19/13 KE
Alkalinity	386	mg/L	10	310.1	11/19/13 KE
Chlorides	312	mg/L	1	325.3	11/12/13 KE
Sulfates	608	mg/L	1	375.4	11/14/13 KE
Hardness	760	mg/L	1	130.2	11/19/13 KE
Fluoride	0.50	mg/L	0.01	340.2	11/13/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	11/14/13 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	11/19/13 KE
Aluminum	< 0.030	mg/L	0.030	202.1	11/13/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	11/13/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	11/13/13 JB
Barium	< 0.020	mg/L	0.020	208.1	11/13/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	11/13/13 JB
Boron	< 0.500	mg/L	0.500	212.3	11/13/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	11/13/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	11/13/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	11/13/13 JB
Copper	< 0.003	mg/L	0.003	220.1	11/13/13 JB
Iron, Total	1.966	mg/L	0.006	236.1	11/13/13 JB
Iron, Dissolved	1.966	mg/L	0.006	236.1	11/13/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	11/13/13 JB
Manganese, Total	0.131	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	0.131	mg/L	0.002	243.1	11/13/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	11/13/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	11/13/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	11/13/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	11/13/13 JB
Silver	< 0.002	mg/L	0.002	272.1	11/13/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	11/13/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	11/13/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	3/12/14
PDL:	15923-7	**COMMENT:**	1.35'
SAMPLE ID:	GW 10	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	2/27/14	**DATE RECEIVED:**	2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	2/27/14 TG
Acidity	54	mg/L	10	305.1	3/10/14 KE
Alkalinity	460	mg/L	10	310.1	3/10/14 KE
Chlorides	680	mg/L	1	325.3	3/10/14 KE
Sulfates	944	mg/L	1	375.4	3/7/14 KE
Hardness	1,530	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	2,636	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	42	mg/L	1	160.2	3/6/14 KE
Fluoride	0.87	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	0.649	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.015	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	0.127	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.083	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-7
SAMPLE ID: GW 10
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 0.00'
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	5/30/14 TG
Acidity	12	mg/L	10	305.1	6/12/14 KE
Alkalinity	400	mg/L	10	310.1	6/12/14 KE
Chlorides	540	mg/L	5	325.3	6/9/14 AK
Sulfates	850	mg/L	5	375.4	6/12/14 AK
Hardness	1,250	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	2,252	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	27	mg/L	5	160.2	6/19/14 KE
Fluoride	0.29	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	1.026	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.089	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	0.197	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-8	**COMMENT:**	4.18'
SAMPLE ID:	GW 11	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	684	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	3	mg/L	1	160.2	08/19/13 KE
pH	7.0	Unit		150.1	08/15/13 TG
Acidity	23	mg/L	10	305.1	08/16/13 KE
Alkalinity	351	mg/L	10	310.1	08/16/13 KE
Chlorides	104	mg/L	1	325.3	08/19/13 KE
Sulfates	362	mg/L	1	375.4	08/19/13 KE
Hardness	350	mg/L	1	130.2	08/16/13 KE
Fluoride	0.60	mg/L	0.01	340.2	08/19/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	08/19/13 KE
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	08/21/19 KE
Aluminum	< 0.030	mg/L	0.030	202.1	08/27/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	08/27/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	08/27/13 JB
Barium	< 0.020	mg/L	0.020	208.1	08/27/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	08/27/13 JB
Boron	< 0.500	mg/L	0.500	212.3	08/27/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	08/27/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	08/27/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	08/27/13 JB
Copper	< 0.003	mg/L	0.003	220.1	08/27/13 JB
Iron, Total	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	08/27/13 JB
Manganese, Total	< 0.002	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	08/27/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	08/27/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	08/27/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	08/27/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	08/27/13 JB
Silver	< 0.002	mg/L	0.002	272.1	08/27/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	08/27/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	08/27/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-8
SAMPLE ID: GW 11
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: 4.36'
SAMPLED BY: Client-TG
DATE RECEIVED: 11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	714	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	< 1	mg/L	1	160.2	11/11/13 KE
pH	7.3	Unit		150.1	11/7/13 TG
Acidity	< 10	mg/L	10	305.1	11/19/13 KE
Alkalinity	356	mg/L	10	310.1	11/19/13 KE
Chlorides	92	mg/L	1	325.3	11/12/13 KE
Sulfates	346	mg/L	1	375.4	11/14/13 KE
Hardness	292	mg/L	1	130.2	11/19/13 KE
Fluoride	0.46	mg/L	0.01	340.2	11/13/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	11/14/13 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	11/19/13 KE
Aluminum	< 0.030	mg/L	0.030	202.1	11/13/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	11/13/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	11/13/13 JB
Barium	< 0.020	mg/L	0.020	208.1	11/13/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	11/13/13 JB
Boron	< 0.500	mg/L	0.500	212.3	11/13/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	11/13/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	11/13/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	11/13/13 JB
Copper	< 0.003	mg/L	0.003	220.1	11/13/13 JB
Iron, Total	0.050	mg/L	0.006	236.1	11/13/13 JB
Iron, Dissolved	0.050	mg/L	0.006	236.1	11/13/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	11/13/13 JB
Manganese, Total	<0.002	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	<0.002	mg/L	0.002	243.1	11/13/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	11/13/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	11/13/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	11/13/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	11/13/13 JB
Silver	< 0.002	mg/L	0.002	272.1	11/13/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	11/13/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	11/13/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-8
SAMPLE ID: GW 11
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 3.28'
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.4	Unit		150.1	2/27/14 TG
Acidity	32	mg/L	10	305.1	3/10/14 KE
Alkalinity	412	mg/L	10	310.1	3/10/14 KE
Chlorides	92	mg/L	1	325.3	3/10/14 KE
Sulfates	284	mg/L	1	375.4	3/7/14 KE
Hardness	336	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	696	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	1	mg/L	1	160.2	3/6/14 KE
Fluoride	0.45	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	0.042	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.012	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	0.023	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-8
SAMPLE ID: GW 11
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 3.98'
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	390	mg/L	10	310.1	6/12/14 KE
Chlorides	82	mg/L	5	325.3	6/9/14 AK
Sulfates	300	mg/L	5	375.4	6/12/14 AK
Hardness	336	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	832	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	7	mg/L	5	160.2	6/19/14 KE
Fluoride	0.02	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	0.073	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.054	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	< 0.002	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-9	**COMMENT:**	7.01'
SAMPLE ID:	GW 12	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	728	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	5	mg/L	1	160.2	08/19/13 KE
pH	6.7	Unit		150.1	08/15/13 TG
Acidity	25	mg/L	10	305.1	08/16/13 KE
Alkalinity	293	mg/L	10	310.1	08/16/13 KE
Chlorides	58	mg/L	1	325.3	08/19/13 KE
Sulfates	352	mg/L	1	375.4	08/19/13 KE
Hardness	500	mg/L	1	130.2	08/16/13 KE
Fluoride	0.47	mg/L	0.01	340.2	08/19/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	08/19/13 KE
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	08/21/19 KE
Aluminum	< 0.030	mg/L	0.030	202.1	08/27/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	08/27/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	08/27/13 JB
Barium	< 0.020	mg/L	0.020	208.1	08/27/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	08/27/13 JB
Boron	< 0.500	mg/L	0.500	212.3	08/27/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	08/27/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	08/27/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	08/27/13 JB
Copper	< 0.003	mg/L	0.003	220.1	08/27/13 JB
Iron, Total	0.083	mg/L	0.006	236.1	08/27/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	08/27/13 JB
Manganese, Total	1.211	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	1.211	mg/L	0.002	243.1	08/27/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	08/27/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	08/27/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	08/27/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	08/27/13 JB
Silver	< 0.002	mg/L	0.002	272.1	08/27/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	08/27/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	08/27/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-9
SAMPLE ID: GW 12
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: 6.27'
SAMPLED BY: Client-TG
DATE RECEIVED: 11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	638	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	2	mg/L	1	160.2	11/11/13 KE
pH	7.0	Unit		150.1	11/7/13 TG
Acidity	30	mg/L	10	305.1	11/19/13 KE
Alkalinity	344	mg/L	10	310.1	11/19/13 KE
Chlorides	60	mg/L	1	325.3	11/12/13 KE
Sulfates	353	mg/L	1	375.4	11/14/13 KE
Hardness	404	mg/L	1	130.2	11/19/13 KE
Fluoride	0.42	mg/L	0.01	340.2	11/13/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	11/14/13 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	11/19/13 KE
Aluminum	< 0.030	mg/L	0.030	202.1	11/13/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	11/13/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	11/13/13 JB
Barium	< 0.020	mg/L	0.020	208.1	11/13/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	11/13/13 JB
Boron	< 0.500	mg/L	0.500	212.3	11/13/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	11/13/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	11/13/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	11/13/13 JB
Copper	< 0.003	mg/L	0.003	220.1	11/13/13 JB
Iron, Total	0.061	mg/L	0.006	236.1	11/13/13 JB
Iron, Dissolved	0.061	mg/L	0.006	236.1	11/13/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	11/13/13 JB
Manganese, Total	0.277	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	0.176	mg/L	0.002	243.1	11/13/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	11/13/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	11/13/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	11/13/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	11/13/13 JB
Silver	< 0.002	mg/L	0.002	272.1	11/13/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	11/13/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	11/13/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-9
SAMPLE ID: GW 12
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 3.98'
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.1	Unit		150.1	2/27/14 TG
Acidity	16	mg/L	10	305.1	3/10/14 KE
Alkalinity	278	mg/L	10	310.1	3/10/14 KE
Chlorides	80	mg/L	1	325.3	3/10/14 KE
Sulfates	402	mg/L	1	375.4	3/7/14 KE
Hardness	424	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	772	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	15	mg/L	1	160.2	3/6/14 KE
Fluoride	0.58	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	0.055	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.040	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	0.144	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.041	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-9
SAMPLE ID: GW 12
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 5.66'
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	6.8	Unit		150.1	5/30/14 TG
Acidity	50	mg/L	10	305.1	6/12/14 KE
Alkalinity	290	mg/L	10	310.1	6/12/14 KE
Chlorides	65	mg/L	5	325.3	6/9/14 AK
Sulfates	340	mg/L	5	375.4	6/12/14 AK
Hardness	460	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	728	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	6	mg/L	5	160.2	6/19/14 KE
Fluoride	< 0.01	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	0.081	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.071	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	1.578	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	0.799	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15716-10
SAMPLE ID: GW 13
DATE SAMPLED: 08/15/13

REPORT DATE: 08/27/13
COMMENT: 17.15'
SAMPLED BY: Client
DATE RECEIVED: 08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	926	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	11	mg/L	1	160.2	08/19/13 KE
pH	7.0	Unit		150.1	08/15/13 TG
Acidity	21	mg/L	10	305.1	08/16/13 KE
Alkalinity	394	mg/L	10	310.1	08/16/13 KE
Chlorides	57	mg/L	1	325.3	08/19/13 KE
Sulfates	574	mg/L	1	375.4	08/19/13 KE
Hardness	854	mg/L	1	130.2	08/16/13 KE
Fluoride	0.64	mg/L	0.01	340.2	08/19/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	08/19/13 KE
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	08/21/19 KE
Aluminum	< 0.030	mg/L	0.030	202.1	08/27/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	08/27/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	08/27/13 JB
Barium	< 0.020	mg/L	0.020	208.1	08/27/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	08/27/13 JB
Boron	< 0.500	mg/L	0.500	212.3	08/27/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	08/27/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	08/27/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	08/27/13 JB
Copper	< 0.003	mg/L	0.003	220.1	08/27/13 JB
Iron, Total	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	08/27/13 JB
Manganese, Total	2.630	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	2.630	mg/L	0.002	243.1	08/27/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	08/27/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	08/27/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	08/27/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	08/27/13 JB
Silver	< 0.002	mg/L	0.002	272.1	08/27/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	08/27/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	08/27/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-10
SAMPLE ID: GW 13
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: 20.82'
SAMPLED BY: Client-TG
DATE RECEIVED: 11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	836	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	20	mg/L	1	160.2	11/11/13 KE
pH	7.1	Unit		150.1	11/7/13 TG
Acidity	48	mg/L	10	305.1	11/19/13 KE
Alkalinity	374	mg/L	10	310.1	11/19/13 KE
Chlorides	40	mg/L	1	325.3	11/12/13 KE
Sulfates	499	mg/L	1	375.4	11/14/13 KE
Hardness	650	mg/L	1	130.2	11/19/13 KE
Fluoride	0.50	mg/L	0.01	340.2	11/13/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	11/14/13 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	11/19/13 KE
Aluminum	< 0.030	mg/L	0.030	202.1	11/13/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	11/13/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	11/13/13 JB
Barium	< 0.020	mg/L	0.020	208.1	11/13/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	11/13/13 JB
Boron	< 0.500	mg/L	0.500	212.3	11/13/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	11/13/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	11/13/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	11/13/13 JB
Copper	< 0.003	mg/L	0.003	220.1	11/13/13 JB
Iron, Total	0.058	mg/L	0.006	236.1	11/13/13 JB
Iron, Dissolved	0.039	mg/L	0.006	236.1	11/13/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	11/13/13 JB
Manganese, Total	4.480	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	4.134	mg/L	0.002	243.1	11/13/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	11/13/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	11/13/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	11/13/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	11/13/13 JB
Silver	< 0.002	mg/L	0.002	272.1	11/13/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	11/13/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	11/13/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-10
SAMPLE ID: GW 13
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 14.28'
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	2/27/14 TG
Acidity	24	mg/L	10	305.1	3/10/14 KE
Alkalinity	370	mg/L	10	310.1	3/10/14 KE
Chlorides	76	mg/L	1	325.3	3/10/14 KE
Sulfates	561	mg/L	1	375.4	3/7/14 KE
Hardness	656	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	972	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	14	mg/L	1	160.2	3/6/14 KE
Fluoride	0.38	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	0.354	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.022	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	1.050	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.032	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-10	**COMMENT:**	13.72'
SAMPLE ID:	GW 13	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.1	Unit		150.1	5/30/14 TG
Acidity	36	mg/L	10	305.1	6/12/14 KE
Alkalinity	344	mg/L	10	310.1	6/12/14 KE
Chlorides	64	mg/L	5	325.3	6/9/14 AK
Sulfates	540	mg/L	5	375.4	6/12/14 AK
Hardness	700	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	1,028	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	12	mg/L	5	160.2	6/19/14 KE
Fluoride	0.13	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	1.477	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.092	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	0.711	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15716-12
SAMPLE ID: GW 28
DATE SAMPLED: 08/15/13

REPORT DATE: 08/27/13
COMMENT: 3.77'
SAMPLED BY: Client
DATE RECEIVED: 08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	2,328	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	3	mg/L	1	160.2	08/19/13 KE
pH	6.6	Unit		150.1	08/15/13 TG
Acidity	43	mg/L	10	305.1	08/16/13 KE
Alkalinity	238	mg/L	10	310.1	08/16/13 KE
Chlorides	60	mg/L	1	325.3	08/19/13 KE
Sulfates	2,600	mg/L	1	375.4	08/19/13 KE
Hardness	2,233	mg/L	1	130.2	08/16/13 KE
Fluoride	1.10	mg/L	0.01	340.2	08/19/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	08/19/13 KE
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	08/21/19 KE
Aluminum	< 0.030	mg/L	0.030	202.1	08/27/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	08/27/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	08/27/13 JB
Barium	< 0.020	mg/L	0.020	208.1	08/27/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	08/27/13 JB
Boron	< 0.500	mg/L	0.500	212.3	08/27/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	08/27/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	08/27/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	08/27/13 JB
Copper	< 0.003	mg/L	0.003	220.1	08/27/13 JB
Iron, Total	0.028	mg/L	0.006	236.1	08/27/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	08/27/13 JB
Manganese, Total	3.843	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	2.449	mg/L	0.002	243.1	08/27/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	08/27/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	08/27/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	08/27/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	08/27/13 JB
Silver	< 0.002	mg/L	0.002	272.1	08/27/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	08/27/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	08/27/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15812-12
SAMPLE ID: GW 28
DATE SAMPLED: 11/7/13

REPORT DATE: 11/20/13
COMMENT: 4.61'
SAMPLED BY: Client
DATE RECEIVED: 11/7/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1550	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	20	mg/L	1	160.2	11/11/13 KE
pH	6.7	Unit		150.1	11/7/13 TG
Acidity	40	mg/L	10	305.1	11/19/13 KE
Alkalinity	190	mg/L	10	310.1	11/19/13 KE
Chlorides	40	mg/L	1	325.3	11/12/13 KE
Sulfates	2020	mg/L	1	375.4	11/14/13 KE
Hardness	920	mg/L	1	130.2	11/19/13 KE
Fluoride	0.42	mg/L	0.01	340.2	11/13/13 KE
Cyanide	< 0.002	mg/L	0.002	335.4	11/14/13 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	11/19/13 KE
Aluminum	< 0.030	mg/L	0.030	202.1	11/13/13 JB
Antimony	< 0.040	mg/L	0.040	204.1	11/13/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	11/13/13 JB
Barium	< 0.020	mg/L	0.020	208.1	11/13/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	11/13/13 JB
Boron	< 0.500	mg/L	0.500	212.3	11/13/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	11/13/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	11/13/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	11/13/13 JB
Copper	< 0.003	mg/L	0.003	220.1	11/13/13 JB
Iron, Total	0.116	mg/L	0.006	236.1	11/13/13 JB
Iron, Dissolved	0.116	mg/L	0.006	236.1	11/13/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	11/13/13 JB
Manganese, Total	6.423	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	6.110	mg/L	0.002	243.1	11/13/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	11/13/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	11/13/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	11/13/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	11/13/13 JB
Silver	< 0.002	mg/L	0.002	272.1	11/13/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	11/13/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	11/13/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-12
SAMPLE ID: GW 28
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 3.67'
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	2/27/14 TG
Acidity	20	mg/L	10	305.1	3/10/14 KE
Alkalinity	228	mg/L	10	310.1	3/10/14 KE
Chlorides	68	mg/L	1	325.3	3/10/14 KE
Sulfates	1,198	mg/L	1	375.4	3/7/14 KE
Hardness	960	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	1,516	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	15	mg/L	1	160.2	3/6/14 KE
Fluoride	0.80	mg/L	0.01	340.2	3/6/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	3/6/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	3/12/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	3/6/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	3/6/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	3/7/14 JB
Barium	< 0.020	mg/L	0.020	208.1	3/6/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	3/6/14 JB
Boron	< 0.500	mg/L	0.500	212.3	3/6/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	3/6/14 JB
Chromium	< 0.006	mg/L	0.006	218.1	3/6/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	3/6/14 JB
Copper	< 0.003	mg/L	0.003	220.1	3/6/14 JB
Iron, Total	0.203	mg/L	0.006	236.1	3/6/14 JB
Iron, Dissolved	0.123	mg/L	0.006	236.1	3/6/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	3/6/14 JB
Manganese, Total	5.593	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	4.824	mg/L	0.002	243.1	3/6/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	3/7/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	3/6/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	3/6/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	3/7/14 JB
Silver	< 0.002	mg/L	0.002	272.1	3/6/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	3/6/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	3/6/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-12
SAMPLE ID: GW 28
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 2.48'
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.3	Unit		150.1	5/30/14 TG
Acidity	90	mg/L	10	305.1	6/12/14 KE
Alkalinity	594	mg/L	10	310.1	6/12/14 KE
Chlorides	55	mg/L	5	325.3	6/9/14 AK
Sulfates	3,350	mg/L	5	375.4	6/12/14 AK
Hardness	3,600	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	5,188	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	12	mg/L	5	160.2	6/19/14 KE
Fluoride	0.69	mg/L	0.01	340.2	6/13/14 AK
Cyanide	< 0.002	mg/L	0.002	335.4	6/5/14 AK
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	6/18/14 KE
Aluminum	< 0.030	mg/L	0.030	202.1	6/12/14 JB
Antimony	< 0.040	mg/L	0.040	204.1	6/12/14 JB
Arsenic	< 0.002	mg/L	0.002	206.4	6/12/14 JB
Barium	< 0.020	mg/L	0.020	208.1	6/12/14 JB
Beryllium	< 0.001	mg/L	0.001	210.1	6/12/14 JB
Boron	< 0.500	mg/L	0.500	212.3	6/12/14 JB
Cadmium	< 0.002	mg/L	0.002	213.1	6/12/14 JB
Chromium	0.010	mg/L	0.006	218.1	6/12/14 JB
Cobalt	< 0.005	mg/L	0.005	219.1	6/12/14 JB
Copper	< 0.003	mg/L	0.003	220.1	6/12/14 JB
Iron, Total	0.203	mg/L	0.006	236.1	6/12/14 JB
Iron, Dissolved	0.103	mg/L	0.006	236.1	6/12/14 JB
Lead	< 0.0075	mg/L	0.0075	239.1	6/12/14 JB
Manganese, Total	8.630	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	3.014	mg/L	0.002	243.1	6/12/14 JB
Mercury	< 0.002	mg/L	0.002	245.1	6/12/14 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	6/12/14 JB
Nickel	< 0.010	mg/L	0.010	249.1	6/12/14 JB
Selenium	< 0.002	mg/L	0.002	270.2	6/12/14 JB
Silver	< 0.002	mg/L	0.002	272.1	6/12/14 JB
Thallium	< 0.020	mg/L	0.020	279.1	6/12/14 JB
Vanadium	< 0.100	mg/L	0.100	286.1	6/12/14 JB
Zinc	< 0.001	mg/L	0.001	289.1	6/12/14 JB

Reviewed By: Jeff Gough

Date	Sample Pnt	Easting	Northing	Stand Pipe Elevation	Water Elev.	Depth	TDS mg/L	Sulfate mg/L	Hardness, Total mg/L	pH unit	Acidity mg/L	Alkalinity mg/L	Fluoride mg/L	Iron, Total mg/L	Zinc mg/L	Manganese, Tot mg/L	Chlorides mg/L
11/26/2012	GW-8R	360211	426371	482.5	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water
12/20/2012	GW-8R	360211	426371	482.5	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water
1/30/2013	GW-8R	360211	426371	482.5	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water
2/27/2013	GW-8R	360211	426371	482.5	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water	No Water
3/28/2013	GW-8R	360211	426371	482.5	462.25	20.25	4376	100	3578	6.7	309	844	0.89	0.508	0.679	4.59	66
4/25/2013	GW-8R	360211	426371	482.5	463.2	19.3	2043	4350	1398	6.7	59	244	0.83	1	<0.001	4.5	53.8
				Average	**462.73**	**19.78**	**3209.50**	**2225.00**	**2488.00**	**6.70**	**184.00**	**544.00**	**0.86**	**0.75**	**<0.34**	**4.55**	**59.90**
				Max	**463.20**	**20.25**	**4376.00**	**4350.00**	**3578.00**	**6.70**	**309.00**	**844.00**	**0.89**	**1.00**	**0.68**	**4.59**	**66.00**
				Min	**462.25**	**19.30**	**2043.00**	**100.00**	**1398.00**	**6.70**	**59.00**	**244.00**	**0.83**	**0.51**	**<0.001**	**4.50**	**53.80**

R09767

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15293-5
SAMPLE ID: GW 8
DATE SAMPLED: 08/27/12

REPORT DATE: 09/05/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 08/27/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1,253	mg/L	1	160.1	08/29/12 BH
Total Suspended Solids	870	mg/L	1	160.2	08/29/12 BH
pH	6.6	Unit		150.1	08/27/12 TG
Acidity	84	mg/L	10	305.1	09/05/12 RT
Alkalinity	248	mg/L	10	310.1	09/05/12 RT
Chlorides	384	mg/L	1	325.3	08/29/12 BH
Sulfates	900	mg/L	1	375.4	08/29/12 BH
Hardness, Total	< 1	mg/L	1	130.2	08/29/12 BH
Fluoride	0.59	mg/L	0.01	340.2	08/29/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	08/29/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	08/30/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	09/05/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	09/05/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	09/05/12 JB
Barium	< 0.020	mg/L	0.020	208.1	09/05/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	09/05/12 JB
Boron	< 0.500	mg/L	0.500	212.3	09/05/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	09/05/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	09/05/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	09/05/12 JB
Copper	< 0.003	mg/L	0.003	220.1	09/05/12 JB
Iron, Total	0.192	mg/L	0.006	236.1	09/05/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	09/05/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	09/05/12 JB
Manganese, Total	1.680	mg/L	0.002	243.1	09/05/12 JB
Manganese, Dissolved	0.656	mg/L	0.002	243.1	09/05/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	09/05/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	09/05/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	09/05/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	09/05/12 JB
Silver	0.003	mg/L	0.002	272.1	09/05/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	09/05/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	09/05/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	09/05/12 JB

Reviewed By: Joseph Boncini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	12/07/12
PDL:	15396-5	**COMMENT:**	
SAMPLE ID:	GW 8R	**SAMPLED BY:**	Client
DATE SAMPLED:	11/26/12	**DATE RECEIVED:**	11/26/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	*	mg/L	1	160.1	*
Total Suspended Solids	*	mg/L	1	160.2	*
pH	*	Unit		150.1	*
Acidity	*	mg/L	10	305.1	*
Alkalinity	*	mg/L	10	310.1	*
Chlorides	*	mg/L	1	325.3	*
Sulfates	*	mg/L	1	375.4	*
Hardness, Total	*	mg/L	1	130.2	*
Fluoride	*	mg/L	0.01	340.2	*
Cyanide	*	mg/L	0.002	8027	*
Phenols, Total Recoverable	*	mg/L	0.002	8047	*
Aluminum	*	mg/L	0.030	202.1	*
Antimony	*	mg/L	0.002	204.1	*
Arsenic	*	mg/L	0.002	206.4	*
Barium	*	mg/L	0.020	208.1	*
Beryllium	*	mg/L	0.001	210.1	*
Boron	*	mg/L	0.500	212.3	*
Cadmium	*	mg/L	0.002	213.1	*
Chromium	*	mg/L	0.006	218.1	*
Cobalt	*	mg/L	0.005	219.1	*
Copper	*	mg/L	0.003	220.1	*
Iron, Total	*	mg/L	0.006	236.1	*
Iron, Dissolved	*	mg/L	0.006	236.1	*
Lead	*	mg/L	0.0075	239.1	*
Manganese, Total	*	mg/L	0.002	243.1	*
Manganese, Dissolved	*	mg/L	0.002	243.1	*
Mercury	*	mg/L	0.002	245.1	*
Molybdenum	*	mg/L	0.020	246.1	*
Nickel	*	mg/L	0.010	249.1	*
Selenium	*	mg/L	0.002	270.2	*
Silver	*	mg/L	0.002	272.1	*
Thallium	*	mg/L	0.020	279.1	*
Vanadium	*	mg/L	0.100	286.1	*
Zinc	*	mg/L	0.001	289.1	*

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	03/11/13
PDL:	15511-5	**COMMENT:**	DRY
SAMPLE ID:	GW 8R	**SAMPLED BY:**	Client
DATE SAMPLED:	02/27/13	**DATE RECEIVED:**	02/27/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	*	mg/L	1	160.1	*
Total Suspended Solids	*	mg/L	1	160.2	*
pH	*	Unit		150.1	*
Acidity	*	mg/L	10	305.1	*
Alkalinity	*	mg/L	10	310.1	*
Chlorides	*	mg/L	1	325.3	*
Sulfates	*	mg/L	1	375.4	*
Hardness	*	mg/L	1	130.2	*
Fluoride	*	mg/L	0.01	340.2	*
Cyanide	*	mg/L	0.002	335.4	*
Phenols, Total Recoverable	*	mg/L	0.002	420.4	*
Aluminum	*	mg/L	0.030	202.1	*
Antimony	*	mg/L	0.002	204.1	*
Arsenic	*	mg/L	0.002	206.4	*
Barium	*	mg/L	0.020	208.1	*
Beryllium	*	mg/L	0.001	210.1	*
Boron	*	mg/L	0.500	212.3	*
Cadmium	*	mg/L	0.002	213.1	*
Chromium	*	mg/L	0.006	218.1	*
Cobalt	*	mg/L	0.005	219.1	*
Copper	*	mg/L	0.003	220.1	*
Iron, Total	*	mg/L	0.006	236.1	*
Iron, Dissolved	*	mg/L	0.006	236.1	*
Lead	*	mg/L	0.0075	239.1	*
Manganese, Total	*	mg/L	0.002	243.1	*
Manganese, Dissolved	*	mg/L	0.002	243.1	*
Mercury	*	mg/L	0.002	245.1	*
Molybdenum	*	mg/L	0.020	246.1	*
Nickel	*	mg/L	0.010	249.1	*
Selenium	*	mg/L	0.002	270.2	*
Silver	*	mg/L	0.002	272.1	*
Thallium	*	mg/L	0.020	279.1	*
Vanadium	*	mg/L	0.100	286.1	*
Zinc	*	mg/L	0.001	289.1	*

Reviewed By: Joseph Bencini

Date	Sample Pnt	Easting	Northing	Stand Pipe Elevation	Water Elev.	Depth	TDS	Sulfate	Hardness, Total	pH	Acidity	Alkalinity	Fluoride	IRON, Total	Zinc	Manganese, Tot	Chlorides
							mg/L	mg/L	mg/L	unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
5/29/09	GW-12	360,444	430,596	438.13	434.21	3.92	622	220	352	6.8	<10	227	<0.02	1.95	0.002	0.163	45
8/27/09	GW-12	360,444	430,596	438.13	431.89	6.24	702	233	408	6.6	140	405	0.19	0.059	<0.001	0.049	68
11/30/09	GW-12	360,444	430,596	438.13	432.18	5.95	686	210	352	7	<10	222	0.48	<0.006	<0.001	0.108	54
2/26/10	GW-12	360,444	430,596	438.13	433.82	4.31	654	170	340	7.1	102	430	0.30	0.099	<0.001	0.309	48
5/31/10	GW-12	360,444	430,596	438.13	430.97	7.16	628	190	420	6.7	149	454	0.38	<0.006	<0.001	0.161	66
7/15/10	GW-12	360,444	430,596	438.13	429.55	8.58	606	120	408	6.8	<10	500	0.24	<0.006	<0.001	0.543	620
8/20/10	GW-12	360,444	430,596	438.13	429.91	8.22	590	140	560	6.3	<10	275	0.22	0.009	<0.001	0.494	64
9/20/10	GW-12	360,444	430,596	438.13	428.46	9.67	646	90	440	7.0	<10	268	0.00	0.181	<0.001	0.544	60
10/15/10	GW-12	360,444	430,596	438.13	427.25	10.88	800	190	370	6.8	<10	265	0.28	0.156	<0.001	0.345	56
11/15/10	GW-12	360,444	430,596	438.13	426.51	11.62	611	140	562	7.8	<10	392	<0.01	0.048	<0.001	0.350	22
12/14/10	GW-12	360,444	430,596	438.13	431.15	6.98	750	180	342	6.8	<10	236	2.30	0.070	0.009	0.125	75
1/17/11	GW-12	360,444	430,596	438.13	432.71	5.42	494	150	412	6.9	<10	344	0.26	<0.006	<0.001	0.389	23
2/15/11	GW-12	360,444	430,596	438.13	433.23	4.9	789	230	407	7.0	110	307	0.78	<0.006	<0.001	0.071	130
3/21/11	GW-12	360,444	430,596	438.13	433.65	4.48	702	150	346	6.7	<10	364	0.23	0.081	0.049	0.016	9
4/20/11	GW-12	360,444	430,596	438.13	434.12	4.01	830	210	361	6.9	<10	280	0.43	<0.006	<0.001	0.277	11
5/20/11	GW-12	360,444	430,596	438.13	431.92	6.21	527	100	243	6.9	<10	219	0.63	0.139	<0.001	<0.002	12
6/21/11	GW-12	360,444	430,596	438.13	433.54	4.59	793	130	330	7.0	<10	275	0.70	0.090	0.015	0.022	47
8/15/11	GW-12	360,444	430,596	438.13	429.61	8.52	839	150	353	6.9	<10	284	0.54	<0.006	<0.001	<0.002	39
11/17/11	GW-12	360,444	430,596	438.13	434.07	4.06	842	140	368	6.9	<10	326	0.36	<0.006	<0.001	0.633	37
2/22/12	GW-12	360,444	430,596	438.13	435.43	2.7	628	270	400	6.8	<10	285	0.26	0.080	<0.001	0.394	43
5/25/12	GW-12	360,444	430,596	438.13	429.77	8.36	841	260	384	6.9	<10	306	0.64	0.035	0.016	0.631	55
8/27/12	GW-12	360,444	430,596	438.13	426.15	11.98	708	250	430	6.8	72	338	0.40	0.436	<0.001	0.634	57
11/26/12	GW-12	360,444	430,596	438.13	427.93	10.2	830	335	410	7.4	42	333	0.3	0.056	<0.001	2.650	57
2/27/2013	GW-12	360,444	430,596	438.13	434.15	3.98	700	342	387	6.9	150	325	0.14	<0.006	<0.001	0.094	56.8
				Average	**431.34**	**6.79**	**700.75**	**191.67**	**391.04**	**6.90**	**< 38.96**	**319.17**	**< 0.44**	**<0.148**	**<0.005**	**<0.375**	**73.117**
				Max	**435.43**	**11.98**	**842.00**	**342.00**	**562.00**	**7.80**	**150.00**	**500.00**	**2.30**	**1.950**	**0.049**	**2.650**	**620.000**
				Min	**426.15**	**2.70**	**494.00**	**90.00**	**243.00**	**6.30**	**42.00**	**219.00**	**0.00**	**<0.006**	**<0.001**	**<0.002**	**9.000**

R09771

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15293-9
SAMPLE ID: GW 12
DATE SAMPLED: 08/27/12

REPORT DATE: 09/05/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 08/27/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	708	mg/L	1	160.1	08/29/12 BH
Total Suspended Solids	17	mg/L	1	160.2	08/29/12 BH
pH	6.8	Unit		150.1	08/27/12 TG
Acidity	72	mg/L	10	305.1	09/05/12 RT
Alkalinity	338	mg/L	10	310.1	09/05/12 RT
Chlorides	57	mg/L	1	325.3	08/29/12 BH
Sulfates	250	mg/L	1	375.4	08/29/12 BH
Hardness, Total	430	mg/L	0.250	130.2	08/29/12 BH
Fluoride	0.40	mg/L	0.01	340.2	08/29/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	08/29/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	08/30/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	09/05/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	09/05/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	09/05/12 JB
Barium	< 0.020	mg/L	0.020	208.1	09/05/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	09/05/12 JB
Boron	< 0.500	mg/L	0.500	212.3	09/05/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	09/05/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	09/05/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	09/05/12 JB
Copper	< 0.003	mg/L	0.003	220.1	09/05/12 JB
Iron, Total	0.436	mg/L	0.006	236.1	09/05/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	09/05/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	09/05/12 JB
Manganese, Total	0.634	mg/L	0.002	243.1	09/05/12 JB
Manganese, Dissolved	0.007	mg/L	0.002	243.1	09/05/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	09/05/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	09/05/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	09/05/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	09/05/12 JB
Silver	0.017	mg/L	0.002	272.1	09/05/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	09/05/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	09/05/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	09/05/12 JB

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15396-9
SAMPLE ID: GW 12
DATE SAMPLED: 11/26/12

REPORT DATE: 12/07/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 11/26/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	830	mg/L	1	160.1	12/03/12 BH
Total Suspended Solids	5	mg/L	1	160.2	12/03/12 BH
pH	7.4	Unit		150.1	11/26/12 TG
Acidity	42	mg/L	10	305.1	12/04/12 RT
Alkalinity	333	mg/L	10	310.1	12/04/12 RT
Chlorides	57	mg/L	1	325.3	12/03/12 RT
Sulfates	335	mg/L	1	375.4	12/03/12 BH
Hardness, Total	410	mg/L	0.250	130.2	12/03/12 RT
Fluoride	0.30	mg/L	0.01	340.2	12/03/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	12/03/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	12/03/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	12/07/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	12/07/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	12/07/12 JB
Barium	< 0.020	mg/L	0.020	208.1	12/07/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	12/07/12 JB
Boron	< 0.500	mg/L	0.500	212.3	12/07/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	12/07/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	12/07/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	12/07/12 JB
Copper	< 0.003	mg/L	0.003	220.1	12/07/12 JB
Iron, Total	0.056	mg/L	0.006	236.1	12/07/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	12/07/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	12/07/12 JB
Manganese, Total	2.65	mg/L	0.002	243.1	12/07/12 JB
Manganese, Dissolved	0.047	mg/L	0.002	243.1	12/07/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	12/07/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	12/07/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	12/07/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	12/07/12 JB
Silver	0.017	mg/L	0.002	272.1	12/07/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	12/07/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	12/07/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	12/07/12 JB

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	03/11/13
PDL:	15511-9	**COMMENT:**	
SAMPLE ID:	GW 12	**SAMPLED BY:**	Client
DATE SAMPLED:	02/27/13	**DATE RECEIVED:**	02/27/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	700	mg/L	1	160.1	03/05/13 RT
Total Suspended Solids	1	mg/L	1	160.2	03/06/13 RT
pH	6.9	Unit		150.1	02/27/13 TG
Acidity	150	mg/L	10	305.1	03/01/13 BH
Alkalinity	325	mg/L	10	310.1	03/01/13 BH
Chlorides	56.8	mg/L	1	325.3	03/04/13 BH
Sulfates	342	mg/L	1	375.4	03/04/13 BH
Hardness	387	mg/L	0.250	130.2	03/04/13 RT
Fluoride	0.14	mg/L	0.01	340.2	03/04/13 RT
Cyanide	< 0.002	mg/L	0.002	335.4	03/06/13 RT
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	03/06/13 RT
Aluminum	< 0.030	mg/L	0.030	202.1	03/07/13 JB
Antimony	< 0.002	mg/L	0.002	204.1	03/07/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	03/07/13 JB
Barium	< 0.020	mg/L	0.020	208.1	03/07/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	03/07/13 JB
Boron	< 0.500	mg/L	0.500	212.3	03/07/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	03/07/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	03/07/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	03/07/13 JB
Copper	< 0.003	mg/L	0.003	220.1	03/07/13 JB
Iron, Total	< 0.006	mg/L	0.006	236.1	03/07/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	03/07/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	03/07/13 JB
Manganese, Total	0.094	mg/L	0.002	243.1	03/07/13 JB
Manganese, Dissolved	0.035	mg/L	0.002	243.1	03/07/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	03/07/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	03/07/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	03/07/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	03/07/13 JB
Silver	< 0.002	mg/L	0.002	272.1	03/07/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	03/07/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	03/07/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	03/07/13 JB

Reviewed By: Joseph Bencini

Date	Sample Pnt	Easting	Northing	Stand Pipe Elevation	Water Elev.	Depth	TDS	Sulfate	Hardness, Total	pH	Acidity	Alkalinity	Fluoride	Iron, Total	Zinc	Manganese, Tot	Chlorides
							mg/L	mg/L	mg/L	unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
5/29/09	GW-13	361,492	430,637	444.57	416.26	28.31	554	20	128	7.8	<10	86	<0.02	0.747	<0.001	1.060	16
8/27/09	GW-13	361,492	430,637	444.57	424.99	19.58	592	363	592	7.1	<10	351	0.07	0.124	<0.001	0.102	59
11/30/09	GW-13	361,492	430,637	444.57	426.89	17.68	998	350	544	7.2	<10	290	0.66	<0.006	<0.001	23.200	76
2/26/10	GW-13	361,492	430,637	444.57	428.46	16.11	982	420	16	7.5	<10	401	0.53	0.127	0.001	12.687	48
5/31/10	GW-13	361,492	430,637	444.57	427.59	16.98	1170	5,202	650	6.9	<10	397	0.64	<0.006	<0.001	0.039	67
7/15/10	GW-13	361,492	430,637	444.57	425.01	19.56	1194	380	<0.250	7	<10	400	0.47	<0.006	<0.001	0.645	680
8/20/10	GW-13	361,492	430,637	444.57	423.54	21.03	518	340	1,640	7.0	<10	411	0.40	<0.006	<0.001	0.012	82
9/20/10	GW-13	361,492	430,637	444.57	422.06	22.51	1084	210	680	7.2	<10	389	0.00	0.109	<0.001	6.245	72
10/15/10	GW-13	361,492	430,637	444.57	421.17	23.4	952	350	733	7.0	<10	318	0.56	0.086	<0.001	0.746	27
11/15/10	GW-13	361,492	430,637	444.57	420.05	24.52	912	280	685	8.0	<10	403	0.08	0.005	<0.001	0.803	47
12/14/10	GW-13	361,492	430,637	444.57	419.43	25.14	935	380	<0.25	7.3	<10	333	1.60	0.069	0.007	1.913	72
1/17/11	GW-13	361,492	430,637	444.57	420.76	23.81	992	300	786	7.1	<10	375	0.82	<0.006	<0.001	0.560	26
2/15/11	GW-13	361,492	430,637	444.57	421.23	23.34	1008	370	10	7.1	<10	366	0.59	<0.006	<0.001	1.780	52
3/21/11	GW-13	361,492	430,637	444.57	425.09	19.48	1220	370	589	7.0	<10	342	0.30	0.130	0.04	1.362	10
4/20/11	GW-13	361,492	430,637	444.57	426.68	17.89	1240	330	692	7.1	<10	337	0.63	<0.006	<0.001	1.700	10
5/20/11	GW-13	361,492	430,637	444.57	428.13	16.44	1148	440	619	7.0	<10	344	0.77	1.390	<0.001	0.128	11
6/21/11	GW-13	361,492	430,637	444.57	426.06	18.51	1193	390	<10	7.1	<10	350	0.56	0.011	<0.001	0.009	45
8/15/11	GW-13	361,492	430,637	444.57	424.77	19.8	1171	41	<0.250	7.2	<10	370	0.49	<0.006	<0.001	0.072	34
11/17/11	GW-13	361,492	430,637	444.57	422.18	22.39	1079	480	<1	7.2	<10	375	0.41	<0.006	<0.001	0.051	28
2/22/12	GW-13	361,492	430,637	444.57	429.74	14.83	999	540	500	7.1	<10	332	0.45	<0.006	<0.001	<0.002	39
5/25/12	GW-13	361,492	430,637	444.57	434.38	10.19	1109	470	564	7.2	<10	331	0.75	<0.006	<0.001	0.044	54
8/27/12	GW-13	361,492	430,637	444.57	421.11	23.46	1054	460	<1	7.1	44	356	0.41	0.116	<0.001	3.863	8
11/26/12	GW-13	361,492	430,637	444.57	418.73	25.84	1096	612	75	7.6	62	351	0.6	<0.006	<0.001	1.260	61
2/27/2013	GW-13	361,492	430,637	444.57	423.44	21.13	1062	522	647	7.2	60	365	0.31	0.049	<0.001	1.47	64.1
				Average	**424.07**	**20.50**	**1010.92**	**567.50**	**<423.45**	**7.21**	**<15.67**	**348.88**	**<0.53**	**<0.126**	**<0.003**	**<2.49**	**70.34**
				Max	**434.38**	**28.31**	**1240.00**	**5202.00**	**1640.00**	**8.00**	**62.00**	**411.00**	**1.60**	**1.390**	**0.04**	**23.20**	**680.00**
				Min	**416.26**	**10.19**	**518.00**	**20.00**	**<0.25**	**6.90**	**<10**	**86.00**	**<0.02**	**<0.006**	**<0.001**	**<0.002**	**8.00**

R09775

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15293-10
SAMPLE ID: GW 13
DATE SAMPLED: 08/27/12

REPORT DATE: 09/05/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 08/27/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1,054	mg/L	1	160.1	08/29/12 BH
Total Suspended Solids	25	mg/L	1	160.2	08/29/12 BH
pH	7.1	Unit		150.1	08/27/12 TG
Acidity	44	mg/L	10	305.1	09/05/12 RT
Alkalinity	356	mg/L	10	310.1	09/05/12 RT
Chlorides	8	mg/L	1	325.3	08/29/12 BH
Sulfates	460	mg/L	1	375.4	08/29/12 BH
Hardness, Total	< 1	mg/L	0.250	130.2	08/29/12 BH
Fluoride	0.41	mg/L	0.01	340.2	08/29/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	08/29/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	08/30/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	09/05/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	09/05/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	09/05/12 JB
Barium	< 0.020	mg/L	0.020	208.1	09/05/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	09/05/12 JB
Boron	< 0.500	mg/L	0.500	212.3	09/05/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	09/05/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	09/05/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	09/05/12 JB
Copper	< 0.003	mg/L	0.003	220.1	09/05/12 JB
Iron, Total	0.116	mg/L	0.006	236.1	09/05/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	09/05/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	09/05/12 JB
Manganese, Total	3.863	mg/L	0.002	243.1	09/05/12 JB
Manganese, Dissolved	0.011	mg/L	0.002	243.1	09/05/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	09/05/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	09/05/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	09/05/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	09/05/12 JB
Silver	0.030	mg/L	0.002	272.1	09/05/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	09/05/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	09/05/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	09/05/12 JB

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15396-10
SAMPLE ID: GW 13
DATE SAMPLED: 11/26/12

REPORT DATE: 12/07/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 11/26/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1,096	mg/L	1	160.1	12/03/12 BH
Total Suspended Solids	79	mg/L	1	160.2	12/03/12 BH
pH	7.6	Unit		150.1	11/26/12 TG
Acidity	62	mg/L	10	305.1	12/04/12 RT
Alkalinity	351	mg/L	10	310.1	12/04/12 RT
Chlorides	61	mg/L	1	325.3	12/03/12 RT
Sulfates	612	mg/L	1	375.4	12/03/12 BH
Hardness, Total	75	mg/L	0.250	130.2	12/03/12 RT
Fluoride	0.60	mg/L	0.01	340.2	12/03/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	12/03/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	12/03/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	12/07/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	12/07/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	12/07/12 JB
Barium	< 0.020	mg/L	0.020	208.1	12/07/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	12/07/12 JB
Boron	< 0.500	mg/L	0.500	212.3	12/07/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	12/07/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	12/07/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	12/07/12 JB
Copper	< 0.003	mg/L	0.003	220.1	12/07/12 JB
Iron, Total	< 0.006	mg/L	0.006	236.1	12/07/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	12/07/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	12/07/12 JB
Manganese, Total	1.26	mg/L	0.002	243.1	12/07/12 JB
Manganese, Dissolved	0.237	mg/L	0.002	243.1	12/07/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	12/07/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	12/07/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	12/07/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	12/07/12 JB
Silver	0.030	mg/L	0.002	272.1	12/07/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	12/07/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	12/07/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	12/07/12 JB

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15511-10
SAMPLE ID: GW 13
DATE SAMPLED: 02/27/13

REPORT DATE: 03/11/13
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 02/27/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	1,062	mg/L	1	160.1	03/05/13 RT
Total Suspended Solids	40	mg/L	1	160.2	03/06/13 RT
pH	7.2	Unit		150.1	02/27/13 TG
Acidity	60	mg/L	10	305.1	03/01/13 BH
Alkalinity	365	mg/L	10	310.1	03/01/13 BH
Chlorides	64.1	mg/L	1	325.3	03/04/13 BH
Sulfates	522	mg/L	1	375.4	03/04/13 BH
Hardness	647	mg/L	0.250	130.2	03/04/13 RT
Fluoride	0.31	mg/L	0.01	340.2	03/04/13 RT
Cyanide	< 0.002	mg/L	0.002	335.4	03/06/13 RT
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	03/06/13 RT
Aluminum	< 0.030	mg/L	0.030	202.1	03/07/13 JB
Antimony	< 0.002	mg/L	0.002	204.1	03/07/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	03/07/13 JB
Barium	< 0.020	mg/L	0.020	208.1	03/07/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	03/07/13 JB
Boron	< 0.500	mg/L	0.500	212.3	03/07/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	03/07/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	03/07/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	03/07/13 JB
Copper	< 0.003	mg/L	0.003	220.1	03/07/13 JB
Iron, Total	0.049	mg/L	0.006	236.1	03/07/13 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	03/07/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	03/07/13 JB
Manganese, Total	1.47	mg/L	0.002	243.1	03/07/13 JB
Manganese, Dissolved	1.16	mg/L	0.002	243.1	03/07/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	03/07/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	03/07/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	03/07/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	03/07/13 JB
Silver	< 0.002	mg/L	0.002	272.1	03/07/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	03/07/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	03/07/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	03/07/13 JB

Reviewed By: Joseph Bencini

Date	Sample Pnt	Easting	Northing	Stand Pipe Elevation	Water Elev.	Depth	TDS mg/L	Sulfate mg/L	Hardness, Total mg/L	pH unit	Acidity mg/L	Alkalinity mg/L	Fluoride mg/L	Iron, Total mg/L	Zinc mg/L	Manganese, Tot mg/L	Chlorides mg/L
5/29/09	GW-14	361,384	428,173	458.52	455.00	3.52	1420	1,180	3,490	6.4	18	548	0.98	0.569	0.689	2.593	29
8/27/09	GW-14	361,384	428,173	458.52	451.84	6.68	5350	1,270	3,080	6.6	215	601	1.55	0.171	<0.001	1.880	40
11/30/09	GW-14	361,384	428,173	458.52	451.04	7.48	5140	1,180	2,130	6.8	10	400	1.69	<0.006	<0.001	0.861	105
2/26/10	GW-14	361,384	428,173	458.52	453.41	5.11	3200	1,110	1,270	8.4	<10	298	1.16	0.11	0.001	0.144	110
5/31/10	GW-14	361,384	428,173	458.52	450.92	7.6	3750	1,120	1,370	7	<10	257	1.31	0.082	<0.001	<0.005	112
7/15/10	GW-14	361,384	428,173	458.52	449.12	9.4	4248	2,500	1,800	7.2	<10	320	0.95	<0.006	<0.001	0.543	1340
8/20/10	GW-14	361,384	428,173	458.52	448.41	10.11	2120	2,900	2,200	6.8	<10	343	1.65	<0.006	<0.001	0.228	168
9/20/10	GW-14	361,384	428,173	458.52	447.17	11.35	4668	310	2,820	7.0	<10	295	?	0.167	<0.001	0.421	152
10/15/10	GW-14	361,384	428,173	458.52	446.10	12.42	3230	1,900	2,030	6.7	<10	288	0.89	<0.006	<0.001	0.448	58
11/15/10	GW-14	361,384	428,173	458.52	445.44	13.08	4100	2,800	1,990	8.3	<10	374	0.78	0.013	0.05	0.519	70
12/14/10	GW-14	361,384	428,173	458.52	448.02	10.5	3744	1,260	2,841	7.2	<10	497	5.20	0.085	0.007	0.698	43
1/17/11	GW-14	361,384	428,173	458.52	449.63	8.89	4574	1,290	2,660	6.7	<10	531	1.82	<0.006	0.565	2.600	10
2/15/11	GW-14	361,384	428,173	458.52	450.40	8.12	3830	2,500	3,170	6.9	<10	456	1.16	0.597	<0.001	0.975	10
3/21/11	GW-14	361,384	428,173	458.52	454.08	4.44	4610	3,400	1,990	7.0	<10	363	0.91	0.103	0.17	0.596	26
4/20/11	GW-14	361,384	428,173	458.52	453.55	4.97	4830	1,150	2,170	7.0	<10	357	0.95	<0.006	0.03	0.017	19
5/20/11	GW-14	361,384	428,173	458.52	453.61	4.91	3276	1,200	2,330	6.8	<10	492	1.60	0.063	0.0728	0.930	8
6/21/11	GW-14	361,384	428,173	458.52	451.87	6.65	3332	2,900	2,384	6.8	<10	476	1.94	0.018	0.119	<0.008	10
8/15/11	GW-14	361,384	428,173	458.52	448.81	9.71	3276	3,472	2,112	6.9	<10	395	1.42	0.083	<0.001	0.432	42
11/17/11	GW-14	361,384	428,173	458.52	450.68	7.84	4180	1,300	1,636	7.0	<10	324	0.93	<0.006	<0.001	0.084	71
2/22/12	GW-14	361,384	428,173	458.52	453.67	4.85	3238	3,100	1,180	6.9	<10	263	1.32	<0.006	<0.001	<0.002	85
5/25/12	GW-14	361,384	428,173	458.52	448.55	9.97	3688	2,500	1,068	7.2	<10	227	1.34	<0.006	<0.001	<0.002	102
8/27/12	GW-14	361,384	428,173	458.52	444.21	14.31	4684	1,800	1,980	7.1	34	330	1.29	<0.006	<0.001	0.007	102
11/26/12	GW-14	361,384	428,173	458.52	445.11	13.41	3930	2580	2460	7.4	28	482	1.57	1.680	<0.001	6.690	34
2/27/2013	GW-14	361,384	428,173	458.52	452.22	6.3	4594	2870	1864	7.2	70	830	1.03	0.040	<0.001	0.329	93.4
				Average	**450.12**	**8.40**	**3875.50**	**1983.00**	**2167.71**	**7.05**	**23.13**	**406.13**	**1.45**	**<0.167**	**<0.072**	**<0.955**	**118.308**
				Max	**455.00**	**14.31**	**5350.00**	**3472.00**	**3490.00**	**8.40**	**215.00**	**830.00**	**5.20**	**1.680**	**0.689**	**6.690**	**1340.000**
				Min	**444.21**	**3.52**	**1420.00**	**310.00**	**1068.00**	**6.40**	**10.00**	**227.00**	**0.78**	**<0.006**	**<0.001**	**<0.005**	**8.000**

R09779

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	09/05/12
PDL:	15293-11	**COMMENT:**	
SAMPLE ID:	GW 14	**SAMPLED BY:**	Client
DATE SAMPLED:	08/27/12	**DATE RECEIVED:**	08/27/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	4,684	mg/L	1	160.1	08/29/12 BH
Total Suspended Solids	1,030	mg/L	1	160.2	08/29/12 BH
pH	7.1	Unit		150.1	08/27/12 TG
Acidity	34	mg/L	10	305.1	09/05/12 RT
Alkalinity	330	mg/L	10	310.1	09/05/12 RT
Chlorides	102	mg/L	1	325.3	08/29/12 BH
Sulfates	1,800	mg/L	1	375.4	08/29/12 BH
Hardness, Total	1,980	mg/L	0.250	130.2	08/29/12 BH
Fluoride	1.29	mg/L	0.01	340.2	08/29/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	08/29/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	08/30/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	09/05/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	09/05/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	09/05/12 JB
Barium	< 0.020	mg/L	0.020	208.1	09/05/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	09/05/12 JB
Boron	< 0.500	mg/L	0.500	212.3	09/05/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	09/05/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	09/05/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	09/05/12 JB
Copper	< 0.003	mg/L	0.003	220.1	09/05/12 JB
Iron, Total	< 0.006	mg/L	0.006	236.1	09/05/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	09/05/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	09/05/12 JB
Manganese, Total	0.007	mg/L	0.002	243.1	09/05/12 JB
Manganese, Dissolved	0.007	mg/L	0.002	243.1	09/05/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	09/05/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	09/05/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	09/05/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	09/05/12 JB
Silver	0.009	mg/L	0.002	272.1	09/05/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	09/05/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	09/05/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	09/05/12 JB

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15396-11
SAMPLE ID: GW 14
DATE SAMPLED: 11/26/12

REPORT DATE: 12/07/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 11/26/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	3,930	mg/L	1	160.1	12/03/12 BH
Total Suspended Solids	539	mg/L	1	160.2	12/03/12 BH
pH	7.4	Unit		150.1	11/26/12 TG
Acidity	28	mg/L	10	305.1	12/04/12 RT
Alkalinity	482	mg/L	10	310.1	12/04/12 RT
Chlorides	34	mg/L	1	325.3	12/03/12 RT
Sulfates	2,580	mg/L	1	375.4	12/03/12 BH
Hardness, Total	2,460	mg/L	0.250	130.2	12/03/12 RT
Fluoride	1.57	mg/L	0.01	340.2	12/03/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	12/03/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	12/03/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	12/07/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	12/07/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	12/07/12 JB
Barium	< 0.020	mg/L	0.020	208.1	12/07/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	12/07/12 JB
Boron	< 0.500	mg/L	0.500	212.3	12/07/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	12/07/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	12/07/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	12/07/12 JB
Copper	< 0.003	mg/L	0.003	220.1	12/07/12 JB
Iron, Total	1.68	mg/L	0.006	236.1	12/07/12 JB
Iron, Dissolved	< 0.006	mg/L	0.006	236.1	12/07/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	12/07/12 JB
Manganese, Total	6.69	mg/L	0.002	243.1	12/07/12 JB
Manganese, Dissolved	0.314	mg/L	0.002	243.1	12/07/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	12/07/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	12/07/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	12/07/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	12/07/12 JB
Silver	0.009	mg/L	0.002	272.1	12/07/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	12/07/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	12/07/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	12/07/12 JB

Reviewed By: *Joseph Bencini*

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15511-11
SAMPLE ID: GW 14
DATE SAMPLED: 02/27/13

REPORT DATE: 03/11/13
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 02/27/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	4,594	mg/L	1	160.1	03/05/13 RT
Total Suspended Solids	23	mg/L	1	160.2	03/06/13 RT
pH	7.2	Unit		150.1	02/27/13 TG
Acidity	70	mg/L	10	305.1	03/01/13 BH
Alkalinity	830	mg/L	10	310.1	03/01/13 BH
Chlorides	93.4	mg/L	1	325.3	03/04/13 BH
Sulfates	2,870	mg/L	1	375.4	03/04/13 BH
Hardness	1,864	mg/L	0.250	130.2	03/04/13 RT
Fluoride	1.03	mg/L	0.01	340.2	03/04/13 RT
Cyanide	< 0.002	mg/L	0.002	335.4	03/06/13 RT
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	03/06/13 RT
Aluminum	< 0.030	mg/L	0.030	202.1	03/07/13 JB
Antimony	< 0.002	mg/L	0.002	204.1	03/07/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	03/07/13 JB
Barium	< 0.020	mg/L	0.020	208.1	03/07/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	03/07/13 JB
Boron	< 0.500	mg/L	0.500	212.3	03/07/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	03/07/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	03/07/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	03/07/13 JB
Copper	< 0.003	mg/L	0.003	220.1	03/07/13 JB
Iron, Total	0.040	mg/L	0.006	236.1	03/07/13 JB
Iron, Dissolved	0.030	mg/L	0.006	236.1	03/07/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	03/07/13 JB
Manganese, Total	0.329	mg/L	0.002	243.1	03/07/13 JB
Manganese, Dissolved	0.250	mg/L	0.002	243.1	03/07/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	03/07/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	03/07/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	03/07/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	03/07/13 JB
Silver	< 0.002	mg/L	0.002	272.1	03/07/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	03/07/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	03/07/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	03/07/13 JB

Reviewed By: Joseph Boncini

Date	Sample Pnt	Easting	Northing	Stand Pipe Elevation	Water Elev.	Depth	TDS mg/L	Sulfate mg/L	Hardness, Total mg/L	pH unit	Acidity mg/L	Alkalinity mg/L	Fluoride mg/L	Iron, Total mg/L	Zinc mg/L	Manganese, Tot mg/L	Chlorides mg/L
6/26/2012	GW-28	362879	426840	467.73	457.83	9.9	4922	2,600	3,028	7	<10	532	1.32	0.548	<0.001	2.850	17
7/27/2012	GW-28	362879	426840	467.73	457.03	10.7	4512	2700	<1.0	7	<10	544	1.2	0.361	<0.001	2.64	39
8/27/2012	GW-28	362879	426840	467.73	456.73	11	-	-	-	-	-	-	-	-	-	-	-
9/25/2012	GW-28	362879	426840	467.73	456.56	11.17	4742	2590	<1.0	6.9	15	483	1.37	5.69	<0.001	15	46
10/26/2012	GW-28	362879	426840	467.73	455.97	11.76	4498	3180	<1.0	6.9	163	715	1.14	0.037	<0.001	3.34	46
11/26/2012	GW-28	362879	426840	467.73	456.53	11.2	3670	3920	inter.	7.4	78	482	1.34	0.2	<0.001	2.03	94
12/20/2012	GW-28	362879	426840	467.73	460.73	7	928	1158	1080	7.3	97	280	0.66	0.125	<0.001	0.879	435
1/30/2013	GW-28	362879	426840	467.73	463.41	4.32	416	210	302	6.6	16	680	0.33	2.222	<0.001	0.239	12
2/27/2013	GW-28	362879	426840	467.73	463.97	3.76	880	307	280	6.8	80	115	0.05	0.153	<0.001	0.336	13.7
3/28/2013	GW-28	362879	426840	467.73	464.63	3.1	732	549	407	6.9	64	147	<0.01	0.172	<0.001	2.24	18.2
4/25/2013	GW-28	362879	426840	467.73	464.99	2.74	4270	6950	2992	6.9	306	808	1.3	0.86	0.193	10.6	63.6
				Average	**459.85**	**7.88**	**2957.00**	**2416.40**	**899.11**	**6.97**	**83.90**	**478.60**	**0.97**	**1.037**	**0.020**	**4.015**	**78.5**
				Max	**464.99**	**11.76**	**4922.00**	**6950.00**	**3028.00**	**7.40**	**306.00**	**808.00**	**1.37**	**5.690**	**0.193**	**15.000**	**435.0**
				Min	**455.97**	**2.74**	**416.00**	**210.00**	**<1.0**	**6.60**	**<10**	**115.00**	**0.05**	**0.037**	**<0.001**	**0.239**	**12.0**

R09783

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15396-12
SAMPLE ID: GW 28
DATE SAMPLED: 11/26/12

REPORT DATE: 12/07/12
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 11/26/12

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	3,670	mg/L	1	160.1	12/03/12 BH
Total Suspended Solids	40	mg/L	1	160.2	12/03/12 BH
pH	7.4	Unit		150.1	11/26/12 TG
Acidity	78	mg/L	10	305.1	12/04/12 RT
Alkalinity	482	mg/L	10	310.1	12/04/12 RT
Chlorides	94	mg/L	1	325.3	12/03/12 RT
Sulfates	3,920	mg/L	1	375.4	12/03/12 BH
Hardness, Total	*	mg/L	0.250	130.2	12/03/12 RT
Fluoride	1.34	mg/L	0.01	340.2	12/03/12 BH
Cyanide	< 0.002	mg/L	0.002	8027	12/03/12 BH
Phenols, Total Recoverable	< 0.002	mg/L	0.002	8047	12/03/12 BH
Aluminum	< 0.030	mg/L	0.030	202.1	12/07/12 JB
Antimony	< 0.002	mg/L	0.002	204.1	12/07/12 JB
Arsenic	< 0.002	mg/L	0.002	206.4	12/07/12 JB
Barium	< 0.020	mg/L	0.020	208.1	12/07/12 JB
Beryllium	< 0.001	mg/L	0.001	210.1	12/07/12 JB
Boron	< 0.500	mg/L	0.500	212.3	12/07/12 JB
Cadmium	< 0.002	mg/L	0.002	213.1	12/07/12 JB
Chromium	< 0.006	mg/L	0.006	218.1	12/07/12 JB
Cobalt	< 0.003	mg/L	0.005	219.1	12/07/12 JB
Copper	< 0.003	mg/L	0.003	220.1	12/07/12 JB
Iron, Total	0.200	mg/L	0.006	236.1	12/07/12 JB
Iron, Dissolved	0.103	mg/L	0.006	236.1	12/07/12 JB
Lead	< 0.0075	mg/L	0.0075	239.1	12/07/12 JB
Manganese, Total	2.03	mg/L	0.002	243.1	12/07/12 JB
Manganese, Dissolved	0.520	mg/L	0.002	243.1	12/07/12 JB
Mercury	< 0.002	mg/L	0.002	245.1	12/07/12 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	12/07/12 JB
Nickel	< 0.010	mg/L	0.010	249.1	12/07/12 JB
Selenium	< 0.002	mg/L	0.002	270.2	12/07/12 JB
Silver	0.009	mg/L	0.002	272.1	12/07/12 JB
Thallium	< 0.020	mg/L	0.020	279.1	12/07/12 JB
Vanadium	< 0.100	mg/L	0.100	286.1	12/07/12 JB
Zinc	< 0.001	mg/L	0.001	289.1	12/07/12 JB

*** Interference**

Reviewed By: Joseph Bencini

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15511-12
SAMPLE ID: GW 28
DATE SAMPLED: 02/27/13

REPORT DATE: 03/11/13
COMMENT:
SAMPLED BY: Client
DATE RECEIVED: 02/27/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	880	mg/L	1	160.1	03/05/13 RT
Total Suspended Solids	6	mg/L	1	160.2	03/06/13 RT
pH	6.8	Unit		150.1	02/27/13 TG
Acidity	80	mg/L	10	305.1	03/01/13 BH
Alkalinity	115	mg/L	10	310.1	03/01/13 BH
Chlorides	13.7	mg/L	1	325.3	03/04/13 BH
Sulfates	307	mg/L	1	375.4	03/04/13 BH
Hardness	280	mg/L	0.250	130.2	03/04/13 RT
Fluoride	0.05	mg/L	0.01	340.2	03/04/13 RT
Cyanide	< 0.002	mg/L	0.002	335.4	03/06/13 RT
Phenols, Total Recoverable	< 0.002	mg/L	0.002	420.4	03/06/13 RT
Aluminum	< 0.030	mg/L	0.030	202.1	03/07/13 JB
Antimony	< 0.002	mg/L	0.002	204.1	03/07/13 JB
Arsenic	< 0.002	mg/L	0.002	206.4	03/07/13 JB
Barium	< 0.020	mg/L	0.020	208.1	03/07/13 JB
Beryllium	< 0.001	mg/L	0.001	210.1	03/07/13 JB
Boron	< 0.500	mg/L	0.500	212.3	03/07/13 JB
Cadmium	< 0.002	mg/L	0.002	213.1	03/07/13 JB
Chromium	< 0.006	mg/L	0.006	218.1	03/07/13 JB
Cobalt	< 0.005	mg/L	0.005	219.1	03/07/13 JB
Copper	< 0.003	mg/L	0.003	220.1	03/07/13 JB
Iron, Total	0.153	mg/L	0.006	236.1	03/07/13 JB
Iron, Dissolved	0.013	mg/L	0.006	236.1	03/07/13 JB
Lead	< 0.0075	mg/L	0.0075	239.1	03/07/13 JB
Manganese, Total	0.336	mg/L	0.002	243.1	03/07/13 JB
Manganese, Dissolved	0.228	mg/L	0.002	243.1	03/07/13 JB
Mercury	< 0.002	mg/L	0.002	245.1	03/07/13 JB
Molybdenum	< 0.020	mg/L	0.020	246.1	03/07/13 JB
Nickel	< 0.010	mg/L	0.010	249.1	03/07/13 JB
Selenium	< 0.002	mg/L	0.002	270.2	03/07/13 JB
Silver	< 0.002	mg/L	0.002	272.1	03/07/13 JB
Thallium	< 0.020	mg/L	0.020	279.1	03/07/13 JB
Vanadium	< 0.100	mg/L	0.100	286.1	03/07/13 JB
Zinc	< 0.001	mg/L	0.001	289.1	03/07/13 JB

Reviewed By: Joseph Bencini

ATTACHMENT III.2.C.2

SURFACE WATER MONITORING DATA

SURFACE WATER DATA SUMMARY SHEET

POND ID	SAMPLE DATE	Hardness (as CaCO3) (mg/L)	Ph	Alkalinity, total (as CaCO3) (mg/L)	Acidity, total (as CaCO3) (mg/L)	Solids, total dissolved (mg/L)	Solids, total suspended (mg/L)	Chloride (as Cl) (mg/L)	Sulfate, total (as SO4) (mg/L)	Iron, total (as Fe) (mg/L)	Manganese, total (as Mn) (mg/L)
PC 1 Pond Creek Below Unnamed Tributary PC 1											
PC 1	11/7/2013	176	7.7	68	10	222	5	28	260	0.34	0.26
PC 1	2/27/2014	232	7.7	60	10	392	13	64	296	0.46	0.46
PC 1	5/30/2014	260	7.6	120	<10	564	10	43	333	0.258	0.36
PC 2 Pond Creek Below Unnamed Tributary from Plant Area											
PC 2	11/7/2013	136	7.9	84	12	208	4	28	169	0.43	0.22
PC 2	2/27/2014	348	7.6	124	10	1272	6	400	668	0.31	0.68
PC 2	5/30/2014	260	7.6	110	<10	1884	5	470	750	0.279	0.14
PC 3 Pond Creek Above Unnamed Tributary PC 4											
PC 3	8/15/2013	180	7.4	82	<10	282	6	11	176	0.14	0.03
PC 3	2/27/2014	264	7.7	70	<10	512	5	56	380	0.48	0.37
PC 3	5/30/2014	260	7.5	94	10	520	6	34	306	0.355	0.31
PC 4 Unnamed Southeast Corner Upstream of RR Spur											
PC 4	8/15/2013	257	7.1	117	16	334	2	10	180	0.15	0.52
PC 4	2/27/2014	160	7.5	50	<10	228	5	24	209	0.77	1.28
PC 4	5/30/2014	340	7.2	94	<10	536	15	9	370	0.381	5.21
C 1 - East Unnamed Tributary Upstream of Corinth Road											
C 1	8/15/2013	345	7.3	262	<10	440	5	16	144	0.07	0.23
C 1	11/7/2013	344	7.4	360	12	530	14	40	230	0.18	1.1
C 1	2/27/2014	280	7.5	160	10	484	2	44	252	0.15	0.23
C 1	5/30/2014	170	7.4	172	<10	304	147	22	110	1.312	0.73
C 2 - West Unnamed Tributary Upstream of Corinth Road											
C 2	8/15/2013	233	7	63	10	342	<1	10	268	0.06	0.07
C 2	2/27/2014	280	7.7	40	<10	392	11	28	325	0.15	0.03
C 2	5/30/2014	100	7.5	62	<10	160	260	11	80	1.735	0.31

R09787

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	11/20/13
PDL:	15812-13	**COMMENT:**	Flow = 2 cfs
SAMPLE ID:	PC 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	11/7/13	**DATE RECEIVED:**	11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	222	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	5	mg/L	1	160.2	11/11/13 KE
pH	7.7	Unit		150.1	11/7/13 TG
Acidity	10	mg/L	10	305.1	11/19/13 KE
Alkalinity	68	mg/L	10	310.1	11/19/13 KE
Chlorides	28	mg/L	1	325.3	11/12/13 KE
Sulfates	260	mg/L	1	375.4	11/14/13 KE
Hardness	176	mg/L	1	130.2	11/19/13 KE
Iron, Total	0.344	mg/L	0.006	236.1	11/13/13 JB
Iron , Dissolved	0.268	mg/L	0.006	236.1	11/13/13 JB
Manganese, Total	0.260	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	0.187	mg/L	0.002	243.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	3/12/14
PDL:	15923-13	**COMMENT:**	5.0 cfs
SAMPLE ID:	PC 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	2/27/14	**DATE RECEIVED:**	2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.7	Unit		150.1	2/27/14 TG
Acidity	10	mg/L	10	305.1	3/10/14 KE
Alkalinity	60	mg/L	10	310.1	3/10/14 KE
Chlorides	64	mg/L	1	325.3	3/10/14 KE
Sulfates	296	mg/L	1	375.4	3/7/14 KE
Hardness	232	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	392	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	13	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.456	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.346	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	0.462	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.461	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-13	**COMMENT:**	1.2 cfs
SAMPLE ID:	PC 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	120	mg/L	10	310.1	6/12/14 KE
Chlorides	43	mg/L	5	325.3	6/9/14 AK
Sulfates	333	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	564	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	10	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.258	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.160	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.357	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	0.045	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	11/20/13
PDL:	15812-14	**COMMENT:**	Flow = 5 cfs
SAMPLE ID:	PC 2	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	11/7/13	**DATE RECEIVED:**	11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	208	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	4	mg/L	1	160.2	11/11/13 KE
pH	7.9	Unit		150.1	11/7/13 TG
Acidity	12	mg/L	10	305.1	11/19/13 KE
Alkalinity	84	mg/L	10	310.1	11/19/13 KE
Chlorides	28	mg/L	1	325.3	11/12/13 KE
Sulfates	169	mg/L	1	375.4	11/14/13 KE
Hardness	136	mg/L	1	130.2	11/19/13 KE
Iron, Total	0.429	mg/L	0.006	236.1	11/13/13 JB
Iron , Dissolved	0.327	mg/L	0.006	236.1	11/13/13 JB
Manganese, Total	0.217	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	0.200	mg/L	0.002	243.1	11/13/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	3/12/14
PDL:	15923-14	**COMMENT:**	5.5 cfs
SAMPLE ID:	PC 2	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	2/27/14	**DATE RECEIVED:**	2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit		150.1	2/27/14 TG
Acidity	10	mg/L	10	305.1	3/10/14 KE
Alkalinity	124	mg/L	10	310.1	3/10/14 KE
Chlorides	400	mg/L	1	325.3	3/10/14 KE
Sulfates	668	mg/L	1	375.4	3/7/14 KE
Hardness	348	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	1,272	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	6	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.306	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.300	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	0.677	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.606	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-14	**COMMENT:**	3.0 cfs
SAMPLE ID:	PC 2	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	110	mg/L	10	310.1	6/12/14 KE
Chlorides	470	mg/L	5	325.3	6/9/14 AK
Sulfates	750	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	1,844	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	5	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.279	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.132	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.138	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-15	**COMMENT:**	Flow = 0.5 cfs
SAMPLE ID:	PC 3	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	282	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	6	mg/L	1	160.2	08/19/13 KE
pH	7.4	Unit		150.1	08/15/13 TG
Acidity	< 10	mg/L	10	305.1	08/16/13 KE
Alkalinity	82	mg/L	10	310.1	08/16/13 KE
Chlorides	11	mg/L	1	325.3	08/19/13 KE
Sulfates	176	mg/L	1	375.4	08/19/13 KE
Hardness	180	mg/L	1	130.2	08/16/13 KE
Iron, Total	0.141	mg/L	0.006	236.1	08/27/13 JB
Iron , Dissolved	0.141	mg/L	0.006	236.1	08/27/13 JB
Manganese, Total	0.034	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	0.030	mg/L	0.002	243.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	3/12/14
PDL:	15923-15	**COMMENT:**	3.0 cfs
SAMPLE ID:	PC 3	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	2/27/14	**DATE RECEIVED:**	2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.7	Unit		150.1	2/27/14 TG
Acidity	< 10	mg/L	10	305.1	3/10/14 KE
Alkalinity	70	mg/L	10	310.1	3/10/14 KE
Chlorides	56	mg/L	1	325.3	3/10/14 KE
Sulfates	380	mg/L	1	375.4	3/7/14 KE
Hardness	264	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	512	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	5	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.482	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.482	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	0.373	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.326	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-15
SAMPLE ID: PC 3
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 0.5 cfs
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	5/30/14 TG
Acidity	10	mg/L	10	305.1	6/12/14 KE
Alkalinity	94	mg/L	10	310.1	6/12/14 KE
Chlorides	34	mg/L	5	325.3	6/9/14 AK
Sulfates	306	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	520	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	6	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.355	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.192	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.311	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-16	**COMMENT:**	Flow = 80 gpm
SAMPLE ID:	PC 4	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	334	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	2	mg/L	1	160.2	08/19/13 KE
pH	7.1	Unit		150.1	08/15/13 TG
Acidity	16	mg/L	10	305.1	08/16/13 KE
Alkalinity	117	mg/L	10	310.1	08/16/13 KE
Chlorides	10	mg/L	1	325.3	08/19/13 KE
Sulfates	180	mg/L	1	375.4	08/19/13 KE
Hardness	257	mg/L	1	130.2	08/16/13 KE
Iron, Total	0.151	mg/L	0.006	236.1	08/27/13 JB
Iron , Dissolved	0.151	mg/L	0.006	236.1	08/27/13 JB
Manganese, Total	0.517	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	0.473	mg/L	0.002	243.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	3/12/14
PDL:	15923-16	**COMMENT:**	0.6 cfs
SAMPLE ID:	PC 4	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	2/27/14	**DATE RECEIVED:**	2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	2/27/14 TG
Acidity	< 10	mg/L	10	305.1	3/10/14 KE
Alkalinity	50	mg/L	10	310.1	3/10/14 KE
Chlorides	24	mg/L	1	325.3	3/10/14 KE
Sulfates	209	mg/L	1	375.4	3/7/14 KE
Hardness	160	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	228	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	5	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.770	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.770	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	1.278	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	1.000	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-16	**COMMENT:**	100 GPM
SAMPLE ID:	PC 4	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.2	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	94	mg/L	10	310.1	6/12/14 KE
Chlorides	9	mg/L	5	325.3	6/9/14 AK
Sulfates	370	mg/L	5	375.4	6/12/14 AK
Hardness	340	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	536	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	15	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.381	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.150	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	5.214	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	2.028	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-17	**COMMENT:**	Flow = 15 gpm
SAMPLE ID:	C 1	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	440	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	5	mg/L	1	160.2	08/19/13 KE
pH	7.3	Unit		150.1	08/15/13 TG
Acidity	< 10	mg/L	10	305.1	08/16/13 KE
Alkalinity	262	mg/L	10	310.1	08/16/13 KE
Chlorides	16	mg/L	1	325.3	08/19/13 KE
Sulfates	144	mg/L	1	375.4	08/19/13 KE
Hardness	345	mg/L	1	130.2	08/16/13 KE
Iron, Total	0.066	mg/L	0.006	236.1	08/27/13 JB
Iron , Dissolved	0.010	mg/L	0.006	236.1	08/27/13 JB
Manganese, Total	0.233	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	0.096	mg/L	0.002	243.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	11/20/13
PDL:	15812-17	**COMMENT:**	Flow = 3 gpm
SAMPLE ID:	C 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	11/7/13	**DATE RECEIVED:**	11/8/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	530	mg/L	1	160.1	11/11/13 KE
Total Suspended Solids	14	mg/L	1	160.2	11/11/13 KE
pH	7.4	Unit		150.1	11/7/13 TG
Acidity	12	mg/L	10	305.1	11/19/13 KE
Alkalinity	360	mg/L	10	310.1	11/19/13 KE
Chlorides	40	mg/L	1	325.3	11/12/13 KE
Sulfates	230	mg/L	1	375.4	11/14/13 KE
Hardness	344	mg/L	1	130.2	11/19/13 KE
Iron, Total	0.180	mg/L	0.006	236.1	11/13/13 JB
Iron , Dissolved	0.170	mg/L	0.006	236.1	11/13/13 JB
Manganese, Total	1.10	mg/L	0.002	243.1	11/13/13 JB
Manganese, Dissolved	0.973	mg/L	0.002	243.1	11/13/13 JB

Reviewed By: Jeff Gough

R09802

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-17
SAMPLE ID: C 1
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 10 GPM
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	2/27/14 TG
Acidity	10	mg/L	10	305.1	3/10/14 KE
Alkalinity	160	mg/L	10	310.1	3/10/14 KE
Chlorides	44	mg/L	1	325.3	3/10/14 KE
Sulfates	252	mg/L	1	375.4	3/7/14 KE
Hardness	280	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	484	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	2	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.154	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.146	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	0.225	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.222	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-17	**COMMENT:**	20 GPM
SAMPLE ID:	C 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.4	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	172	mg/L	10	310.1	6/12/14 KE
Chlorides	22	mg/L	5	325.3	6/9/14 AK
Sulfates	110	mg/L	5	375.4	6/12/14 AK
Hardness	170	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	304	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	147	mg/L	5	160.2	6/19/14 KE
Iron, Total	1.312	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.337	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.729	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	0.021	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	08/27/13
PDL:	15716-18	**COMMENT:**	Flow = 10 gpm
SAMPLE ID:	C 2	**SAMPLED BY:**	Client
DATE SAMPLED:	08/15/13	**DATE RECEIVED:**	08/15/13

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
Total Dissolved Solids	342	mg/L	1	160.1	08/19/13 KE
Total Suspended Solids	< 1	mg/L	1	160.2	08/19/13 KE
pH	7.0	Unit		150.1	08/15/13 TG
Acidity	10	mg/L	10	305.1	08/16/13 KE
Alkalinity	63	mg/L	10	310.1	08/16/13 KE
Chlorides	10	mg/L	1	325.3	08/19/13 KE
Sulfates	268	mg/L	1	375.4	08/19/13 KE
Hardness	233	mg/L	1	130.2	08/16/13 KE
Iron, Total	0.064	mg/L	0.006	236.1	08/27/13 JB
Iron , Dissolved	< 0.006	mg/L	0.006	236.1	08/27/13 JB
Manganese, Total	0.067	mg/L	0.002	243.1	08/27/13 JB
Manganese, Dissolved	0.042	mg/L	0.002	243.1	08/27/13 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.
CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 15923-18
SAMPLE ID: C 2
DATE SAMPLED: 2/27/14

REPORT DATE: 3/12/14
COMMENT: 20 GPM
SAMPLED BY: Client-TG
DATE RECEIVED: 2/27/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.7	Unit		150.1	2/27/14 TG
Acidity	< 10	mg/L	10	305.1	3/10/14 KE
Alkalinity	40	mg/L	10	310.1	3/10/14 KE
Chlorides	28	mg/L	1	325.3	3/10/14 KE
Sulfates	325	mg/L	1	375.4	3/7/14 KE
Hardness	280	mg/L	10	130.2	3/10/14 KE
Total Dissolved Solids	392	mg/L	50	160.1	3/6/14 KE
Total Suspended Solids	11	mg/L	1	160.2	3/6/14 KE
Iron, Total	0.152	mg/L	0.006	236.1	3/6/14 JB
Iron , Dissolved	0.152	mg/L	0.006	236.1	3/6/14 JB
Manganese, Total	0.033	mg/L	0.002	243.1	3/6/14 JB
Manganese, Dissolved	0.033	mg/L	0.002	243.1	3/6/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Pond Creek
PDL: 16038-18
SAMPLE ID: C 2
DATE SAMPLED: 5/30/14

REPORT DATE: 6/20/14
COMMENT: 20 GPM
SAMPLED BY: Client-TG
DATE RECEIVED: 5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	62	mg/L	10	310.1	6/12/14 KE
Chlorides	11	mg/L	5	325.3	6/9/14 AK
Sulfates	80	mg/L	5	375.4	6/12/14 AK
Hardness	100	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	160	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	260	mg/L	5	160.2	6/19/14 KE
Iron, Total	1.735	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.585	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.310	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

3001-15
part 9

R09807

PART IV

OPERATIONS PLAN

1) Proposed Operational Procedures and Methods for the Mine Over Its Projected Life

Describe the type and method of mining procedures and proposed engineering techniques to be employed in the operation of the proposed mine. Describe the major equipment to be employed and how such equipment will be used in the different aspects of the mining operation. Provide an estimation of the anticipated annual coal production and anticipated coal production by tonnage once the mine is at full operational capacity.

RESPONSE: This application is for the development of a coal refuse disposal facility. No surface and/or underground mining is proposed. Equipment to be used could include conveyor belts, excavators, dozers and/or trucks, and pumps for the transport, placement and compaction of coal refuse. The mine is currently operating at full capacity under Permit No. 375 at a rate of 7 million tons of clean coal per year.

2) Mining Operations Plan for the Proposed Permit Area

RESPONSE: Refer to Volume 2 for information concerning development of a coal refuse disposal area within the permit area. An impoundment will be constructed for the disposal of fine and coarse coal refuse. A sediment control structure will be constructed around the perimeter of the impoundment. Cleanings from the sediment control structure will be placed in the impoundment.

Describe the proposed mining operations plan for the permit area in terms of the mining sequence, the employment of facilities, establishment and maintenance of erosion control facilities, air pollution control facilities, coal storage, cleaning and loading areas, location and placement of topsoil, spoil, coal waste, or other storage facilities.

A) 1) Describe how each type of overburden (soil horizons, glacial drift and consolidated material) will be handled with regards to shaft excavations.

RESPONSE: N/A

2) If toxic materials have been identified as occurring in the overburden, describe how these materials will be handled to insure proper disposal.

RESPONSE: N/A

B) 1) Locate on the operations map all soil horizon storage areas and/or root medium stockpiles. Identify each storage area as to its content.

RESPONSE: Topsoil and subsoil will be stored on adjacent Permit No. 375. There is an existing stockpile area south of the refuse area that has not been filled to capacity. There is an area west of the existing stockpile that is currently being permitted. Also, there is an area currently permitted east of the current stockpile which is a potential topsoil/subsoil storage area. There is also an airshaft/storage area due north of the area which could be used to store soil. The locations have been identified on Drawing No. B12-271-M24.

2) Describe measures to be employed to prevent or minimize exposure of soil stockpiles to excessive water and wind erosion, unnecessary compaction and contamination by undesirable materials.

RESPONSE: Stockpiles will be revegetated as soon as practical after all of the soil has been placed. This should minimize exposure to excessive water and wind erosion, and contamination by undesirable material. Outer slopes will not be over compacted by mining.

3) Describe methods and treatment measures to be used on exposed areas where topsoil has been removed to prevent excess air and water pollution.

RESPONSE: Seeding with small grain or grass cover crops and applying straw or hay mulch will be used where practicable and the installation of sediment basins will be used as a means of controlling suspended solids from exposed areas where topsoil has been remove. If necessary to control air pollution on such exposed areas, surface water will be applied utilizing suitable equipment.

C) The permit map and plans shall show the lands proposed to be affected within the proposed permit through the operation, according to the sequence of mining and reclamation and any change in a facility or feature to be caused by the proposed operations if the facility or feature was shown under 62 Ill. Adm. Code Sections 1783.24 through 1783.25.

RESPONSE: See Map 6 S.F., Operations Plan Map.

D) Show on the permit map or other designated map each area of land for which a performance bond will be posted under 62 Ill. Adm. Code 1800.

RESPONSE: See Map 6 S.F., Operations Plan Map.

E) Mining Operations Plan for the Proposed Shadow Area

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

1) Provide a map at a scale of 1 inch to 1,000 feet or other scales as approved by the Department identifying the limits of the proposed shadow area (area from which coal is proposed to be extracted by underground mining methods).

2) Within the limits of the proposed shadow area identify all areas projected to be mined, at a minimum, during the term of the permit showing the proposed size, sequence and yearly projections for the development of underground workings.

3) Subsidence Control Plan

A) General Requirements

2) Within the permit, shadow and adjacent areas are there structures or renewable resource lands?

Yes _____ No _____

If yes, on the shadow area map described in 2.E. above, or other designated map, provide survey information which identifies all structures and renewable resource lands. Include all topographic features at a maximum contour interval of 10 feet. Identify all surface and subsurface man made features within, passing through, or passing over the area in which underground mining operations are located or will be projected to be located. Such features shall include but are not limited to all buildings, facilities, roads, bridges, major electric transmission lines, pipelines, agricultural drainage tile fields, gas and oil wells and water wells.

If no, provide evidence and support documentation that no structures or renewable resource lands exist as a result of a survey conducted within these areas.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

2) Within the proposed permit, shadow or adjacent areas does the applicant intend to adopt mining technologies which provide for planned subsidence in a predictable and controlled manner?

Yes _____ No _____

If yes, provide information requested under "Planned Subsidence", Subsection B.
If no, provide information requested under "Subsidence Unplanned", Subsection C.
If the applicant intends to conduct both planned and unplanned subsidence mining operations both subsections B and C must be addressed.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

3) Provide geologic descriptions characterizing the thickness and lithology of the coal and overburden geological units throughout the shadow area. Provide stratigraphy test boring and core sampling log descriptions from the shadow area. Include the elevation and locations of the boring logs.

RESPONSE: Refer to the geologic logs, which are located in Attachment IV.3.A.3.

B) Planned Subsidence

1) Provide a detailed description of the mining technology used to produce planned and predictable subsidence?

RESPONSE: N/A. No underground mining is proposed by this permit application.

2) Provide a description of factors (i.e. drift thickness variations, expected variations in extraction height, or presence of faults and their direction (strike & dip) in relation to mine panels, etc.) with supporting documentation which may influence the magnitude, extent and predictability of planned subsidence. Include data on predicted subsidence profiles and post-subsidence contours, including calculations on the predicted angle of draw. Provide a description of measures taken in the field to confirm the accuracy and reliability of predicted subsidence profiles.

RESPONSE: N/A. No underground mining is proposed by this permit application.

3) On a plan base map(s), at a map scale of 1 inch to 400 feet provide a map of underground workings which locates all areas where planned subsidence mining operations are to be conducted. Include detailed information in regard to the location, length, width and height of projected panel development and extraction areas. Give typical percentage of coal removed in planned subsidence extraction areas.

RESPONSE: N/A. No underground mining is proposed by this permit application.

4) On the 1 inch to 400 feet plan base map(s) the information regarding the location of features required in Parts a-d below is to be provided in relation to areas of planned subsidence.

RESPONSE: N/A. No underground mining is proposed by this permit application.

a) Identify all topographic features at a maximum contour interval of 10 feet.

RESPONSE: N/A. No underground mining is proposed by this permit application.

b) Identify and label all impoundments with a storage capacity of 20 acre-feet or more, or bodies of water with a volume of 20 acre feet or more. In a written narrative provide information which assures compliance with the requirement of Title 62 Ill. Adm. Code 1817.121(d) to permit such proposed mining operations. If no such features exist provide a specific statement indicating such.

RESPONSE: N/A. No 20 acre-feet impoundments and/or bodies of water existing within the proposed permit area.

c) Identify and label all public road right-of-ways and cemeteries located within 100 feet measured horizontally of surface areas of predicted planned subsidence. In a written narrative provide information which assures compliance with the requirements of Title 62 Ill. Adm. Code 1761.11 and 12 as may be necessary to permit planned subsidence mining operations within the prohibited area. If no such features exist provide a specific statement indicating such.

RESPONSE: N/A. No underground mining is proposed by this permit application.

d) Identify and label all occupied dwellings, public buildings and facilities, schools, churches, hospitals, community or institutional buildings, or public parks located within 300 feet measured horizontally of surface areas of predicted planned subsidence. If no such features exist provide a specific statement indicating such. If such features do exist include the following information as may be necessary:

i) Provide a written narrative with support documentation which assures compliance with the requirements of Title 62 Ill. Adm. Code 1761.11 and 12 as may be necessary to permit planned subsidence mining operations within the prohibited area.

RESPONSE: N/A. No underground mining is proposed by this permit application.

ii) Provide a written narrative which assures compliance with the requirements of Title 62 Ill. Adm. Code 1817.121(d) as may be necessary to permit such proposed mining operations in relation to public buildings and facilities, schools, churches and hospitals.

RESPONSE: N/A. No underground mining is proposed by this permit application.

5) Describe the anticipated effects of planned subsidence.

a) Using the predicted magnitude, extent of planned subsidence profiles, post-subsidence contours and angle of draw provided in response to 4.B. above, provide a list of all structures and facilities located within the projected area of influence of the planned subsidence. The list provided must correspond to each panel or extraction area to be mined by planned subsidence mining methods and must cross-reference with surface structures and feature map(s).

RESPONSE: N/A. No underground mining is proposed by this permit application. Longwall mining has been completed beneath the proposed disposal facility.

b) Using the predicted magnitude, extent of planned subsidence profiles and post-subsidence contours provided in response to B, 2, above, locate and identify all areas of where surface subsidence impacts are projected to cause disruptions of surface drainage or drainage problems on a map(s) at a 1" to 400' scale.

RESPONSE: N/A. No underground mining is proposed by this permit application.

c) Describe any other anticipated effects of planned subsidence.

6) Describe, if any, measures to be taken on the surface to prevent or minimize the effects of planned subsidence.

RESPONSE: N/A. No underground mining is proposed by this permit application.

7) Describe measures to be taken to mitigate or remedy any subsidence-related material damages.

a) Provide a description of mitigation measures to be taken to repair or compensate the owners of structures or facilities which sustain material damage caused by subsidence, including but not limited to the following:

i) Compensate the owner of structures or facilities in the full amount of the diminution in value resulting from the subsidence.

ii) Repair, restore, rehabilitate or replace damaged structures or facilities.

iii) Compensation may be accomplished by the purchase prior to mining of a noncancelable premium prepaid insurance policy payable to the surface owner in the full amount of the possible material damage. Documentation of the purchase of such qualifying insurance must be provided.

RESPONSE: N/A. No underground mining is proposed by this permit application.

b) Provide a description of measures adopted to control and correct material damage resulting from subsidence caused to surface lands, to the extent technologically and economically feasible, by restoring the land to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before subsidence. Also provide descriptions of specific repair measures recommended to remedy anticipated material damages detailed in 7.a above.

RESPONSE: N/A. No underground mining is proposed by this permit application.

c) to mitigate subsidence-related material damage to land and structures, provide a description of measures to be taken to determine the degree of material damage or diminution of value or reasonable foreseeable use of the surface.

RESPONSE: N/A. No underground mining is proposed by this permit application.

C) Subsidence Unplanned (Maximize Mine Stability)

1) Describe the method of coal removal which is designed consistent with known technology to maximize mine stability to prevent or minimize subsidence and subsidence related damage so that if subsidence does occur it cannot be considered planned subsidence.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

2) On the shadow area map(s) describe in 2.E. above, or other designated map show all areas where coal extraction as described above in 3.C.1 is to occur. Include the following detailed information:

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

a) Provide the location of mains, submains and extraction panels giving geometric sizes, dimensions and orientation including lengths, widths, and extraction heights of each.

b) Identify and label all impoundments with a storage capacity of 20 acre-feet or more, or bodies of water with a volume of 20 acre feet or more, public buildings and facilities, churches, schools and hospitals. In a written narrative provide information which assures compliance with the requirements of Title 62 Ill. Adm. Code 1817.121(d) as may be necessary to permit such proposed mining operations. If no such features exist provide a specific statement indicating such.

c) Provide calculations for the estimated potential angle of draw.

3) Provide information regarding proposed mining extraction geometries, including information on the dimensions of pillars, extraction widths of rooms, entries, and crosscuts, etc., for all mains, submains, panel entries and all development areas. Provide information regarding the highest extraction percentage for each of the mining geometries proposed by the operator, if variations are proposed. Information is to include specific details of the effects of any proposed second mining operations on final mining geometries and extraction percentages. Map(s) at a scale of 1 inch to 400 feet (other scales as approved by the Department) are to be provided representing all proposed extraction geometries, including any proposed second mining.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

Provide information regarding the design engineering of the various mining geometries proposed in 3.C.3 above in maximizing mine stability to prevent subsidence. Include the following:

i) Detailed information regarding the specific methodology used to calculate mine stability with support documentation and design calculations.

ii) Data concerning actual coal strengths typical of the coal to be mined and as this information relates to pillar design and stability.

iii) Data regarding the strength and geotechnical characteristics of the actual mine floor and subfloor as it relates to mine design and stability. Information is to be included describing the thickness and lithology of the floor and subfloor units.

4) Provide detailed descriptions of subsidence control measures that will be taken to prevent or minimize subsidence and subsidence-related damage which includes, but is not limited to the following:

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

a) Backstowing or backfilling, include map locations;

b) Leaving areas in which no coal is removed within the shadow area, including a description of the overlying area to be protected by solid coal blocks left in place. Identify any such areas by map locations;

c) Surface measures taken to prevent material damage or lessening of the value of reasonably foreseeable uses of the surface;

d) Monitoring, if any, to determine the commencement and degree of subsidence so that other appropriate measures can be taken to prevent or reduce material damage. Include map locations of any proposed monitoring sites.

5) Describe measures to be taken to mitigate or remedy any subsidence-related material damages.

RESPONSE: N/A. No surface and/or underground mining are proposed by this permit.

a) Provide a description of mitigation measures taken to repair or compensate the owners of structures or facilities which may be materially damaged by subsidence, including but, not limited to the following:

i) Compensate the owner of structures or facilities in the full amount of diminution in value resulting from the subsidence.

ii) Repair, restore, rehabilitate or replace damaged structures or facilities.

iii) Compensation may be accomplished by the purchase prior to mining of a noncancelable premium prepaid insurance policy payable to the surface owner in the full amount of the possible material damage. Documentation of the purchase of such qualifying insurance must be provided.

b) Provide a description of measures adopted to control and correct material damage resulting from subsidence caused to surface lands, to the extent technologically and economically feasible, by restoring the land to a condition capable of maintaining the value and reasonably foreseeable uses which it was capable of supporting before subsidence.

c) In conjunction with the requirements to mitigate subsidence-related material damage to land, and structures provide a description of measures to be taken to determine the degree of material damage or diminution of value or reasonable foreseeable uses of the surface.

4) Existing Structures

A) Provide a description of each existing structure proposed to be used in connection with or to facilitate the surface coal mining and reclamation operations. The description shall include the following:

1) Locate the structure on the operations map or other designated map,

2) provide plans of the structure detailing its current, pre-mining condition,

3) provide approximate dates, beginning and completion for construction of the structure, and

4) provide a showing that the structure meets the performance standards of either 62 Ill. Adm. Code Sections 1810 through 1828 or 62 Ill. Adm. Code Sections 280-300 (Interim Regulation Program). The showing shall monitor data or other substantiating evidence.

RESPONSE: N/A. No existing structures are proposed to be used in connection with this permit.

B) For each structure proposed to be modified or reconstructed for use in connection with or to facilitate the surface coal mining and reclamation operations a compliance plan is required which shall include the following:

1) Design specifications for reconstruction or modification of the structure to meet the design and performance standards of 62 Ill. Adm. Code Sections 1810 through 1828.

2) A schedule for reconstruction or modification of the structure showing dates for beginning and completing interim steps as well as final reconstruction,

3) provisions for monitoring the structure during and after modification to ensure that the performance standards of 62 Ill. Adm. Code Sections 1810 through 1828 are met, and

4) a showing that the risk of harm of the environment or to public health or safety is not significant during the period of modification or reconstruction.

RESPONSE: N/A. No existing structures are proposed to be used in connection with this permit.

5) Support Facilities

A) Locate on a mining operations map each of the areas to be permitted for surface disturbance to facilitate the mining operation. Map shall include all support facilities including buildings, structures, conveyors, parking areas, coal preparation plants, yards, railroad spurs, on-site rail yards, each air pollution collection and control facility, each facility to be used to protect and enhance fish and wildlife and related environmental values, and each explosive storage and handling facility.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

B) Indicate acreage of each type of facility within permit area such as: buildings, roads, railroads, parking areas, pavements, loading and unloading facilities, sanitary facilities, and undeveloped areas. (Summation of above areas should equal total support facility area.)

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

SUPPORT AREA		ACRES
Mine Buildings		0.00
Mine Office Parking		0.00
Mine Yard		0.00
Preparation Plant Buildings		0.00
Prep Plant Parking		0.00
Prep Plant Yard		0.00
Refuse Area		203.87
Railroad		0.00
Access Roads (Roads and Shoulders)		0.00
Topsoil Storage		0.00
Dirt Stockpile		0.00
Drainage Facilities		25.91
Coal Storage		0.00
Mine Support Areas		0.00
Plant Support Areas		0.00
Other		0.00
Undeveloped Areas		0.00
TOTAL		229.78

C) Transportation Facilities

1) Provide a detailed description on mining operations map or other map and show location of the following:

a) Proposed road(s), conveyor system(s), or rail system.

b) Related sediment control facilities.

c) Earth borrow locations and/or locations for deposition of excess excavation.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

2) Provide specifications and plan-profiles of existing gradeline, proposed road centerline, ditch flow lines, road cut, fill embankment, culvert, bridge and drainage structures. Provide typical cross sections where appropriate.

RESPONSE: Refer to Volume 2.

3) For all transportation facilities to be constructed, provide construction details for all sediment control facilities to be constructed to prevent additional contributions of suspended solids to streamflow or to runoff outside the permit area.

RESPONSE: Transportation facilities to be constructed consist of a road around the perimeter of the impoundment which will be infrequently used and a conveyor belt to transport refuse. An access road from abandoned Dwina Road to the refuse facility will be constructed. The sediment ditch around the perimeter of the refuse pile and proposed sediment pond will provide sediment control for all of the transportation facilities.

4) Discuss the revegetation of ditch and borrow areas involved in construction.

RESPONSE: Borrow areas, cut and fill slopes, roadside ditches, and other disturbed areas are to be mulched and seeded following construction activities within the respective areas. Other best management practices may also be used in these areas prior to establishment of the vegetative cover and/or to supplement erosion and sediment control practices in these areas.

5) Discuss the estimated life of each facility and how materials will be removed when the facility becomes inactive.

RESPONSE: The life of the refuse facility proposed in this application is approximately fifteen (15) years.

6) Provide a report of appropriate geo-technical analysis where approval from the Department is required for alternative specifications or steep cut slopes under 62 Ill. Adm. Code 1817.150.

RESPONSE: N/A

7) Provide a description of measures to be taken to protect the inlet end of a ditch relief culvert, other than use of a rock headwall, and for alteration or relocation of a natural drainageway for approval by the Department under 62 Ill. Adm. Code 1817.150.

RESPONSE: Information for protecting the inlet end of culverts is shown on Drawing Nos. B12-271-B3 and B12-271-B4.

6) Waste Material

A) Identify the nature of all waste material including shaft excavation material and non-coal waste to be disposed of within the permit area. Give the net neutralization potential.

RESPONSE: Coarse and fine refuse generated from coal processing will be disposed of in the permit area. Sources of coal refuse are primarily roof and floor lithologies associated with the coal seam. Therefore, the refuse is expected to be primarily composed of gray to black shale and underclay or claystone. Acid base accounting is contained in Attachment IV.6.A.

B) Coal processing waste bank dams shall be designed to comply with requirements of 62 Ill. Adm. Code 1817.81 through 1817.84. For coal processing waste dams and embankments each plan shall comply with the requirements of MSHA, 30 CFR 77.216-1 and 77.216-2, and shall contain the results of a geo-technical investigation as prescribed under 62 Ill. Adm. Code 1784.16(e).

RESPONSE: Refer to the Engineering Design and Report contained in Volume 2.

C) Indicate location of all areas in which such materials including shaft excavation material and non-coal waste (including those under Subtitle C of RCRA) are to be disposed of on the mining operations map. Indicate all streams, creeks, and surface water impoundments within such areas or which receive runoff from such areas. Provide acreage of disposal area and borrow areas. Indicate location of borrow area on mining operations map.

RESPONSE: The location of the area where coal refuse will be placed is shown on the "Operation Plan Map", Drawing No. B12-271-M24.

D) Provide construction details for all impoundments and structures to contain such waste material. Provide typical cross-sections of all proposed levees, dams and excavations.

RESPONSE: Refer to Volume 2.

E) Indicate location and provide details for diversions as necessary to divert surface water around such areas on the mining operations map.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

F) Provide details of diversions or other devices designed to collect surface runoff from waste disposal sites and transport same to appropriate treatment facility.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map.

G) Provide details of such treatment facilities and identify points of discharge.

RESPONSE: Refer to Refer to Map 6 S.F. Operations Plan Map and Volume 2.

H) For disposal areas explain measures to be taken to avoid pollution of surface or groundwater due to leaching through levees or dams and through underlying soil.

RESPONSE: During mining and reclamation activities, erosion and sediment control measures will be applied to disturbed areas to minimize contamination of surface runoff.

Soil material shall be rolled and compacted to 95% beneath the Coal Refuse Disposal Area No. 3 Facility. Coal processing wastes will be placed in the refuse disposal areas and covered with soil materials to minimize contact with surface runoff. Runoff from disposal areas will pass through approved sediment control structures for treatment before release and will meet appropriate NPDES effluent criteria. Should runoff from the refuse disposal area develop acidic characteristics, the runoff will be collected and neutralized to meet water quality standards. The fine-grained soil materials underlying the refuse disposal area exhibit very low permeability that will inhibit infiltration and percolation of leachate from the refuse material into the ground water system. Covering the refuse material with four feet of soil will protect the material from the effects of oxidation and erosion as well as minimize the potential for impacts to ground water resources by minimizing leachate production. Earthen materials used in the construction of dams and levees will be compacted to reduce permeability and minimize the potential for flow through the structures. Therefore, it is unlikely the proposed disposal operations will adversely impact the quantity or quality of surface and ground water in the permit or adjacent area.

I) Describe estimated life of each area.

RESPONSE: Refer to Volume 2.

J) Coal preparation:

1) Give a general description of the coal processing operation at this facility.

RESPONSE: N/A

2) Describe the fresh water (makeup) and slurry circuits for this operation and indicate if a discharge occurs. If a discharge does occur, it should be included on Schedule A. If a discharge does not occur, a detailed description of how this will be accomplished must be submitted.

RESPONSE: Raw water is distributed to the different circuits within the adjacent preparation plant. Water is recirculated within the circuits from dewatering processes and refuse fines are accumulated in the thickener. From the thickener, clarified water is returned to the circuits and the underflow is pumped to the refuse impoundment to separate the fines from the liquid.

Clarified water from the proposed slurry cell will be pumped into the sediment ditches and will discharge into Sediment Structure No. 9 and/or to the approved water circuit system for Permit 375.

3) What safeguards are provided to prevent the discharge of slurry fines and untreated slurry water during emergency situations (e.g. power outages, mechanical equipment breakdown, plant shutdowns, etc.)? Also indicate where the slurry would go by gravity flow in the event of an emergency discharge, and the environmental impact this would have.

RESPONSE: If a power outage or mechanical equipment breakdown occurs, the fine coal refuse would be contained inside the adjacent preparation plant pipelines and equipment or emptied into the thickener. Fine coal refuse could be temporarily placed in sediment control structures where it could potentially flow by gravity. If so, Williamson Energy maintains pumps, which are powered by diesel generators. These pumps can be used to pump the fine coal refuse into the impoundment.

7) Surface Drainage Control

A) 1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems. Show drainage patterns of all affected mining areas.

RESPONSE: Refer to Map 6 S.F. Operations Plan Map.

2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the permit area?

Yes __X__ No _____

If yes, delineate how and where surface drainage will be collected and treated, and list permit numbers and type of permit that the drainage control systems are operated under. If above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of Section 1817.46(e).

RESPONSE: A sediment pond and sediment ditch structures will be constructed around the perimeter of the coal refuse disposal facility.

B) Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes_____ No __X____

If no, please discuss.

RESPONSE: A sediment pond and sediment ditch structures will be constructed around the perimeter of the coal refuse disposal facility.

C) Describe the timing in which all construction of the sediment ponds and surface drainage control structures will be complete. Include a discussion of the vegetation stabilization of these structures.

RESPONSE: Adequate drainage control in the form of temporary and/or permanent sediment control structure(s) will be in place before any other mine related disturbance occurs in the watershed. Upon completion of construction of the drainage control structures, areas disturbed during the construction, including embankments, cut and fill slopes, and soil stockpiles, will be mulched and seeded with a permanent grass species to stabilize the exposed areas. Depending on the season, a cover crop will be used to provide temporary protection until a permanent cover could be established. Temporary drainage structures will be installed as embankment construction progresses until the permanent structures are installed.

D) Overland Flow Diversions

For all diversions of overland flow, shallow groundwater flow, and ephemeral streams which divert surface water around the mining area, and all collection drains that transport affected area runoff into water-treatment facilities, provide the following:

1) Typical cross sections bottom width, side slopes and depth.

2) Proposed flow line slopes.

3) Runoff and diversion capacity calculations.

4) Details of proposed erosion and sediment control measures to be employed.

RESPONSE: N/A

For permanent diversion also include:

5) Watershed limits upstream from the diversions.

RESPONSE: N/A

6) Plan profile drawings of the proposed diversion showing existing gradeline, proposed diversion bottom gradeline and water surface at design storm.

RESPONSE: N/A

E) Sediment pond Design:
NPDES
MSHA#
Total Drainage Area (Acres)
Total Disturbed Drainage Area (Acres)
Total Calculated Inflow From Design Storm (AC-FT)
Sediment Storage Volume (AC- FT)
Total Volume Below Primary Spillway Elevation (AC-FT)
Total Volume Below Emerg. Spillway Elevation (AC-FT)

NPDES	MSHA #	Total Drainage Area (ac.)	Total Disturbed Area (ac.)	Total Calculated Inflow from Design Storm (ac-ft)	Sediment Storage Volume (ac-ft)	Total Volume Below Primary Spillway (ac-ft)	Total Volume Below Emergency Spillway (ac-ft)	Embankment Height from Upstream Toe to Emergency Spillway (ft)
009	N/A	265.10	265.10	1.98	24.60	23.89	34.67 *	1.0 **

*** - Basin has single, open-channel spillway.**
**** - Embankment height is from U/S toe to open-channel spillway.**

F) 1) Discuss the design basis for the sediment pond(s) calculations.

Submit calculations used in spillway designs and determination of inflow volume and pond volume.

RESPONSE: Refer to the calculations contained in Appendix B of Volume 2.

2) Submit a typical section of the embankment(s), details of the principal and emergency spillways and a plan view of each pond at a scale of 1 inch = 200 ft. or larger showing pond bottom contours and points of inflow.

RESPONSE: Refer to the Plan View and Details for Sediment Pond No. 9 (Drawing No. B12-271-E2) in Volume 2.

3) For all sedimentation ponds provide design information showing compliance with the requirements of 62 Ill. Adm. Code 1817.46. Each plan shall, at minimum, comply with the requirements of MSHA, 30 CFR 77.216-1 and 77.216-2.

RESPONSE: Refer to the Plan View and Details for Sediment Pond No. 9 (Drawing No. B12-271-E4) in Volume 2 and Appendix B.

G) If sediment removal becomes necessary, explain how the sediment will be removed, where it will be disposed of, and what disposal methods will be used.

RESPONSE: The sediment basins have been designed to provide adequate sediment storage volume, with routine maintenance. If removal of sediment from basins becomes necessary, the following procedure is to be followed. The pool level within the basin is to be lowered by pumping to the lowest possible level. After the pool level is sufficiently lowered, appropriate equipment will be used to remove sediment from the basin. The sediment removed from the structures will be placed in the impoundment.

H) Will pH adjustment be necessary on any of the discharges in order to meet the applicable State and Federal Standards?

Yes _____ No ___X___

If yes, a discussion of the situation is necessary, along with a detailed basis of design. The basis should include a detailed description of the proposed treatment facilities, process flow diagrams, and design calculations.

RESPONSE: Treatment of discharges to adjust pH is not anticipated. However, should treatment become necessary, a plan to insure applicable water quality

standards are met will be developed. If pH control should be required in the future it could be done with a liquid sodium hydroxide solution dispensed by gravity from a portable tank or, hydrated lime (dry or slurry) and/or, soda ash could be easily and quickly applied.

I) Does a perennial or intermittent stream occur within the proposed permit area?

Yes ___X___ No _____

If yes, is an exception to the 100 foot buffer zone being requested or is a stream diversion being proposed. For exception to the 100 foot buffer zone, indicate how compliance with Section 1817.57 will be assured. For a stream diversion, complete Part V 6) of the application form.

RESPONSE: **The discharge channel from Pond No. 9 is inside the 100 foot buffer zone. If required, an exception to the 100 foot buffer zone is being requested, as allowed under Section 1817.57, based on the following information.**

Water Quality – Water quality will not be adversely affected. The disturbance is temporary and consists of a spillway. Once the spillway is constructed, the area will be seeded in accordance to the approved permit.

Water Quantity – Water quantity will not be adversely affected. The applicant does not propose to alter the watershed of the stream, therefore, water quantity should remain unchanged as a result of the operation.

Other Environmental Resources of the Stream - The fish and invertebrate communities in the stream represent a biological community subject to frequent dry channel conditions and which have been subjected to the effects of intense rowcrop agriculture for decades. As such the organisms found here are environmentally tolerant species (i.e. not sensitive). No adverse impacts to this community are anticipated.

Restoration of Channel and Riparian Vegetation – Woody riparian vegetation will be established along the constructed spillway based on pre-disturbance species and quantities.

Based on the above, the applicant requests the exception to the 100 foot buffer zone to the extent required by 1817.57 and in accordance with the provisions of Section 1817.57.

J) Permanent and Temporary Impoundments, Ponds, Banks, Dams and Embankments

1) All temporary and permanent impoundments must meet the requirements of 62 Ill. Adm. Code 1817.49. Will the mining operation involve the construction of any impoundments other than those waste retention?

Yes _____ No ___X___

If yes, include the following information:

a) Locate on mining operations map all impoundments, dam locations, and watershed limits, indicate which impoundments are proposed to be permanent and complete Part V 3)D) of the application.

RESPONSE: N/A

b) Provide construction and maintenance details of dams, spillways, seepage control measures, and erosion control measures for inlets and outlets. Employ maps and cross sections where necessary. Where design plans for proposed structures are not provided, submit a certification statement providing a schedule for submission of detailed design plans for each structure.

RESPONSE: Refer to Volume 2.

2) Describe proposed reclamation plans for each structure, including a time table and plans for removal and disposal of material. Each plan shall:

a) Be prepared by or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) contain a description, map, and cross-section of the structure and its location,

c) contain preliminary hydrologic and geologic information required to assess the hydrologic impact of the structure,

d) if underground mining has occurred, the plan shall contain a survey describing the potential effect on the structure from subsidence of the subsurface strata resulting from the post underground mining operations,

e) for structures where the detailed design plans are not submitted to the Department with the general plan, the plan shall contain a certification

statement which includes a schedule setting forth the dates that detailed design plans are to be submitted. For these structures, the detailed design plans must be submitted to the Department and approved in writing prior to the beginning of construction.

RESPONSE: The sediment control structure is proposed to be retained as permanent structure as indicated on Map 7 SF, Reclamation Plan Map. There will be no excess material to be disposed. The impoundment will be reclaimed by covering the final slurry surface with coarse refuse or other appropriate fill material to prevent future impoundment of water or slurry. The coarse refuse will be reclaimed by covering with soil material and vegetated to a wildlife land use.

No significant impacts from this structure is anticipated on surface or groundwater, see Part III.

Underground mining has already occurred within the permit area.

3) For each structure that meets or exceeds the size or other criteria of MSHA, 30 CFR 77.216(a), the detailed design plan shall:

a) Be prepared by or under the direction of and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) include any design and construction requirements for the structure, including any required geo-technical information,

c) describe the operation and maintenance requirements for each structure, and

d) describe the timetable and plans for removal of each structure if appropriate.

RESPONSE: Refer to Volume 2.

4) For each structure that does not meet or exceed the size or other criteria of MSHA, 30 CFR 77.216(a), the detailed plan shall:

a) Be prepared by or under the direction of and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act,

b) include any design and construction requirements for the structure, including any required geo-technical information,

c) describe the operation and maintenance requirements for each structure, and d) describe the timetable and plans for removal of each structure if appropriate.

RESPONSE: Refer to Volume 2.

K) If any of the following questions are answered yes, a permit may be needed from Illinois Department of Natural Resources, Office of Water Resource Management.

1) Will the mining operation involve the construction of any levees, dikes, haul roads or other similar structures or the placement of any fill along or in the flood plain of any stream serving a drainage area of ten (10) square miles or greater at the point of construction?

Yes _____ No ___X___

2) Will the mining operation involve any relocation or diversion of or any construction activity in, over, under or along the banks of any stream serving a drainage area of ten (10) square miles or greater at the point of construction?

Yes _____ No ___X___

3) Is there any urban development (residential, commercial or industrial uses) in the areas immediately surrounding the mining operation?

Yes _____ No ___X___

(If yes, please re-answer questions 1 and 2 above applying a one (1) square mile drainage area limit.)

4) Will the mining operation involve the construction, major modification, or removal of any dam which in the event of failure would have probability for loss of life or additional economic loss in excess of that which would occur downstream of the dam in the absence of the dam?

Yes___X___ No _____

5) Will the mining operation involve the construction, major modification, or removal of any dam 25 feet or more in height?

Yes__X____ No _____

6) Will the mining operation involve construction, major modification, or removal of any dam which would have an impounding capacity of 50 acre feet or more?

Yes __X____ No _____

RESPONSE: The proposed Coal Refuse Disposal Facility No. 3 plans will exceed the Office of Water Resources requirements for dams.

8) Provide a plan detailing fugitive dust control practices to be employed during proposed surface coal mining and reclamation operations as required under 62 Ill. Adm. Code 1817.95.

RESPONSE: Fugitive particulate emissions will be controlled by applying water or other IEPA approved dust suppressants on an as-needed basis. All construction areas will be stabilized with permanent vegetative species, graded stone and/or paving material. Haul roads and other unpaved roads will be sprinkled with water to control fugitive dust. Conveyor transfer points will be provided with enclosed hoods over the discharge roller. Conveyor transfer points and the railcar load-out will employ chutes and be enclosed to control emissions.

PART IV ATTACHMENTS

PART IV ATTACHMENT IV.3.A.3
SOIL BORINGS
AND ATTACHMENT IV.6
GEOTECHNICAL INFORMATION

R09833

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW-8R

N 426370.501
E 360211.303

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 479.35
				4" Topsoil
				Brown Silty CLAY (CL)
5				
10		au		Gray Weathered SHALE
15				Tan SHALE
				Dark Brown SHALE
20				
				Limestone Auger Refusal
				End of Boring @ -22.5'
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling and Dry Upon Completion.

Project: Monitoring Well Installation Mach Mine
Williamson Energy, LLC Johnston City, Illinois

Date of Boring
November 13, 2012

Client: Williamson Energy, LLC
Johnston City, Illinois

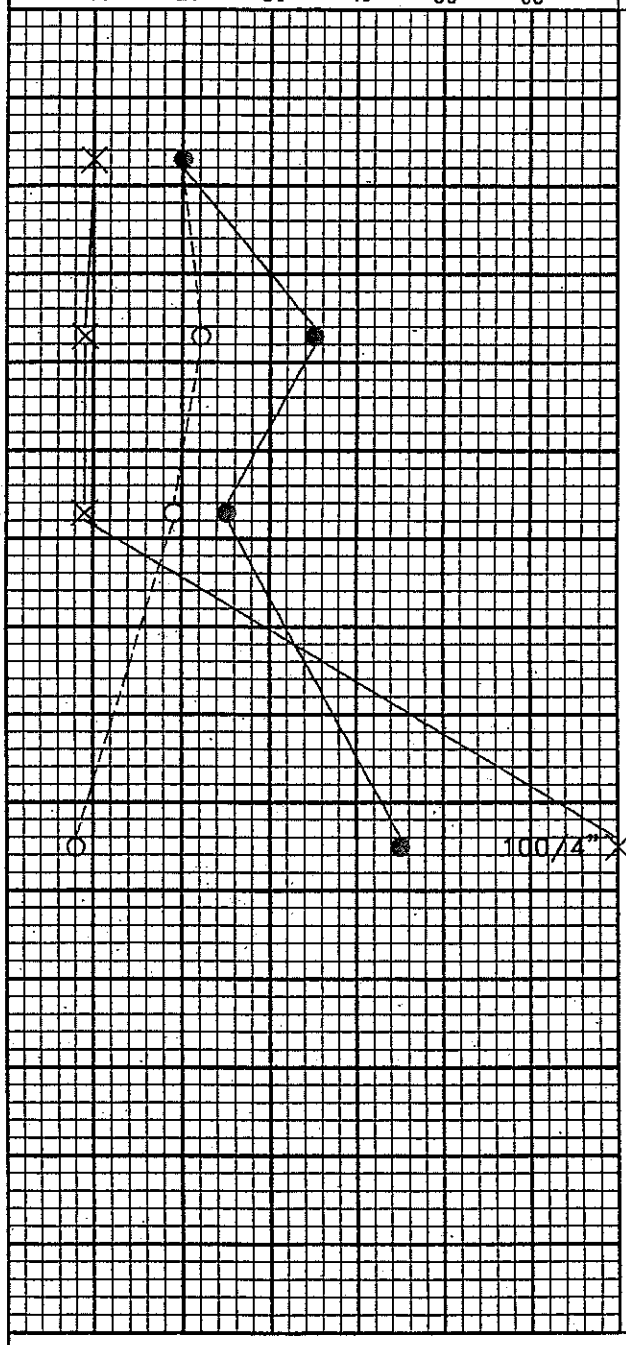
Project No.
H-07227

R09834

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH7

N427298
E360638



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 452.1
				Brown Mottled Gray Silty CLAY (CL)
5	1	ss		
10	2	ss		
15	3	ss		
20	4	st		
25	5	ss		Gray SHALE
	6	rc		
30	7	rc		Gray Sandy SHALE
				Gray SHALE
35				End of Boring @ -34.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 19, 2009

Client: Williamson Energy
Marion, Illinois

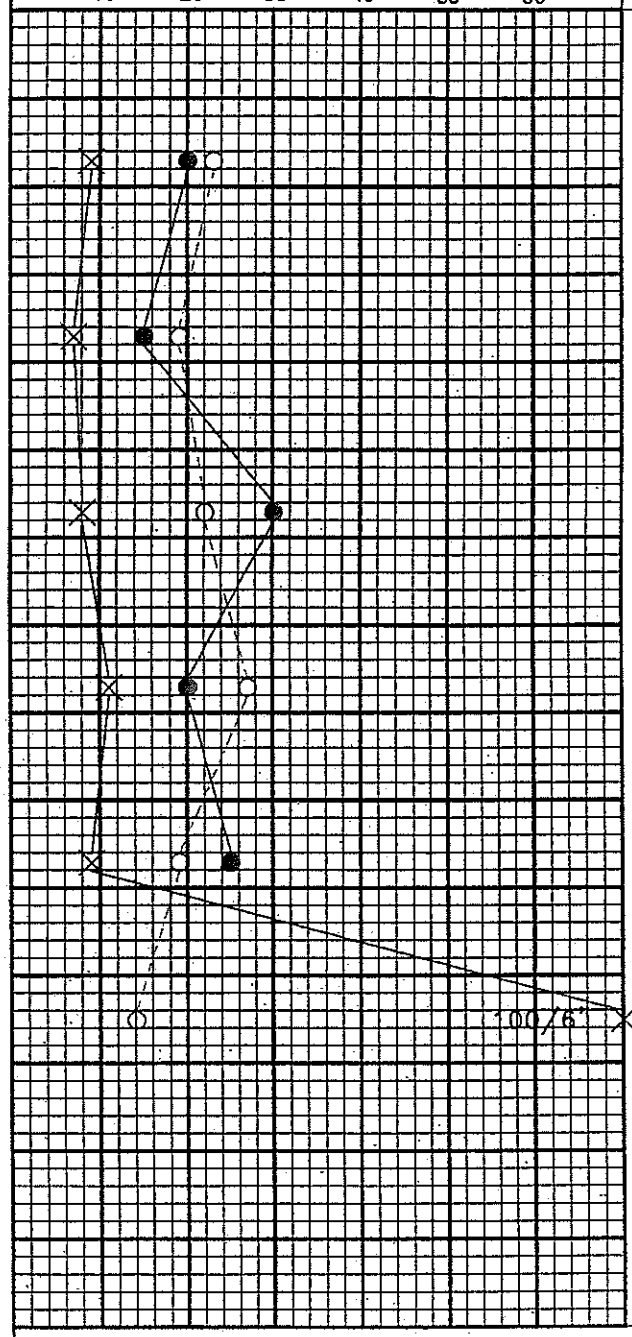
Project No.
H-08283

R09835

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH5

N429376
E361463



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 444.28
				Brown Mottled Gray Silty CLAY (CL)
5	1	ss		
10	2	ss		
	3	ss		
15				Brown Mottled Gray Silty CLAY (CL) with sand
	4	ss		Brown Mottled Gray Silty CLAY (CL)
20				
	5	ss		
25				Gray Mottled Brown SHALE
	6	ss		
30				End of Boring @ −29.0'
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 20, 2009

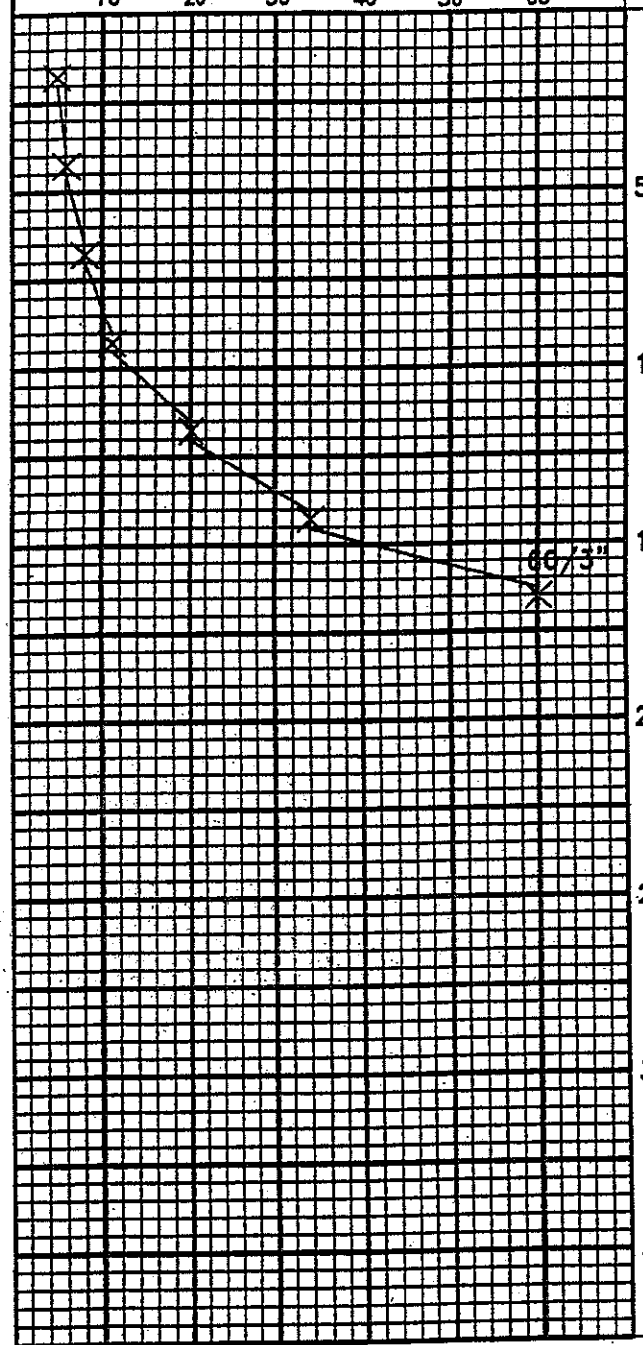
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09836

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP4 ALSO GW-28



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
	2	ss		
5	3	ss		
	4	ss		Brown Mott. Gray Sandy CLAY (CL)
10	5	ss		
	6	ss		Gray Weathered Shale
15	7	ss		
				End of Boring @ -17.0'
				Well set @ -16.0'
20				
25				BP4 = GW28
				Has water??
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH5A

N429376
E361463
R09837

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 444.28
				Brown Mottled Gray Silty CLAY (CL)
5				
10				
15				
20	1	st		
				End of Boring @ -21.0'
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 20, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co., Inc.

R09838

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

July 21, 2009

Williamson Energy
330 ½ Commercial Drive
PO Box 1829
Marion, Illinois 62959

Attention: Mr. Jim Slapak

Re: Soil Borings and Ground Water Well Installations
Pond Creek Mine #1 Refuse Disposal Area
Williamson Energy
Johnston City, Illinois
HFE File H-08283
Purchase Order No. 9578

Dear Sir:

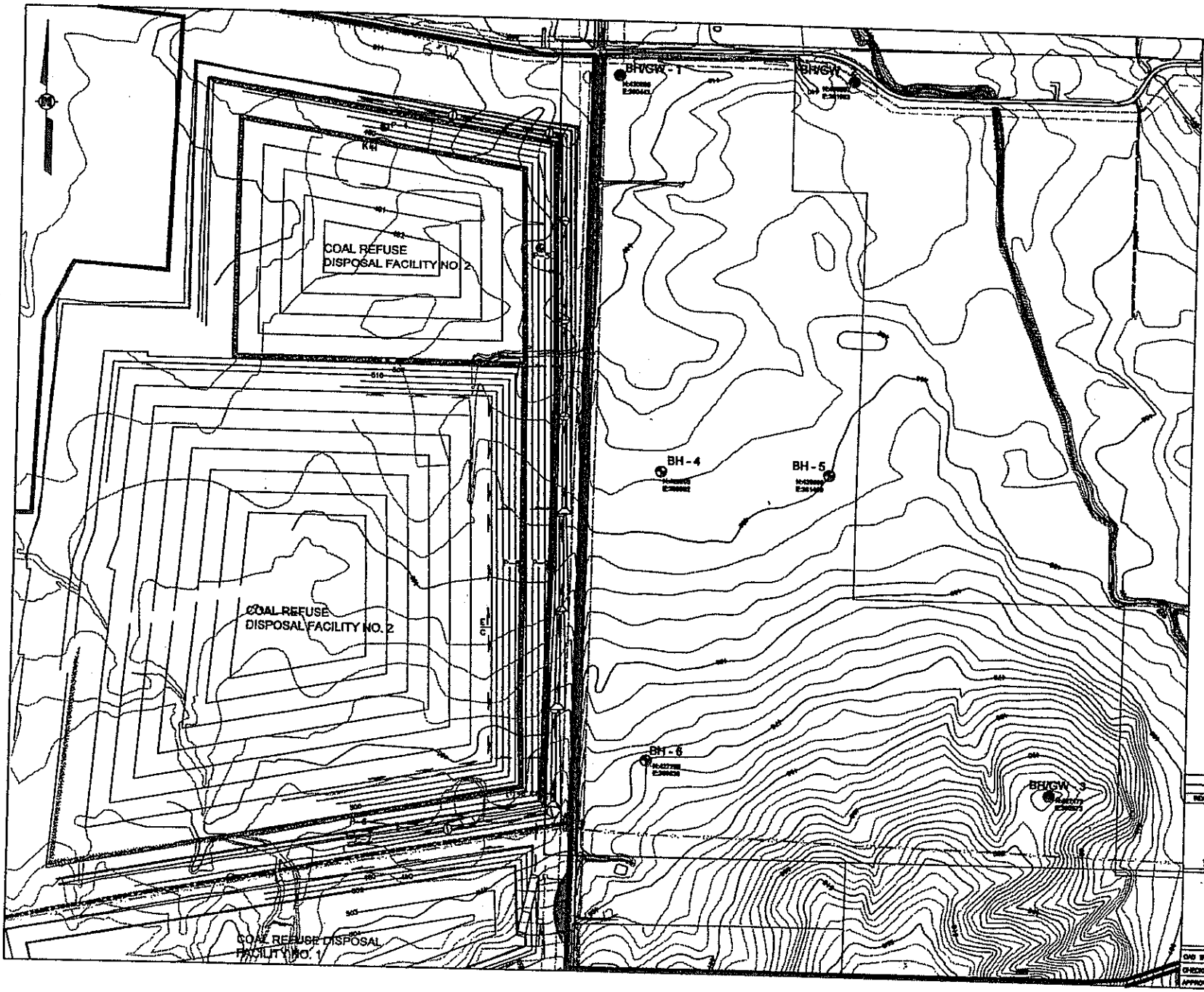
In accordance with your request, we drilled ten soil borings and installed five ground water monitoring wells at the above referenced site. The subsoils were sampled with split barrel samplers, Shelby tubes, and NWX rock cores were cut in two of the soil borings. The soil samples were subjected to unconfined compressive strength tests, moisture contents, standard Proctor tests, and permeability tests.

The Boring Logs, Well Completion Diagrams, and Laboratory Test Results are enclosed. If you should have any questions, or if we can be of further assistance, please feel free to contact me at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING INC.

Timothy J. Holcomb, P.E.


BH/GW - 1
BH/GW - 2
BH - 4
BH - 5
BH - 6
BH/GW - 3
COAL REFUSE DISPOSAL FACILITY NO. 2
COAL REFUSE DISPOSAL FACILITY NO. 2
COAL REFUSE DISPOSAL FACILITY NO. 1
LEGEND
BH - 1
EXPLORATION HOLE
BH/GW - 1
EXPLORATION HOLE/GROUND WATER WELL
PROPERTY LINE
SCALE
200 0 200 400 FEET
NO. DATE DESCRIPTION PM
Alliance Consulting, Inc.
Engineers • Constructors • Scientists
BOREHOLE LOCATION MAP
EAST REFUSE AREA
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC.
BECKLEY, WEST VIRGINIA
DWG BY
CHECKED BY
APPROVED BY
10/21/08
PROJECT NO. 808-462-1413
DRAWING NO. 808-462-E2
RP98-476

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW10

N429483
E358105
R09840

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 435.17
				Brown Mottled Gray Silty CLAY (CL)
5				
10				
15				
				Gray SHALE
20				End of Boring @ −17.0'
25				
30				
35				

Ground Water Data
Ground Water Encountered @ −15.0' During Drilling and @ −14.0'. Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring May 21, 2009
Client: Williamson Energy Marion, Illinois	Project No. H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW11

N430660
E359981

R09841

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 437.77
				6" Topsoil
				Brown Mottled Gray Silty CLAY (CL)
5				
10				
15				
20				
				Gray SHALE
25				End of Boring @ −25.0'
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 19, 2009

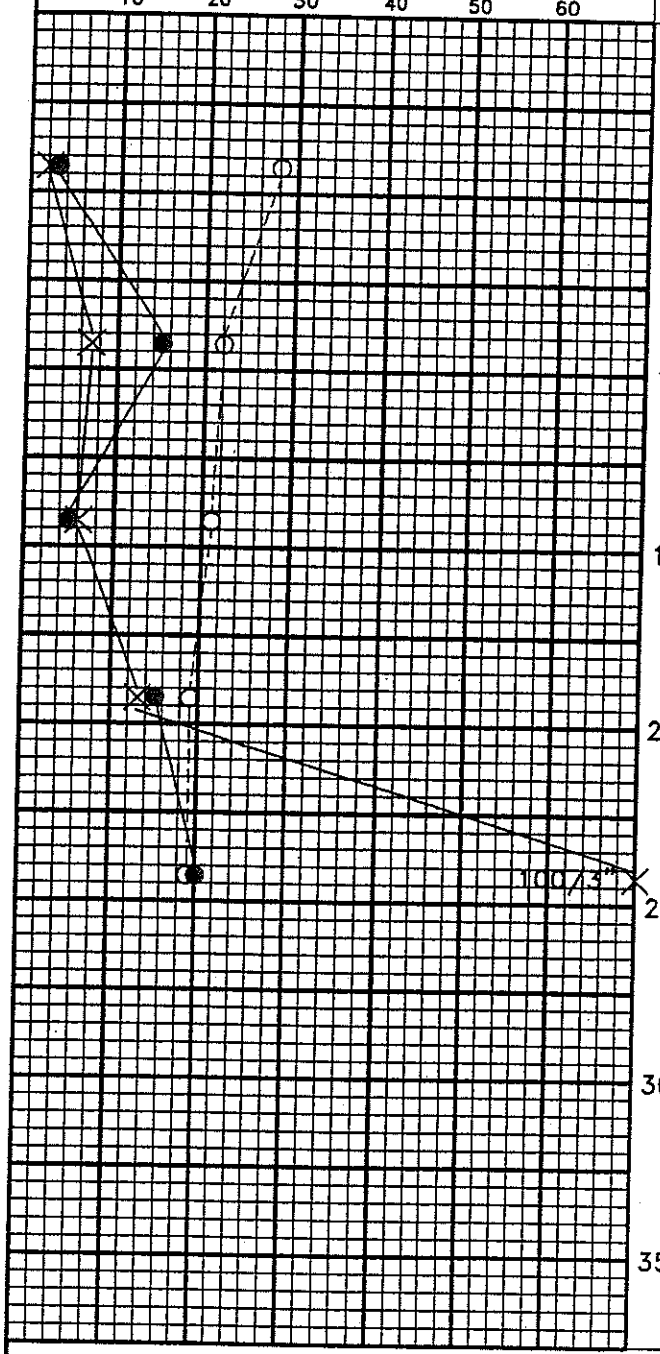
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW12

N430596
E360443
R09842



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 435.25
				6" Topsoil
				Gray Mottled Brown Silty CLAY to Clayey SILT (CL–ML)
5	1	ss		
10	2	ss		
15	3	ss		Brown Silty CLAY (CL)
	4	st		
20	5	ss		Brown Silty CLAY (CL) with sand
	6	st		Brown SHALE
25	7	ss		
				End of Boring @ –25.0'
30				
35				

Ground Water Data
Ground Water Encountered @ –14.5' During Drilling and @ –9.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring May 19, 2009
Client: Williamson Energy Marion, Illinois	Project No. H–08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW13

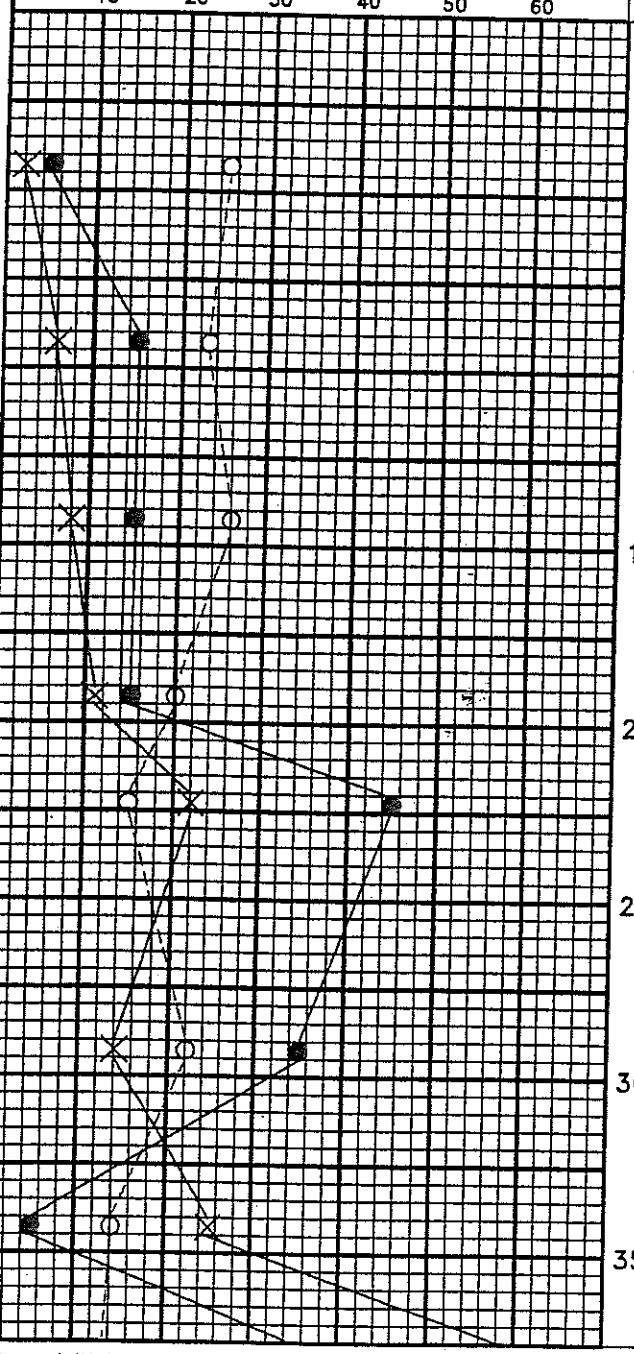
N430637
E361492
R09843

Page 1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 441.57
				6" Topsoil
				Gray Mottled Brown Silty CLAY (CL)
5	1	ss		
10	2	ss		
15	3	ss		
	4	st		
20	5	ss		Brown Silty CLAY (CL)
	6	ss		Gray Silty CLAY (CL)
25	7	st		
30	8	ss		Brown Silty CLAY (CL) with sand
35	9	ss		Gray–Brown Weathered SANDSTONE

Ground Water Data
Ground Water Encountered@ −16.0' During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 19, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

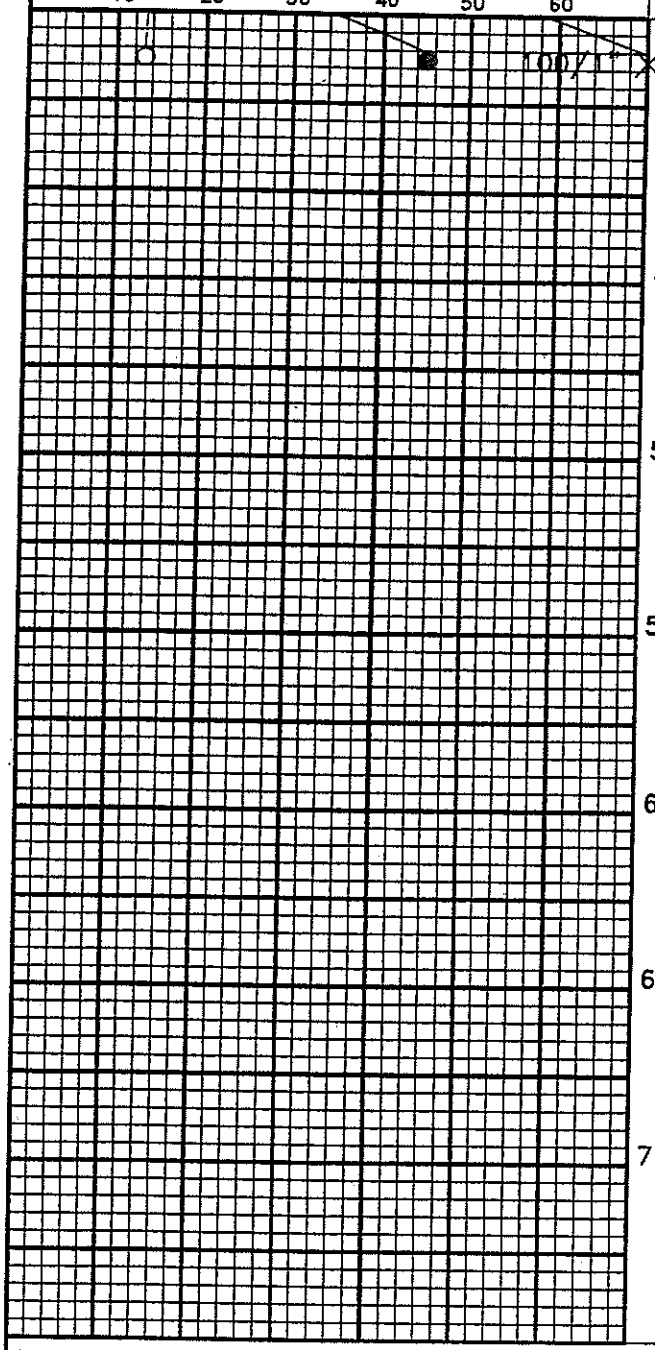
LOG of BORING GW13

N430637
E361492
R09844

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 441.57
40	10	ss		Gray SANDSTONE
	11	rc		
45	12	rc		
50				End of Boring @ -49.0'
55				
60				
65				
70				

Ground Water Data
Ground Water Encountered@ -16.0' During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 19, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

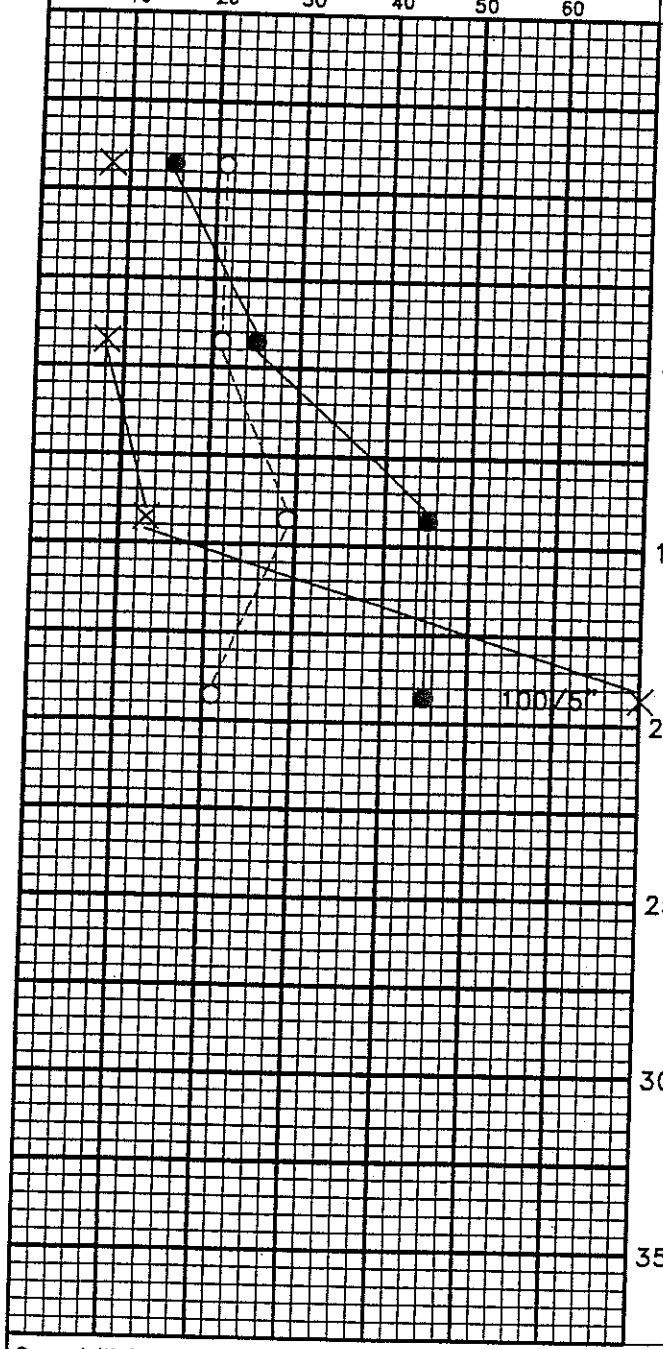
LOG of BORING GW14

N428172 E361383 R09845

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 455.56
				3" Topsoil
				Brown Mottled Gray Silty CLAY (CL)
5	1	ss		
10	2	ss		
15	3	ss		
	4	st		
20	5	ss		Brown Silty CLAY (CL) with coal
				Gray SHALE
				End of Boring @ -21.0'
25				
30				
35				

Ground Water Data
Ground Water Encountered @ -19.0' During Drilling and @ -19.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 21, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09846

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW10

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing 429483 Easting 358105

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 5/21/2009

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 5/21/2009

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 2 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

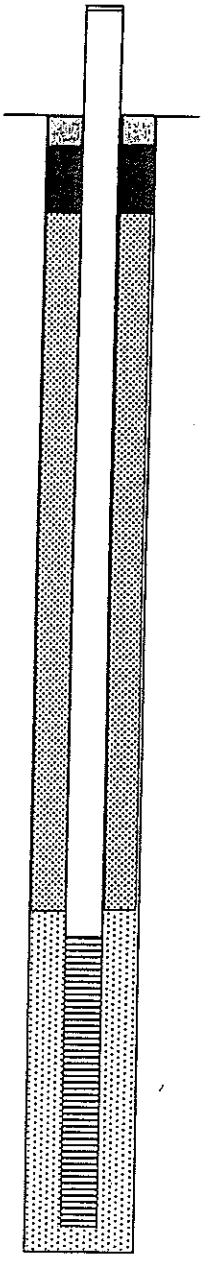
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			9.7'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



437.9 MSL Top of Riser Pipe

435.2 MSL Ground Surface

2 ft. Concrete Seal

433.2 ft. Top of Bentonite

2 ft. Bentonite

430.2 ft. Top of Sand

428.2 ft. Top of Screen

10.0 ft. Total Screen Interval

418.2 ft. Bottom of Screen

418.2 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09847

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW11

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing 430660 Easting 359981

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 5/19/2009

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 5/19/2009

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 3 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

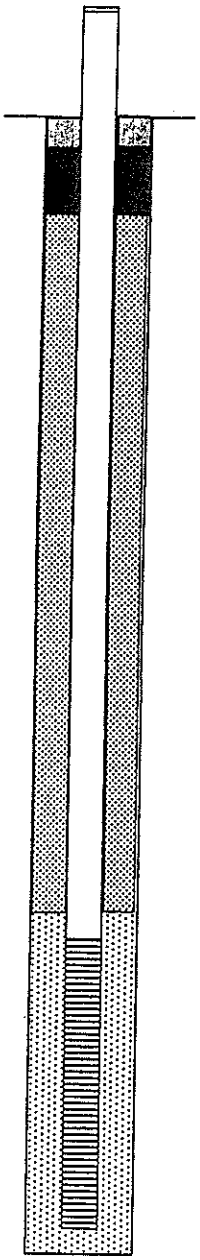
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			15.7'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



440.5 MSL Top of Riser Pipe

437.8 MSL Ground Surface

2 ft. Concrete Seal

435.8 ft. Top of Bentonite

9 ft. Bentonite

426.8 ft. Top of Sand

424.8 ft. Top of Screen

10.0 ft. Total Screen Interval

414.77 ft. Bottom of Screen

412.77 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09848

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW12

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing 430596 Easting 360443

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 5/19/2009

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 5/19/2009

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 3 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

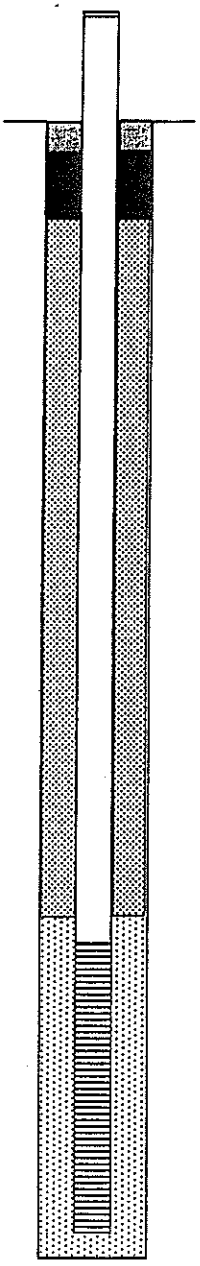
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			15.8'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



438.1 MSL Top of Riser Pipe

435.3 MSL Ground Surface

2 ft. Concrete Seal

433.3 ft. Top of Bentonite

9 ft. Bentonite

424.3 ft. Top of Sand

422.3 ft. Top of Screen

10.0 ft. Total Screen Interval

412.3 ft. Bottom of Screen

410.3 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09849

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW13

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing 430637 Easting 361492

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 5/19/2009

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 5/19/2009

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 6 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

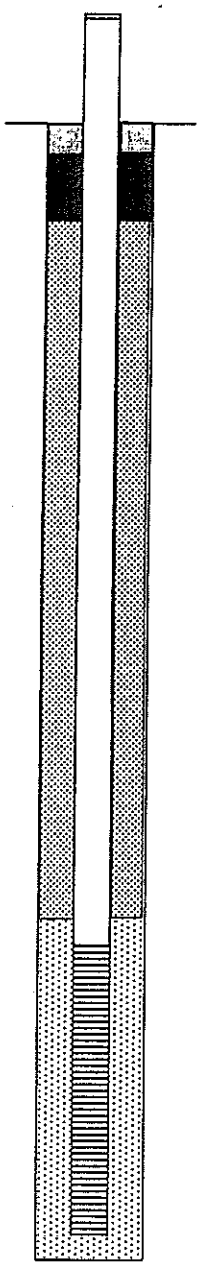
Amount of Sand: # of bags 8 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			26.0'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			—	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



444.57 MSL Top of Riser Pipe

441.57 MSL Ground Surface

2 ft. Concrete Seal

439.6 ft. Top of Bentonite

19 ft. Bentonite

420.6 ft. Top of Sand

418.6 ft. Top of Screen

10.0 ft. Total Screen Interval

408.6 ft. Bottom of Screen

392.6 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09850

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW14

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing 428172 Easting 361383

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 5/21/2009

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 5/21/2009

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 3 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

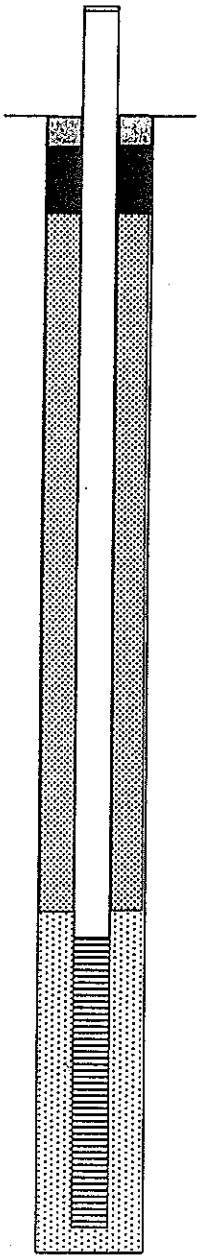
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			13.9'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



458.52 MSL Top of Riser Pipe

455.56 MSL Ground Surface

2 ft. Concrete Seal

453.56 ft. Top of Bentonite

7 ft. Bentonite

446.6 ft. Top of Sand

444.6 ft. Top of Screen

10.0 ft. Total Screen Interval

434.6 ft. Bottom of Screen

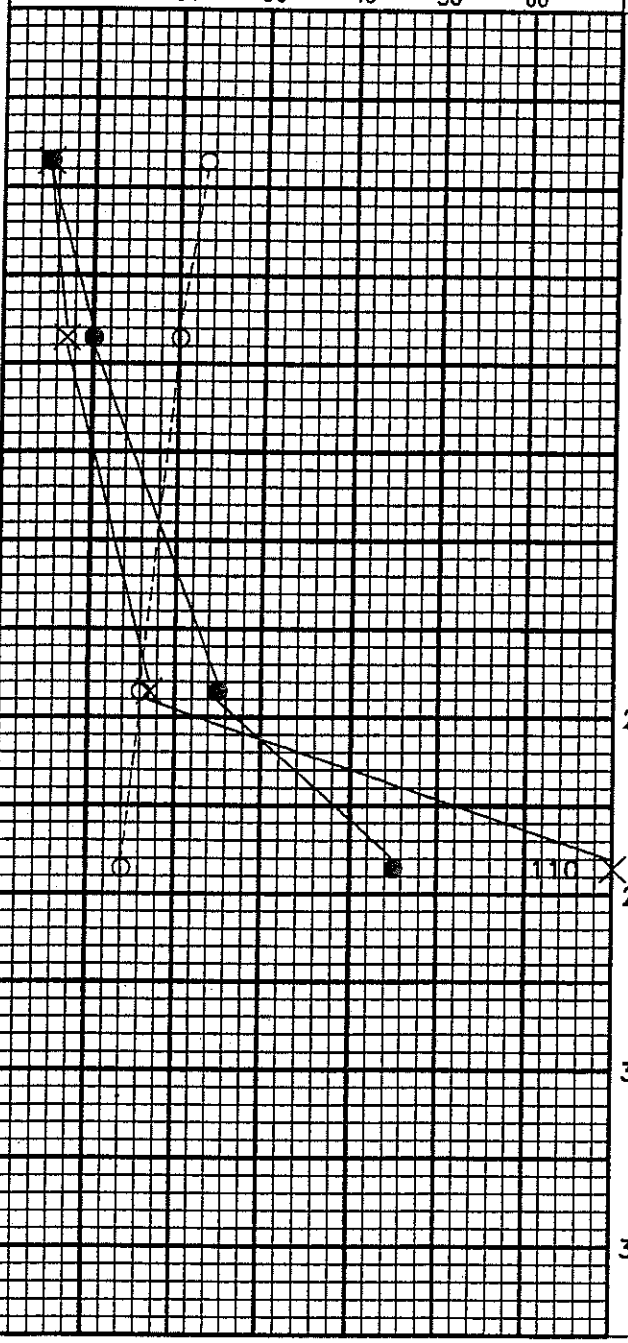
434.6 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH4

N429343
E360407 R09851



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 436.27
				4" Topsoil
				Gray Mottled Brown Silty CLAY to Clayey SILT (CL–ML)
5	1	ss		
10	2	ss		
15	3	st		
20	4	ss		Brown Sandy CLAY (CL)
				Gray SHALE
25	5	ss		End of Boring @ –25.0'
30				
35				

Ground Water Data
Ground Water Encountered @ –21.0' During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring May 20, 2009
Client: Williamson Energy Marion, Illinois	Project No. H–08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

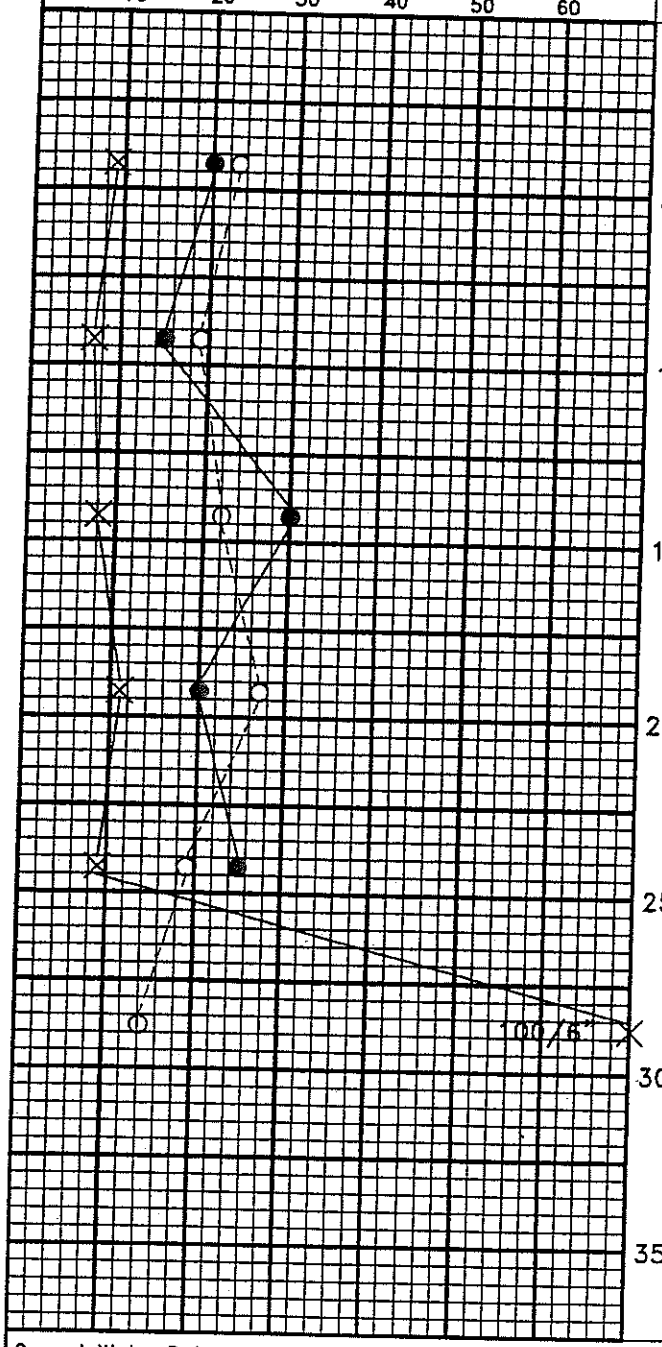
LOG of BORING BH5

N429376
E361463
R09852

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 444.28
				Brown Mottled Gray Silty CLAY (CL)
5	1	ss		
10	2	ss		
15	3	ss		Brown Mottled Gray Silty CLAY (CL) with sand
20	4	ss		Brown Mottled Gray Silty CLAY (CL)
25	5	ss		Gray Mottled Brown SHALE
30	6	ss		End of Boring @ −29.0'
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 20, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH5A

N429376
E361463
R09853

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 444.28
				Brown Mottled Gray Silty CLAY (CL)
5				
10				
15				
20	1	st		
				End of Boring @ -21.0'
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 20, 2009

Client: Williamson Energy
Marion, Illinois

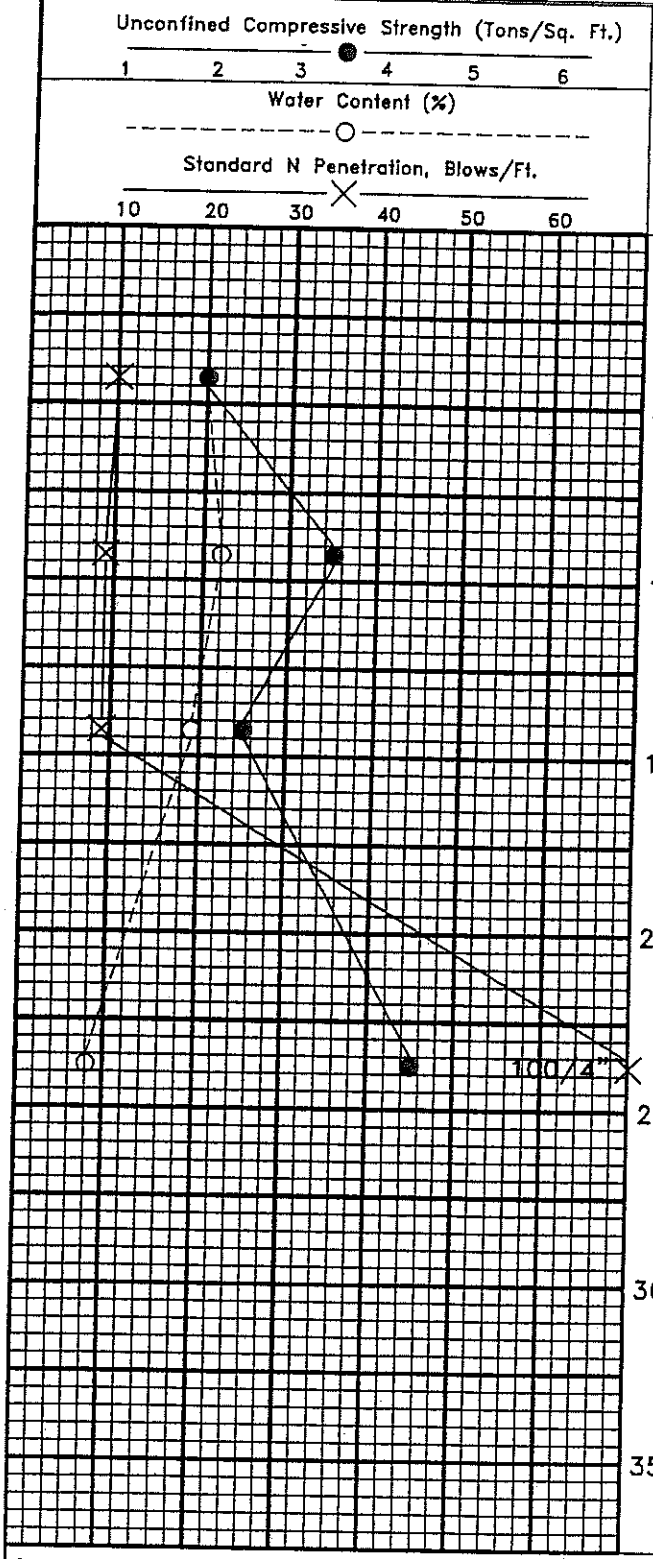
Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BH6

N428164
E360375

R09854



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 452.07
				Brown Mottled Gray Silty CLAY (CL)
5	1	ss		
10	2	ss		
15	3	ss		
20	4	st		
	5	ss		Gray SHALE
25	6	rc		
30	7	rc		Gray Sandy SHALE
				Gray SHALE
35				End of Boring @ −34.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 20, 2009

Client: Williamson Energy
Marion, Illinois

Project No.
H−08283

Holcomb Foundation Engineering

Moisture Density Relationship

Project: Pond Creek Refuse Disposal Site
Williamson County, Illinois

Location: GW12 16-18.5'
GW13 16-18.5'
GW13 26-28.5'

Project No.: H-08283

Date: 7/14/2009

Proctor Test Results

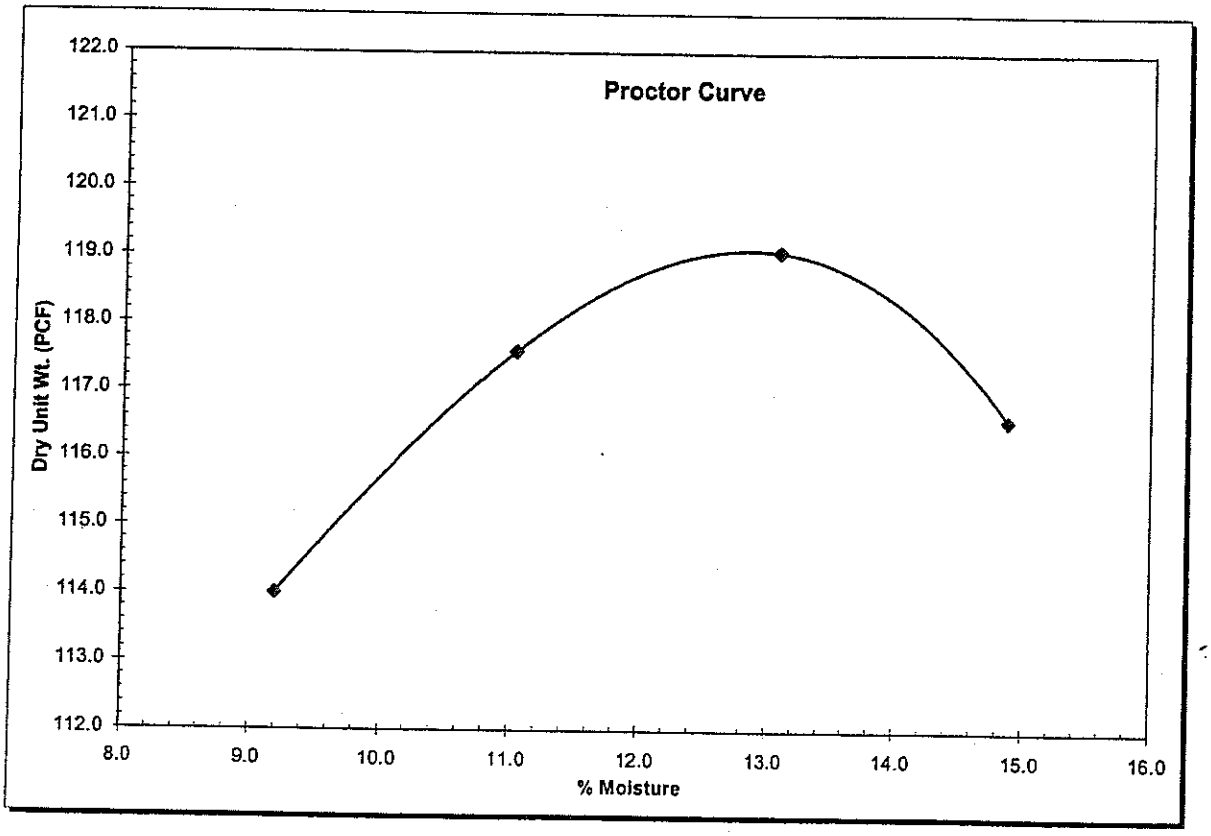
Soil Classification: **Brown Mottled Gray Silty CLAY (CL)**

Maximum Dry Density (PCF) **119.1**

Optimum Moisture Content (%) **12.8**

Test Data ASTM D-698 (standard)

Moisture Content (%)	Dry Unit Wt. (PCF)
11.0	117.6
13.1	119.1
14.9	116.6
9.2	114.0



Holcomb Foundation Engineering

Moisture Density Relationship

Project: Pond Creek Refuse Disposal Site
Williamson County, Illinois

Location: GW14 16-18.5'
BH6 18.5-21'

Project No.: H-08283

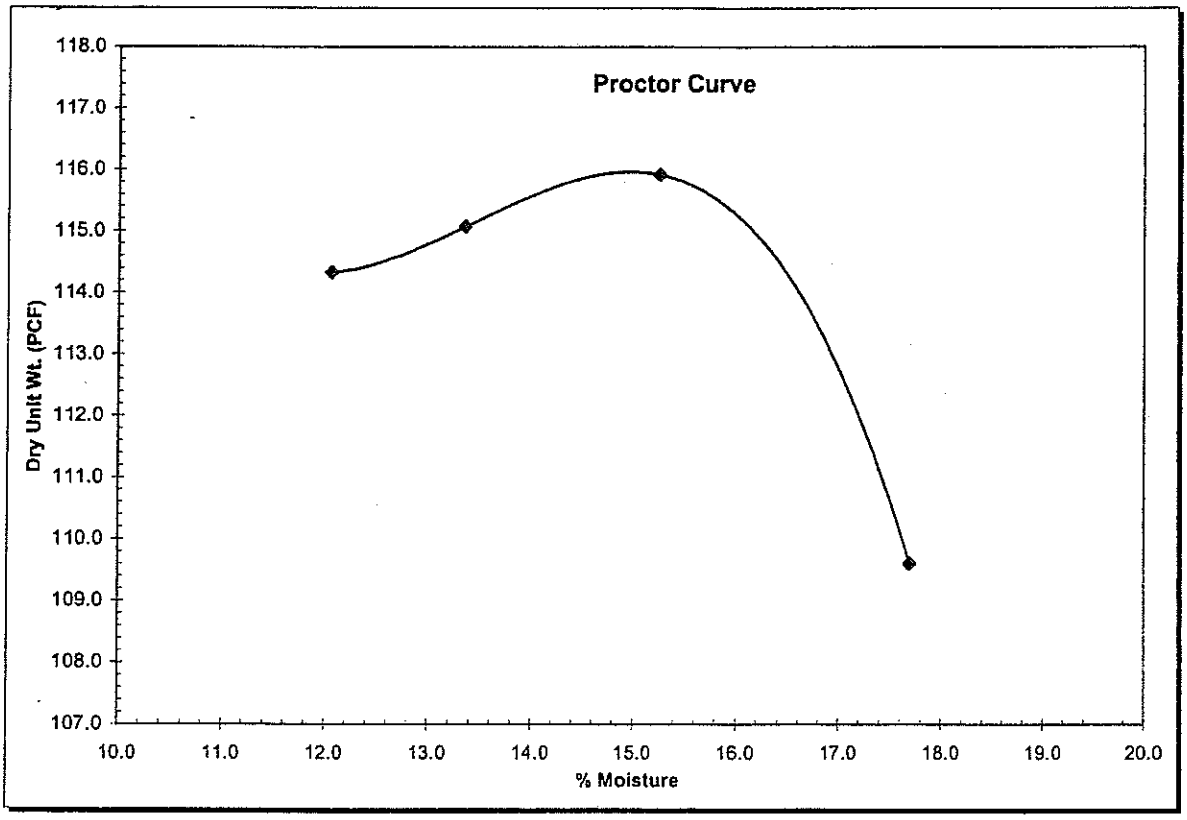
Date: 7/14/2009

Proctor Test Results

Soil Classification:	**Brown Mottled Gray Silty CLAY (CL)**
Maximum Dry Density (PCF)	**115.9**
Optimum Moisture Content (%)	**14.9**

Test Data ASTM D-698 (standard)

Moisture Content (%)	Dry Unit Wt. (PCF)
12.1	114.3
13.4	115.1
15.3	115.9
17.7	109.6



Holcomb Foundation Engineering Co., Inc.

R09857

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

Permeability Tests Results

Pond Creek Mine Refuse Disposal Area
Williamson County, Illinois

Date: 7/21/2009

Client: Williamson Energy
Marion, Illinois

Project No.: H-08283

Boring No.	Depth (Ft.)	Moisture Content (%) Before Test	Moisture Content (%) After Test	Dry Unit Weight (PCF)	Permeability (Cm./Sec.)
GW-12 GW-13 GW-13	16.0-18.5' 16.0-18.5' 26.0-28.5'	11.3	18.8	113.3	1 x 10-7*
GW-14 BH-6	16.0-18.5' 18.5-21.0'	14.4	18.4	110.2	1 x 10-7*
BH-4	13.5-16.0'	17.3	20.9	117.6	2 x 10-7
BH-5	18.5-21.0'	26.6	28.7	100.3	3 x 10-8

Permeability Tests performed in accordance with ASTM D-5084

* - Soil Samples Remolded at 95% Standard Proctor Dry Density

R09858

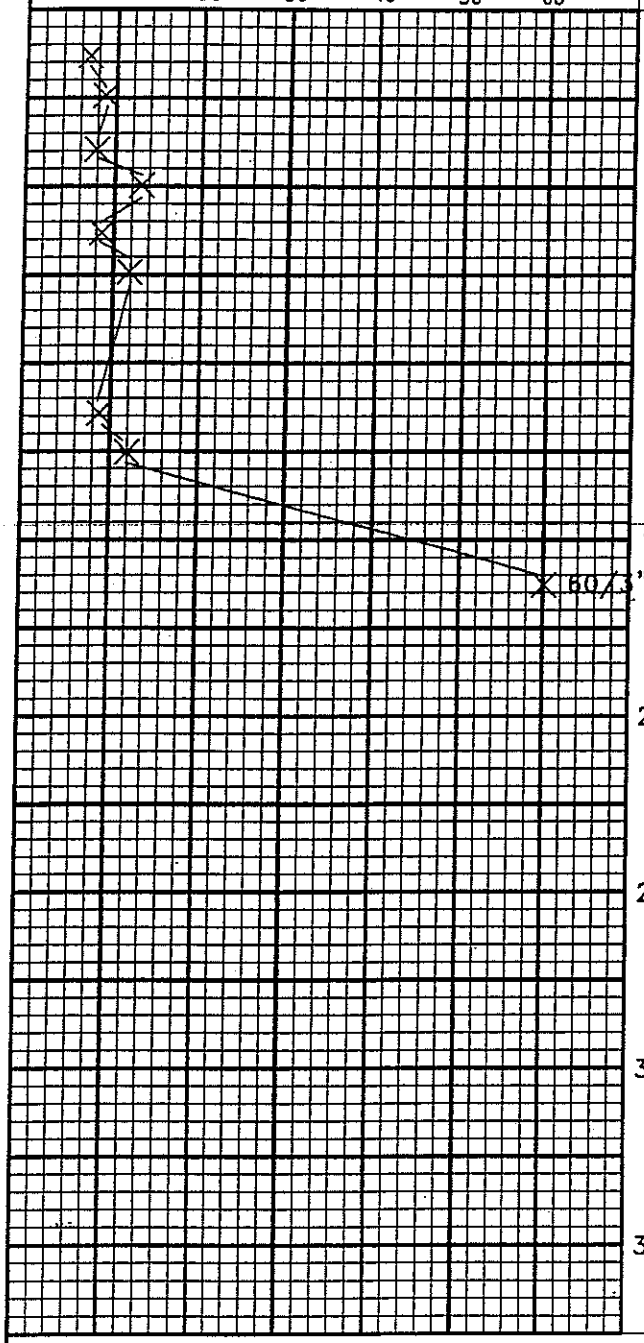
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
5	2	ss		
	3	ss		
10	4	st		
	5	ss		
	6	st		
15	7	ss		Brown Weathered SHALE
				End of Boring @ −15.5'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

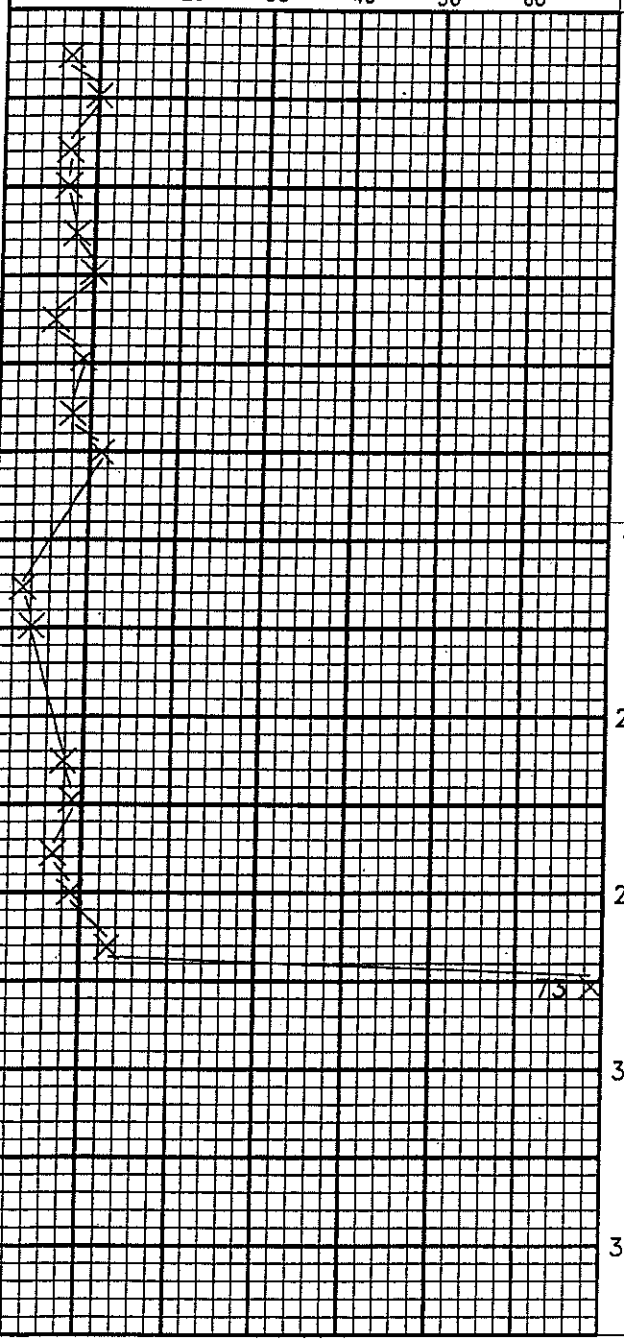
Client: Williamson Energy
Marion, Illinois

Project No.
H−08283

R09859

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D2



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
	1	ss		Brown Mottled Gray Silty CLAY (CL)
	2	ss		
	3	ss		
	4	ss		
	5	ss		
	6	st		
	7	ss		Brown Mottled Gray Sandy CLAY(CL)
	8	st		
	9	ss		
	10	ss		Gray Silty CLAY (CL)
	11	ss		Gray – Brown Weathered SHALE
				Gray SHALE
				End of Boring @ –28.0'

Ground Water Data
Ground Water Encountered @ –16.0' During Drilling and @ –25.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring June 8, 2012
Client: Williamson Energy Marion, Illinois	Project No. H–08283

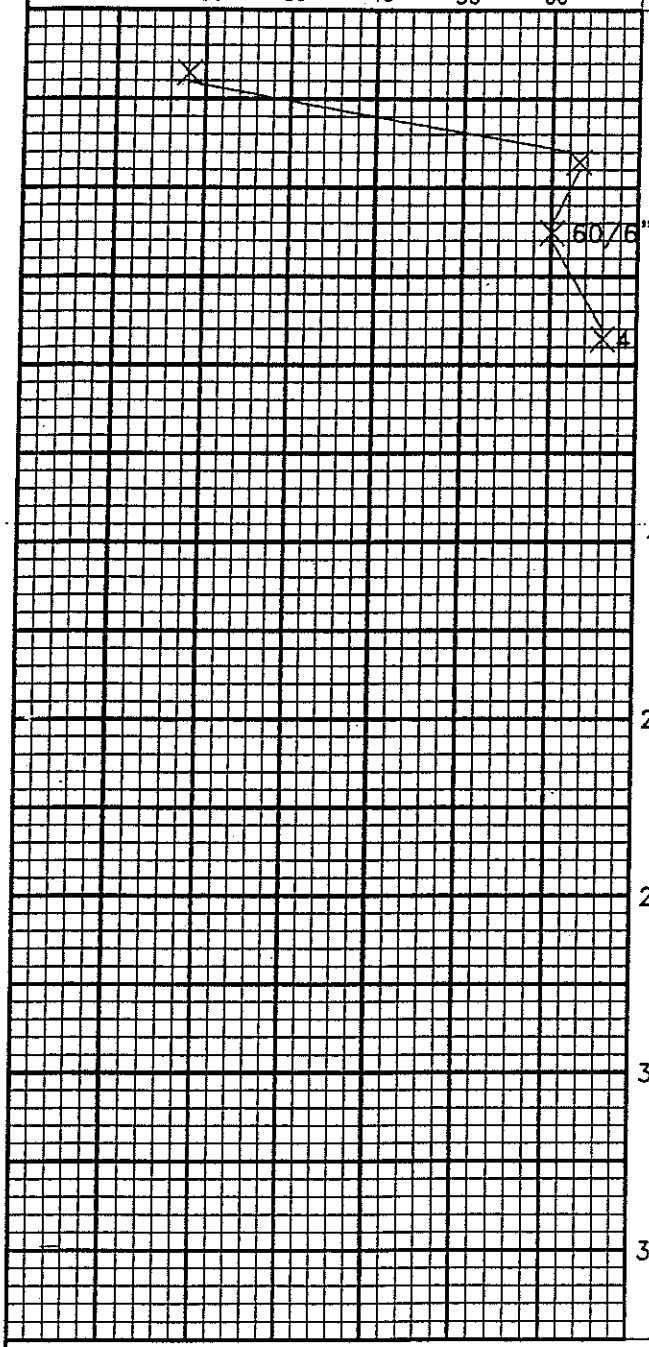
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" Topsoil
	1	ss		Brown Mottled Gray Silty CLAY (CL) with sand
	2	ss		Brown SANDSTONE
5	3	ss		
	4	ss		
10	5	rc		Gray Mottled Brown SHALE
15	6	rc		Gray SHALE
20	7	rc		
25	8	rc		
30	9	rc		
35	10	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ −8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
40				
	11	rc		
45				
	12	rc		
50				Black SHALE
	13	rc		Gray Sandy SHALE
55				
	14	rc		
60				
	15	rc		
65				
	16	rc		
70				End of Boring @ -70.0'

Ground Water Data
No Ground Water Encountered During Drilling and @ -8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

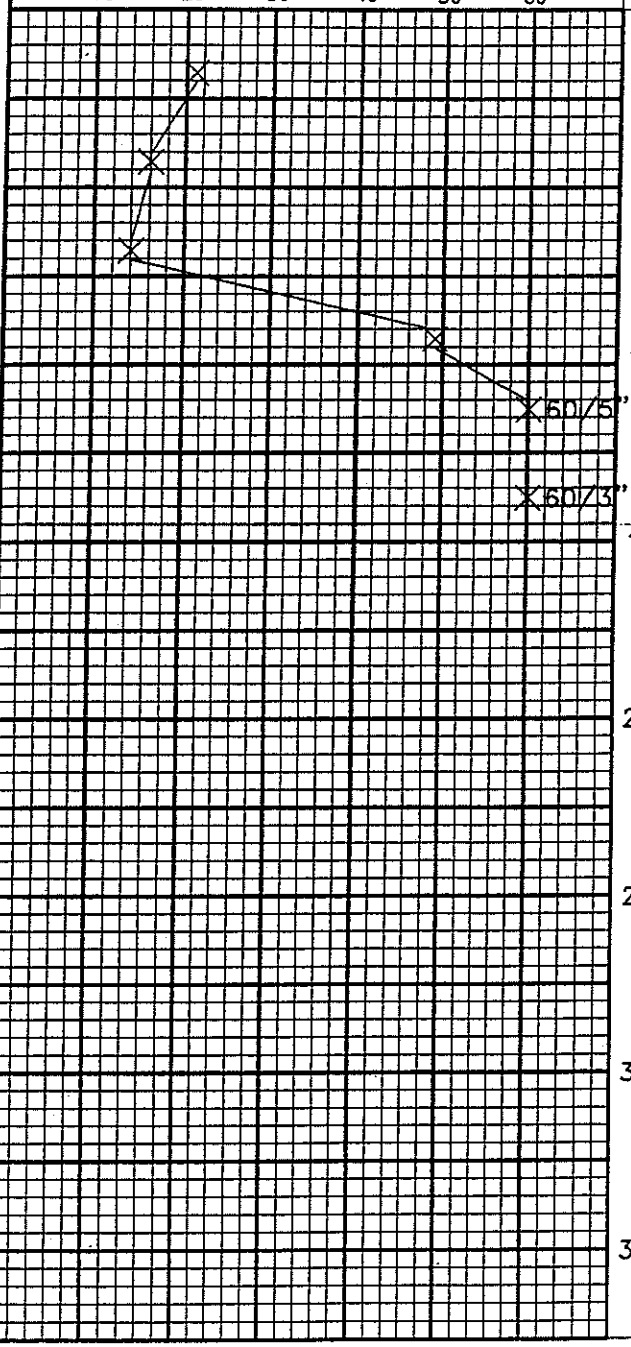
Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2

Page 1 of 2

R09862



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
	2	ss		
5	3	ss		
	4	ss		Brown Mottled Gray SANDSTONE
10	5	ss		
	6	ss		
15	7	rc		
20	8	rc		
25	9	rc		
30	10	rc		Brown-Gray Clayey SHALE
35	11	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ −10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

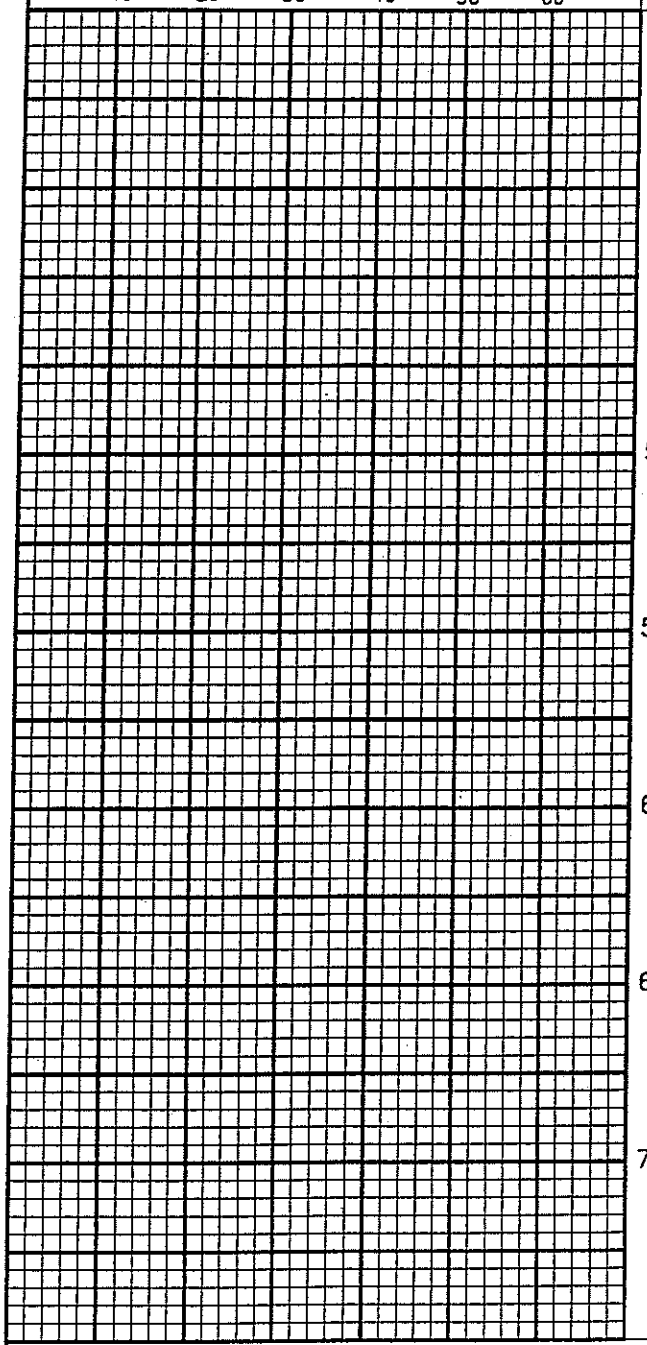
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				GRay SHALE
40				
	12	rc		
45				
	13	rc		
50				
	14	rc		
55				
	15	rc		
60				
	16	rc		
65				End of Boring @ −65.0'
70				

Ground Water Data
No Ground Water Encountered During Drilling and @ −10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

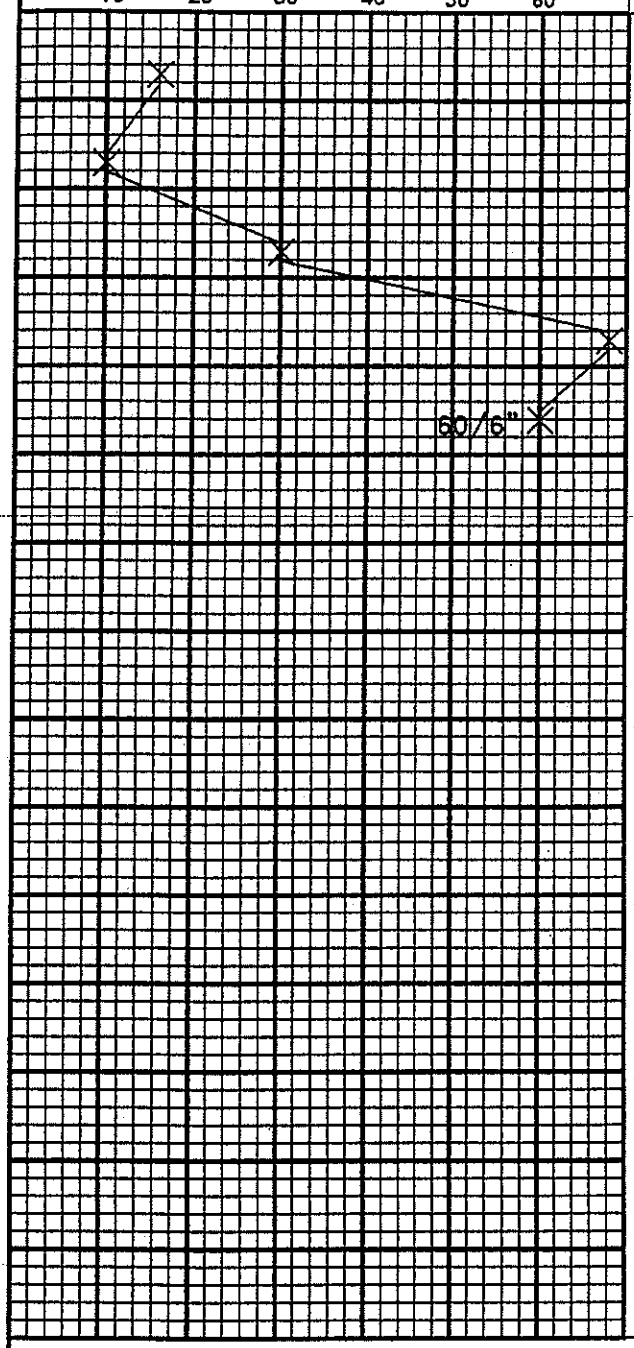
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09864

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-1



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Silty CLAY (CL)
	2	ss		
5	3	ss		
				Brown Sandy CLAY (CL)
	4	ss		Brown Weathered Sandstone
10	5	ss		Brown Sandstone
				End of Boring @ -12.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

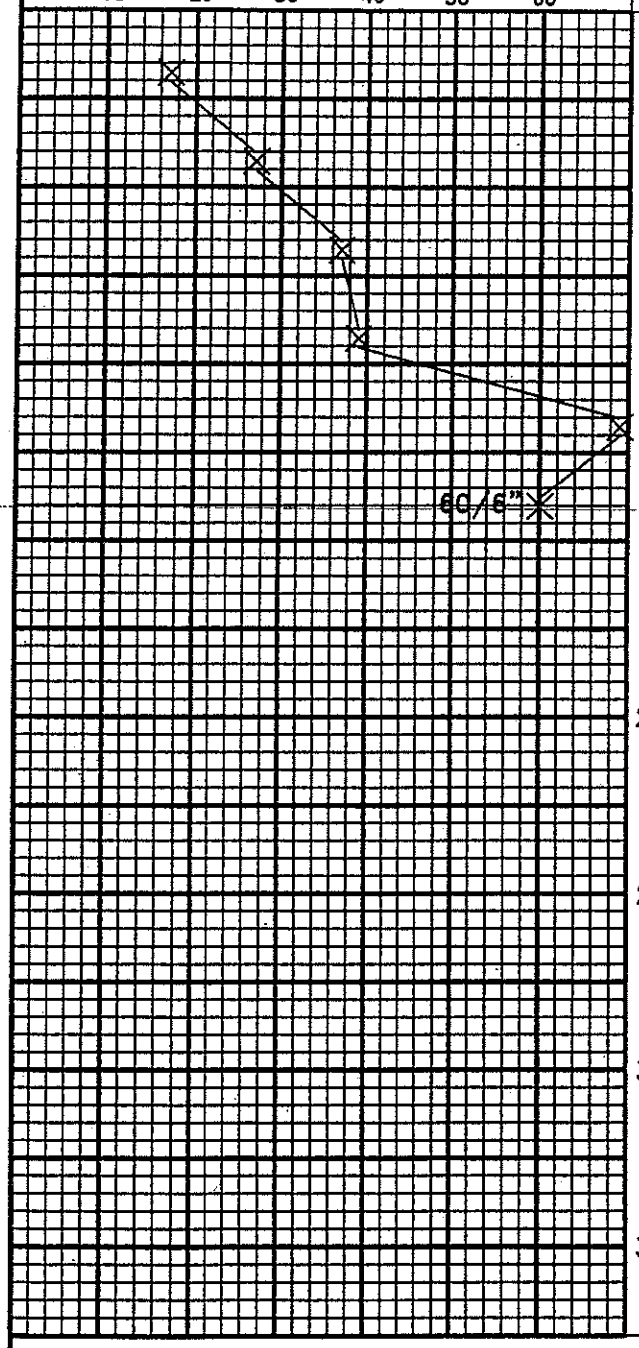
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09865

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-2



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
	2	ss		Brown Mott. Gray Weathered Shale
	3	ss		Brown Mott. Gray Shale
	4	ss		
	5	ss		
	6	ss		Gray Mott. Brown Shale
				End of Boring @ -14.5'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

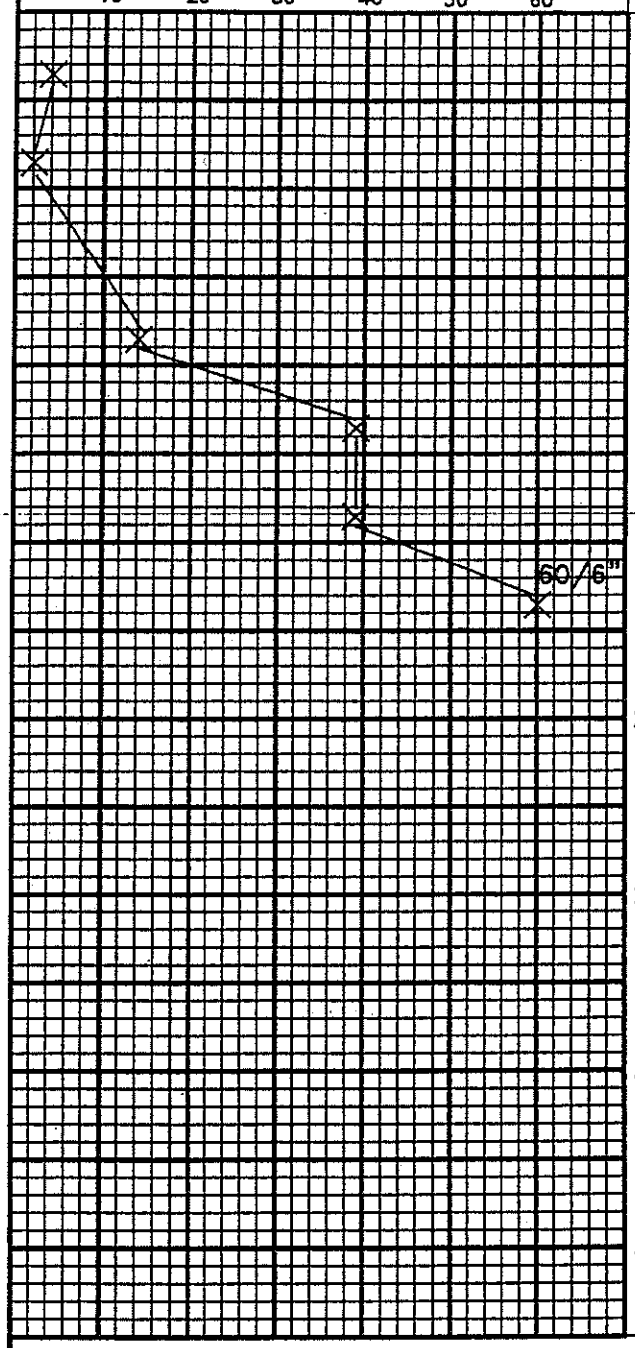
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09866

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-3



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
	2	ss		Gray Mott. Brown Silty CLAY (CL)
	3	ss		Brown Mott. Gray Silty CLAY (CL)
	4	ss		
	5	ss		Gray Mott. Brown Shale
	6	ss		
	7	ss		
				End of Boring @ -17.5'
				*Note: Moved Rig 4' up & pushed Shelby Tube 3-5' Deep

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

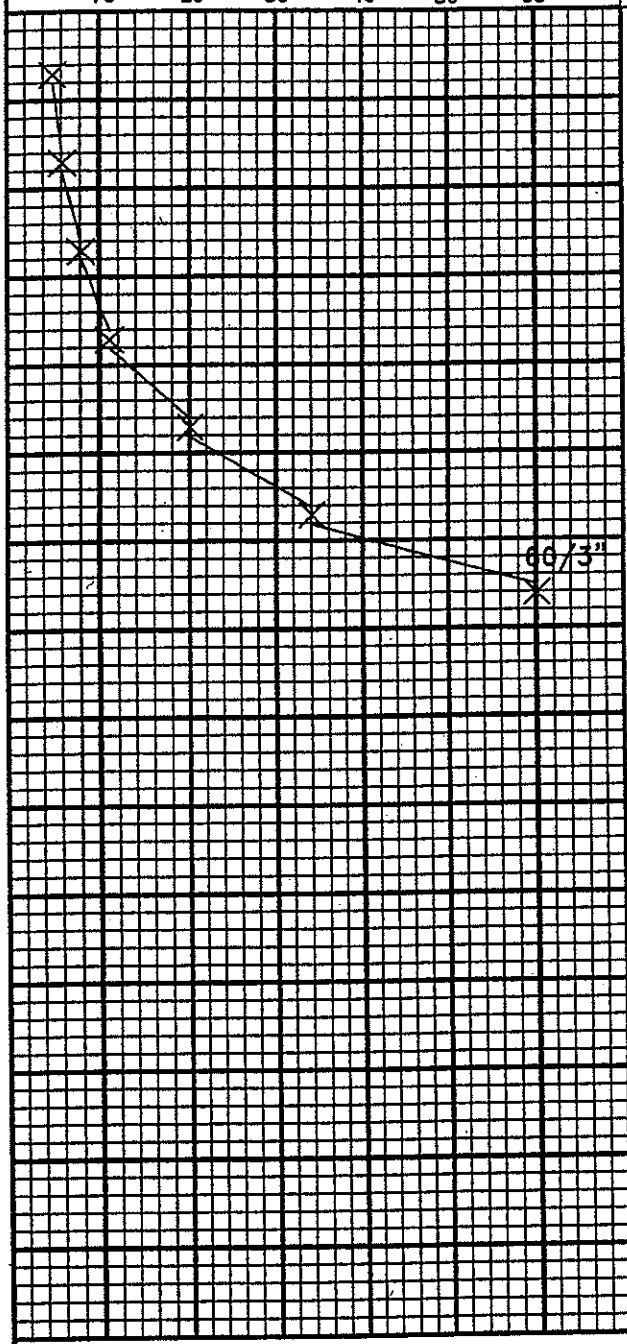
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R09867

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP4



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
	2	ss		
5	3	ss		
	4	ss		Brown Mott. Gray Sandy CLAY (CL)
10	5	ss		
	6	ss		Gray Weathered Shale
15	7	ss		
				End of Boring @ -17.0'
				Well set @ -16.0'
20				
25				BP4 = GW28
				Has water??
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring June 5, 2012
Client: Williamson Energy Marion, Illinois	Project No. H-08283

R09868

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW28

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 6/5/2012

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 6/5/2012

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Sand Pack: FilterSil #0

Source of Sand: FilterSil Junction City, GA

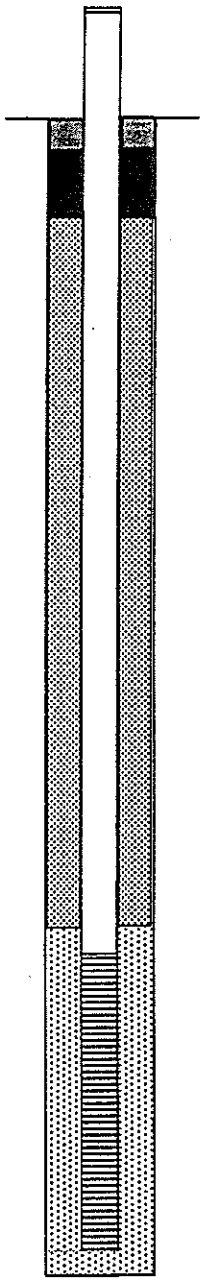
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			10.0'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			—	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



+3.0 MSL Top of Riser Pipe

0 MSL Ground Surface

2 ft. Concrete Seal

2 ft. Top of Bentonite

3 ft. Bentonite

5 ft. Top of Sand

6 ft. Top of Screen

10.0 ft. Total Screen Interval

16 ft. Bottom of Screen

17 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

HOLCOMB FOUNDATION ENGINEERING CO., INC.

SOILS - BITUMINOUS - CONCRETE - INVESTIGATIONS AND TESTING

SHIPPING ADDRESS
Box 393 Wood Road
Carbondale, IL 62901

www.holcombengineering.com
MAILING ADDRESS
P.O. Box 88
Carbondale, IL 62903

618-529-5262
800-333-1740
FAX 618-457-8991

June 26, 2008

Mach Mine
330 ½ Commercial Drive
PO Box 1829
Marion, Illinois 62959

Attention: Mr. Jim Slapak

Re: Groundwater Well Installation
Mach Mine
HFE File H-07227

Dear Sir:

In response to your request, we installed a new ground water monitoring well at Mach Mine to replace Well 7A on June 18, 2008. The well was drilled to 35 feet in depth, and set in accordance with the enclosed Monitoring Well Completion Report.

If you should have any questions, or if we can be of further assistance, please feel free to contact me at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

Timothy J. Holcomb, P.E.

Holcomb Foundation Engineering Company — Well Completion Report

Job # H-04154 County Williamson Well # GW7A

Site Name Steelhead Development Grid Coordinate Northing 427582.92 Easting 358306.37

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 4/29/2005

Driller J. Carter Geologist Tim Holcomb Date Completed: 4/29/2005

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Soil Cuttings

Type of Annular Sealant: Bentonite Slurry

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags 2 lbs. per bag 50

Type of Bentonite Seal _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Sand Pack: 20-40 Silica

Source of Sand: Filter-Sil

Amount of Sand: # of bags 1 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length	27.5'
Protective casing length	
Screen length	9.8'
Bottom of screen to end cap	0.1'
Top of screen to first joint	0.1'
Total length of casing	—
Screen slot size	0.010"
% of openings in screen	—
Diameter of borehole (in)	8.0"
ID of riser pipe (in)	2.0"



Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09871

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-07227 County Franklin Well # GW9

Site Name Akin Energy Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 6/18/2008

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 6/18/2008

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

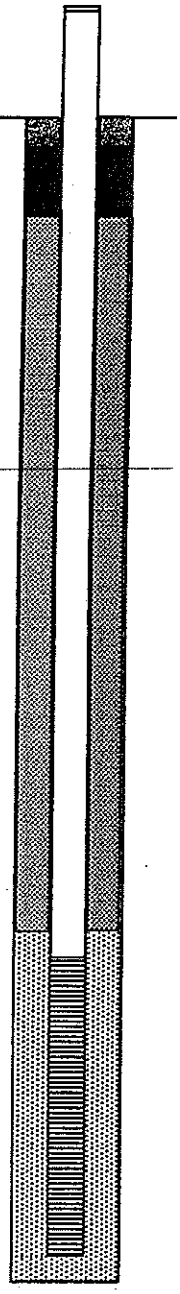
Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 8 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

Amount of Sand: # of bags 8 lbs. per bag 50



+2.5 MSL Top of Riser Pipe

0.0 MSL Ground Surface

2.0 ft. Concrete Seal

-2.0 ft. Top of Bentonite

21 ft. Bentonite

-23.0 ft. Top of Sand

-25.0 ft. Top of Screen

10.0 ft. Total Screen Interval

-35.0 ft. Bottom of Screen

-35.0 ft. Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
**Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			27.5'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			—	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	

**Screen is prepacked with sand

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

R09872

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-07227 County Franklin Well # GW9

Site Name Akin Energy Grid Coordinate Northing 428356.04 Easting 357692.54

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 6/18/2008

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 6/18/2008

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant:

Amount of Cement: # of bags ____ lbs. per bag ____

Amount of bentonite: # of bags ____ lbs. per bag ____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 8 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

Amount of Sand: # of bags 8 lbs. per bag 50

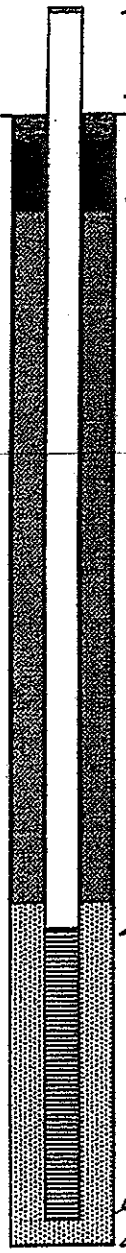
Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
**Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			27.5'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	

**Screen is prepacked with sand



449.3 +2.5 MSL Top of Riser Pipe

446.8 0.0 MSL Ground Surface

2.0 ft. Concrete Seal

444.8 -2.0 ft. Top of Bentonite

21 ft. Bentonite

423.8 -23.0 ft. Top of Sand

421.8 -25.0 ft. Top of Screen

10.0 ft. Total Screen Interval

~~413.8~~ -35.0 ft. Bottom of Screen

411.8 -35.0 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: ____ Ill. registration # ____

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING GW9

R09873

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Gray Mottled Brown Silty CLAY (CL) with sand
5				
10				
15		au		
20				
25				
30				
35				End of Boring @ −35.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Mach Mine Monitoring Well Installation
Williamson County, Illinois

Date of Boring
June 18, 2008

Client: Mach Mine
Marion, Illinois

Project No.
H-07227

ATTACHMENT IV.5.C.2

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	65.61	65.61

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	65.61	65.610
	Σ	**265.100**						**65.61**	**65.610**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	100.58	82.95

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	100.58	82.950
	Σ	**265.100**						**100.58**	**82.950**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

GENERAL INFORMATION
Permit No. **375 / 417**
Structure ID: **Sediment Pond No. 9**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in	
B.	Estimated Runoff Area:	**265.10**	acres	
C.	Estimated Distrubed Area:	**265.10**	acres	
D.	Runoff Coefficient:	**100.00**	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr stor	**27.34**	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	**26.51**	ac/ft	
G.	Pit Pumpage:	**2000.00**	gpm	
H.	Pit Pumpage Treatment:	**None**		
I.	Basin Volume (Required at Normal Pool*):	**58.27**	ac/ft	
	Basin Volume (Provided at Normal Pool):		ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (100yr/6hr):	-	acres	
L.	Diversion Ditching:	**None**		
M.	Inlet Elevation**:	**N/A**	feet	
	Outlet Elevation	**N/A**	feet	
	Outfall Elevation	**N/A**	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**		

Notes:

* Basin Volume Required = (0.416 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Pond Creek - Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413
DESCRIPTION:

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :

TOTAL AREA =	265.10	ACRES	DISTURBED AREA =	265.10	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	26.51	AC. FT.
10 YR - 24 HR RUNOFF VOL =	65.61	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	27.34	AC. FT.
PUMPAGE =	2000	GPM	PUMPAGE VOLUME =	4.42	AC. FT.
LINEAR FEET OF DITCHLINE =	8105	FEET	SEDIMENT CAPACITY REQD =	58.27	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	20.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	8		BARRIER SPACING =	1013.13	FEET
NUMBER OF BARRIERS =	7		TOP WIDTH (TOTAL) =	53.91	FEET
POOL AREA=	4.22	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	32.44	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.22	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	32.22	ACRE FEET
60% CLEANOUT DEPTH = 6.08 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 100.58 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	42.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.88	FEET
AREA OF FLOW =	38.70	SQ.FT.
VELOCITY =	2.60	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	53.91	FEET

Q ACTUAL = 100.64 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.88 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.48 FEET

POND CAPACITY REQUIRED:

(SEDIMENT CAPACITY REQD - SEDIMENT DITCH STORAGE AVAILABLE) = (56.83 - 32.22) = **26.05** AC. FT.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.58
BOTTOM WIDTH (ft), b=	32.00
CHANNEL SLOPE (%), So=	0.25
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	1.00
AREA OF FLOW (sq ft), A=	34.00
WETTED PERIMETER (ft), P=	36.47
HYDRAULIC RADIUS (ft), R=	0.93
VELOCITY OF FLOW (fps), V=	4.73
LINING PERIMETER (ft)=	41.47
TOP WIDTH (ft)=	40.47
FREEBOARD (ft)=	1.12
TOTAL DITCH DEPTH (ft), d=	2.12

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.15

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.11

TOTAL STRESS

t (psf) = 0.15
T (lb/ft) = 5.30

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.22
(lb/ft) = 7.96

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\tan(d)-So\right)$$ (psf)= 14.87

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.29

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.51 Tr,t (lb/ft) = 601.74

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

ANCHOR RESISTING STRESS

REMAINING RESISTANCE REQUIRED (psf)= -14.29 (lb/ft) = -593.78

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 15.31

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

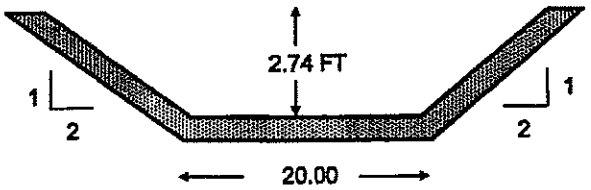
DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

INPUT: ***SPILLWAY SLOPE SECTION***

PEAK FLOW (REQ'D) =	100.58 CFS
BOTTOM WIDTH =	20.00 FT
SIDE SLOPES =	2.00:1
CHANNEL SLOPE =	0.007 FT/FT
MANNING'S N =	0.015 FT^(1/6)



CHANNEL LINING :
USM

OUTPUT: ***TRAPEZOIDAL DITCH***

STARTING DEPTH = **0.0**
DEPTH OF FLOW = 0.74 FT

WETTED PERIMETER =	23.31 FT
AREA OF FLOW =	15.90 SQ.FT.
HYDRAULIC RADIUS, Rh =	0.68 FT
CALC. VELOCITY =	6.44 FPS
CALC. FLOW =	102.35 CFS

mean depth= 0.69
froude no.= 1.36 *SUPERCRITICAL*

FREEBOARD REQUIRED = 2.00 FT

TOTAL DEPTH = 2.74 FT USE **2.74**
TOTAL WIDTH = **30.96** FT

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.58
BOTTOM WIDTH (ft), b=	20.00
CHANNEL SLOPE (%), So=	0.70
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	0.74
AREA OF FLOW (sq ft), A=	15.90
WETTED PERIMETER (ft), P=	23.31
HYDRAULIC RADIUS (ft), R=	0.68
VELOCITY OF FLOW (fps), V=	6.42
LINING PERIMETER (ft)=	28.43
TOP WIDTH (ft)=	27.54
FREEBOARD (ft)=	1.15
TOTAL DITCH DEPTH (ft), d=	1.89

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.30

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.24

TOTAL STRESS

t (psf) = 0.30
T (lb/ft) = 6.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.45
(lb/ft) = 10.41

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}(\tan(d)-So)$$ (psf)= 14.75

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.18

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.29 Tr,t (lb/ft) = 406.14

NCHOR RESISTING STRESS

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

REMAINING RESISTANCE REQUIRED (psf)= -13.84 (lb/ft) = -395.73

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 11.33

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Bench Gutter

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	BENCH



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	50.03	4.06

Structure Detail:

Structure #1 (Null)

BENCH

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.331	0.000	0.000	87.000	M	50.03	4.058
	Σ	**12.900**						**50.03**	**4.058**

Subwatershed Time of Concentration Details:

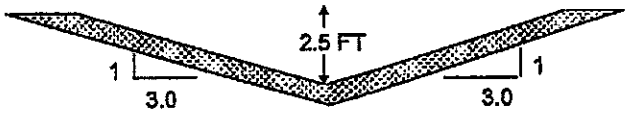
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	27.78	50.00	180.00	15.810	0.003
		8. Large gullies, diversions, and low flowing streams	0.50	12.53	2,506.00	2.120	0.328
#1	**1**	**Time of Concentration:**					**0.331**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL BENCH GUTTER

PEAK FLOW =	50.0	CFS
BOTTOM WIDTH =	0	FT
SIDE SLOPE 1 =	3.00:1	
SIDE SLOPE 2 =	3.00:1	
CHANNEL SLOPE =	0.005	FT/FT
MANNING'S N =	0.033	FT^(1/6)



OUTPUT:

TRIANGULAR DITCH

WETTED PERIMETER =	14.17	FT	DEPTH OF FLOW =	2.24	FT
AREA OF FLOW =	15.06	SQ.FT.	MEAN DEPTH =	1.12	FT
HYDRAULIC RADIUS, Rh =	1.06	FT	FROUDE NO. =	0.55	SUBCRITICAL
CALC. VELOCITY =	3.32	FPS			

FREEBOARD REQUIRED =	0.30	FT	(0+0.025vd^1/3)
TOTAL DEPTH =	**2.5**	FT	**ADDITIONAL FREEBOARD AVAILABLE BY SLOPE OF BENCH**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Access Road Gutter

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	GUTTER



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.700	1.700	10.61	0.67

Structure Detail:

Structure #1 (Null)

GUTTER

Subwatershed Hydrology Detail:

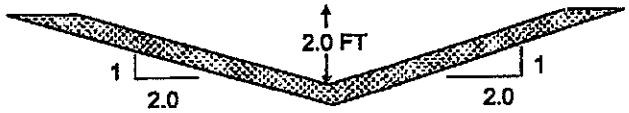
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1.700	0.000	0.000	0.000	87.000	M	10.61	0.666
	Σ	**1.700**						**10.61**	**0.666**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

ACCESS ROAD GUTTER DITCH DESIGN

PEAK FLOW =	10.61	CFS
BOTTOM WIDTH =	0	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.1	FT/FT
MANNING'S N =	0.035	FT^(1/6)



OUTPUT:

TRIANGULAR DITCH

WETTED PERIMETER =	3.86	FT	DEPTH OF FLOW =	0.86	FT
AREA OF FLOW =	1.49	SQ.FT.	MEAN DEPTH =	0.43	FT
HYDRAULIC RADIUS, Rh =	0.39	FT	FROUDE NO. =	1.91	SUPERCRITICAL
CALC. VELOCITY =	7.11	FPS			

FREEBOARD REQUIRED =	1.17	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	**2.0**	**FT**	

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Perimeter Ditch

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	PERIMETER DITCH



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	39.000	39.000	159.35	12.28

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	39.000	0.262	0.000	0.000	87.000	M	159.35	12.275
	Σ	**39.000**						**159.35**	**12.275**

Subwatershed Time of Concentration Details:

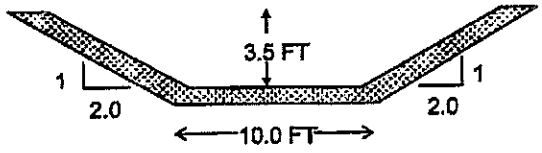
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	810.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	20.20	2,020.00	3.000	0.187
#1	**1**	**Time of Concentration:**					**0.262**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL PERIMETER DITCH

PEAK FLOW =	159.35	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.01	FT/FT
MANNING'S N =	0.045	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	20.43	FT	DEPTH OF FLOW =	2.33	FT
AREA OF FLOW =	34.21	SQ.FT.	MEAN DEPTH =	1.77	FT
HYDRAULIC RADIUS, Rh =	1.67	FT	FROUDE NO. =	0.62	SUBCRITICAL
CALC. VELOCITY =	4.66	FPS			

FREEBOARD REQUIRED =	1.15	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	**3.5**	**FT**	**CHANNEL LINING: SOIL AND GRASS**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Temporary Conveyance Ditch

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 Inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	TEMP



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	36.800	36.800	74.28	9.20

Structure Detail:

Structure #1 (Null)

TEMP

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	36.800	0.458	0.000	0.000	87.000	M	74.28	9.199
	Σ	**36.800**						**74.28**	**9.199**

Subwatershed Time of Concentration Details:

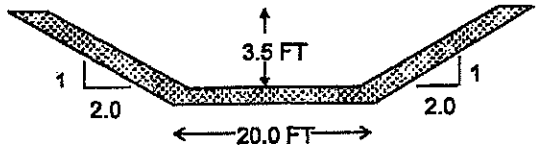
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	29.55	65.00	220.00	16.300	0.003
		8. Large gullies, diversions, and low flowing streams	0.72	30.00	4,164.35	2.540	0.455
#1	**1**	**Time of Concentration:**					**0.458**

CALCULATED BY: RPC 3/6/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

Temporary Conveyance Ditch

PEAK FLOW =	74.28	CFS
BOTTOM WIDTH =	20	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.0075	FT/FT
MANNING'S N =	0.069	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	26.60	FT	DEPTH OF FLOW =	1.48	FT
AREA OF FLOW =	33.87	SQ.FT.	MEAN DEPTH =	1.31	FT
HYDRAULIC RADIUS, Rh =	1.27	FT	FROUDE NO. =	0.34	SUBCRITICAL
CALC. VELOCITY =	2.19	FPS			

FREEBOARD REQUIRED =	2.06	FT	(2+0.025vd^1/3)
TOTAL DEPTH =	**3.5**	FT	**CHANNEL LINING: SOIL AND GRASS**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Flume

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	FLUME



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	81.200	81.200	328.44	25.57

Structure Detail:

Structure #1 (Null)

FLUME

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	81.200	0.274	0.000	0.000	87.000	M	328.44	25.567
	Σ	**81.200**						**328.44**	**25.567**

Subwatershed Time of Concentration Details:

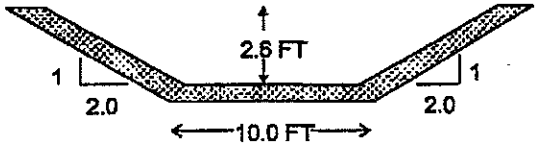
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	20.20	2,021.00	3.000	0.187
		8. Large gullies, diversions, and low flowing streams	25.79	180.00	698.00	15.230	0.012
#1	**1**	**Time of Concentration:**					**0.274**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL FLUME - USM DITCH DESIGN

PEAK FLOW =	328.44	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.33	FT/FT
MANNING'S N =	0.015	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	13.14	FT	DEPTH OF FLOW =	0.70	FT
AREA OF FLOW =	8.02	SQ.FT.	MEAN DEPTH =	0.63	FT
HYDRAULIC RADIUS, Rh =	0.61	FT	FROUDE NO. =	9.12	SUPERCRITICAL
CALC. VELOCITY =	40.94	FPS			

FREEBOARD REQUIRED =	1.91	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	**2.6**	**FT**	

Alliance Consulting, Inc.
ngineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING TYPICAL FLUME

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	328.44
BOTTOM WIDTH (ft), b=	10.00
CHANNEL SLOPE (%), So=	33.00
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	0.63
AREA OF FLOW (sq ft), A=	7.09
WETTED PERIMETER (ft), P=	12.82
HYDRAULIC RADIUS (ft), R=	0.55
VELOCITY OF FLOW (fps), V=	38.36
LINING PERIMETER (ft)=	20.97
TOP WIDTH (ft)=	19.81
FREEBOARD (ft)=	1.82
TOTAL DITCH DEPTH (ft), d=	2.45

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 11.40

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 9.00

TOTAL STRESS

t (psf) = 11.40
T (lb/ft) = 146.08

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 17.09
(lb/ft) = 219.11

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\tan(d)-So\right)$$ (psf)= 6.08

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 4.58

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 5.29 Tr,t (lb/ft) = 110.97

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING TYPICAL FLUME

ANCHOR RESISTING STRESS

REMAINING RESISTANCE REQUIRED (psf)= 11.80 (lb/ft) = 108.14

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= 21.13

USE REBAR SPACING OF 20.00 20 ft MAXIMUM

RESISTANCE PROVIDED (psf)= 13.18

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 9.64

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 4.5 FT SPACING.
SEE ANCHOR BOLT SPACING SHEET FOR CALCULATIONS.

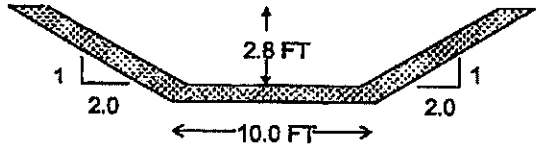
Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL FLUME - GROUTED RIPRAP DITCH DESIGN

PEAK FLOW =	328.44	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.33	FT/FT
MANNING'S N =	0.035	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	15.13	FT	DEPTH OF FLOW =	1.15	FT
AREA OF FLOW =	14.11	SQ.FT.	MEAN DEPTH =	0.97	FT
HYDRAULIC RADIUS, Rh =	0.93	FT	FROUDE NO. =	4.17	SUPERCRITICAL
CALC. VELOCITY =	23.28	FPS			

FREEBOARD REQUIRED =	1.61	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	**2.8**	FT	

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Culvert C-1

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	C-1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	64.400	64.400	287.84	20.50

Structure Detail:

Structure #1 (Null)

C-1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	64.400	0.179	0.000	0.000	87.000	M	287.84	20.503
	Σ	**64.400**						**287.84**	**20.503**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	810.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	964.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
#1	**1**	**Time of Concentration:**					**0.179**

Culvert C-1, (3)-48" cmp's Required

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.00	0.0240	5.75	0.00	0.90

Culvert Results:

Minimum pipe diameter: 1 - 48 inch pipe(s) required

Detailed Performance Curves

Design Discharge = 95.96 cfs

Maximum Headwater = 5.75 ft

(BOLD indicates design pipe size)

Headwater (ft)	Discharge (cfs) (45 in)	**Discharge (cfs) (48 in)**	Discharge (cfs) (54 in)
0.57	13.15	**14.40**	16.83
1.15	19.27	**21.45**	25.83
1.72	24.57	**27.59**	33.84
2.30	29.27	**33.06**	41.00
2.88	33.60	**37.98**	47.47
3.45	44.02	**46.12**	53.42
4.03	56.89	**60.05**	65.62
4.60	71.84	**74.44**	82.43
5.17	80.64	**89.81**	99.72
5.75	88.57	**99.34**	120.62
6.32	95.84	**108.02**	132.72
6.90	102.60	**116.06**	143.83
7.47	108.95	**123.56**	154.14
8.05	114.94	**130.64**	163.79
8.62	120.63	**137.36**	172.90

3001 - 15
part 10

R09938

PART V

RECLAMATION PLAN

1) Provide a reclamation plan outlining proposed reclamation of the lands within the proposed permit area. The reclamation plan shall include the following:

A) Provide for each major step in the proposed reclamation plan a detailed timetable for completion.

RESPONSE: **When permanent cessation of operations occurs, final reclamation of the permit area is to commence immediately and be completed in accordance with the approved reclamation plan and the permit conditions developed in accordance with 62 IAC 1817.106. The abandonment configuration is contained in Volume 2. The timeframes and limits established in 62 IAC 1817.117 and 1817.100 are to govern the reclamation activities. If variances or extensions are necessary, timely requests are to be made to the IDNR for approval.**

Coarse refuse or suitable soil is to be placed in the impoundment to cover exposed fines. Prior to soil placement, acid-base accounting will be performed on the coarse refuse to determine if a lime application is needed. If lime is required, it will be incorporated into the coarse refuse to a depth of 12 inch. A final cover consisting of 42 inches of subsoil and 6 inches of topsoil is to be placed over all coarse coal refuse. A vegetative cover will be established successively as areas are covered.

Grading, final cover placement, and vegetation establishment will be dictated by seasonal weather conditions. Soil placement is expected to be accomplished during the drier months of the year to avoid undesirable compaction. Soils required for the reclamation effort are to be obtained from stockpiled soils removed prior to disturbance by the mining operations, or borrow areas in the vicinity of the refuse disposal area. Borrow areas used as sources for cover material are to be graded to approximate original contour to blend into the surrounding topography and revegetated in accordance with the approved post-mining land use plan. Reclaimed areas are to be planted during the first normal period of favorable planting conditions following replacement of the soil.

Surface and groundwater monitoring is to continue until IDNR and/or IEPA approve discontinuing the monitoring.

B) Provide a detailed estimate of the cost of reclamation for the proposed surface mining operation required to be covered by a performance bond. Provide calculations and/or drawings, cross sections, maps, etc. to support the reclamation cost estimate.

Response: **Refer to Attachment V.1.B for the detailed itemization of the cost of reclamation for the proposed surface mining operations to be covered by a performance bond.**

Misc. Bldg Steel 2	N/A			
Misc. Bldg Steel 3	N/A			

b.

Concrete Structures	Struct ID	Height ft.	Width ft.	Length ft.
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			
Reinforced	N/A			

c.

Silos	Struct ID	Height ft.	Width ft.	Length ft.
		N/A		
		N/A		

d.

Paving	Struct ID	Width ft.	Length ft.
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Concrete	N/A		
Asphalt	N/A		
Asphalt	N/A		
Asphalt	N/A		
Asphalt	N/A		

e.

Conveyors	Length
Conveyor 1	7,000 feet

Approximate original contour will not be achieved for the refuse disposal area. The refuse area will be at a higher elevation than the natural ground elevation. The out slopes of the refuse disposal area will be graded no steeper than 3H:1V. After toxic and/or potentially toxic material from the mine site has been disposed of in the refuse area, the refuse area will be covered with subsoil and topsoil. Soil from the storage area adjacent to the refuse area (soil storage area south of Refuse Area No. 1, Permit 382) will be trucked to the site and dozers will spread the topsoil material to a depth of capable of supporting the post mining vegetation.

Backfilling and regarding operations will be achieve by using scrapers, dozers, loaders and/or trucks. Topsoil material (topsoil and subsoil) will be redistributed throughout the refuse disposal areas in a method that will allow for proper soil depth placement and minimize soil compaction. The minimization of soil compaction will allow for a better root medium and promote plant growth. In the mine site area, topsoil depth will be the approximate thickness of pre-mining conditions.

2) Provide sufficient contour maps and cross-sections to show the anticipated final surface configuration of the proposed permit area when reclamation work is completed.

RESPONSE: **Refer to "Reclamation Map" in Volume 1 and "Abandonment Map" in Volume 2.**

3) The areas other than those reclaimed to the standards of high capability lands and prime farmlands, describe all water and erosion control structures to be constructed such as terraces, diversions, etc.

RESPONSE: **Methods to deter erosion of reclaimed area will include, but not limited to the use of terraces, ditches, hay bales, silt fence, vegetation, erosion control matting, and/or riprap. Other methods may be used for site-specific situations. Design criteria for these alternate means of sediment control will be in accordance with the NRCS design criteria and shall meet post construction certification requirements.**

4) Describe the timing in which all grading and the construction and removal or renovation of water and erosion control structures will be complete and the sequence for accomplishing the work in relation to seasonal weather conditions.

RESPONSE: **Grading and construction and the removal or renovation of water and erosion control structures will occur between April 1 and November 15. This time schedule will allow for revegetation and mulching of the disturbed areas. Unforeseen situations may require for the construction of structures during adverse weather conditions. If this should occur, a temporary vegetation seed mixture will be used until the area can be seeded with a permanent seed mixture. The same time schedule of April 1 through November 15 will be used for the removal and/or renovation of structures. Prior to this type of work being**

as crops can be planted. At that time, the temporary crops will be turned under and the sites will be established and managed using standard agricultural equipment normally used in crop production.

The reclaimed side slopes of the proposed refuse impoundment will be seeded with the temporary seed mixture to provide a quick cover if seeding is before or after the optimum seeding period. If the reclamation is performed during the optimum seeding period, then the side slopes will be reclaimed using the permanent cool season seed mix.

A part of the final abandonment of the proposed refuse impoundment, the top portion of the impoundment will be first covered with coarse refuse to eliminate the impounding capability. Upon completion of "capping" the impoundment, 42 inches of subsoil and 6 inches of topsoil will be distributed over the gently sloping cap. As areas are reclaimed with the required soil thickness, a temporary seed mixture will be used to provide a quick cover, if seeding is before or after the optimum seeding period. Prior to planting a permanent warm season seed mix, the temporary cover will be turned under. If seeding can established during the optimum seeding period, then a permanent warm season seed mix will be used.

2) a) For areas other than forest and/or wildlife habitat planting, list the species and seeding rates on a per acre basis for each species proposed to be utilized.

RESPONSE: **N/A. The post mining land use for the area being added by this application is fish and wildlife.**

b) For forestry and/or wildlife habitat areas, list the planned species and density on a per acre basis of trees, shrubs and herbaceous cover to be seeded and planted.

RESPONSE: **Refer to Attachment V.1.D.2.b**

3) Describe the methods to be used in planting and seeding. Include the type of equipment to be used for seeding and seedbed preparation.

RESPONSE: **The method of application will include the use of conventional seed drills, Brillion seeders, broadcast seeders or aerial seeding, depending upon soil conditions. Fertilization rates will typically include agricultural lime at 3 ton/acre, phosphorus (P_2O_5) at 150 lbs./acre, potassium (K_2O) at 200 lbs./acre, and nitrogen at 120 lbs./acre. These are typical cover crop application rates and will be adjusted based upon soil chemical analysis and yield requirements. The areas shall be mulched as per Part V.1.D.5 of this permit application and fertilizer/lime shall be applied as per recommendations from soil testing to be performed as per V.1.D.9 of this permit application.**

Two different seed mixtures are being proposed for this permit area. A cool season grass mixture is being proposed for the Herbaceous Wildlife Planting Area and the Woody Wildlife Planting Area shown on the Reclamation Map (Drawing No. B12-271-M25). A

RESPONSE: **Straw mulch will be spread by hand or mechanically at a rate of about 1.5 tons per acre. Where the situation dictates, straw and hay mulch will be applied between the dates of November 1 through March 1. Between March 1 and November 1, areas will be protected with quick-growing standing mulch (annual ryegrass, spring oats, pearl millet, etc.). During the growing season, straw or hay mulch will be applied as needed or as directed by the Department.**

6) Provide Measures proposed to be used to determine success of revegetation required under 62 Ill. Adm. Code 1817.117.

RESPONSE: **The approved Illinois Productivity Formula will be used to determine success for cropland. A minimum of 250 live stems per acre and sufficient herbaceous cover to control erosion will be used as the success criteria for wildlife land use areas. No trees will be planted on the covered refuse piles, and the standard for success will be the groundcover standard used for herbaceous wildlife. A minimum of 450 live stems per acre and sufficient herbaceous cover** to control erosion will be used as the success criteria for reclaimed forestry land use.

7) If any of the post-mining land uses are to include industrial or residential uses, describe revegetation measures to control erosion.

RESPONSE: **No post-mining land use of industrial or residential are proposed within the being permitted.**

8) Are there any plans to use nurse crops or crop rotations to improve future rowcrop productivity?

Yes _____ No __X__

If yes describe type, duration and management of these areas.

9) Describe soil testing plan for evaluation of soil nutrients and amendments necessary for revegetation.

RESPONSE: **Composite soil samples will be collected and analyzed for pH, P1, and K. One representative composite sample will be collected from approximately every four acres. Laboratory analyses of the samples combined with the vegetative being planted will be used to determine the appropriate amendments and quantities to be applied to the reclaimed areas.**

E) Describe measures to be employed to maximize the use and conservation of the coal resources per regulation Section 1817.59.

Pasture Land	**0.00**
Grazing Land	**0.00**
Forestry	**0.00**
Residential	**0.00**
Industrial, Commercial	**0.00**
Recreation	**0.00**
Fish and Wildlife - Water	**3.67**
Fish & Wildlife - Herbaceous (Cool Season Grasses)	**117.45**
Fish & Wildlife – Herbaceous (Warm Season Grasses)	**91.08**
Fish & Wildlife - Woody	**17.58**
Fish & Wildlife - Wetland	**0**
TOTAL	**229.78**

B) 1) Provide a description of how the proposed post-mining land uses are to be achieved, and describe any necessary support activities which will be needed to achieve the proposed land uses.

RESPONSE: **The post-mining land use will be achieved by a coordinated effort combining the operational aspects of site reclamation, landowner comments, and Department suggestions and regulations. The support facilities and refuse disposal areas are planned for the existing cropland areas to both avoid and minimize the impact on the identified wetlands in the forested stream valleys. Thus, the proposed plan will involve a conversion from cropland to wildlife habitat when the refuse pile is reclaimed.**

2) Discuss the utility and capacity of the reclaimed lands to support a variety of alternative uses and the relationship of the proposed uses to existing land use policies and plans.

RESPONSE: **The pre-mining land uses are cropland, industrial commercial, fish and wildlife, and undeveloped land as shown on Drawing No. B12-271-E6. The proposed post-mining land uses are herbaceous wildlife habitat for the refuse area and woody wildlife habitat for all other areas as shown on Drawing No. B12-271-M25.**

These changes in land use do not present any actual or probable hazard to the public health and safety, nor do they pose any threat of water diminution or pollution. The changes will allow for recovery of coal resources and will facilitate both practicable and reasonable land management in the future.

62 Ill. Adm. Code 1823.11 provides for exemption from prime farmland reclamation requirements for coal preparation plants, support facilities, and roads of underground mines that are used over extended periods of time and where uses affect minimal amount of land. Further exemption from prime farmland requirements area granted for disposal areas containing coal mine waste resulting from underground mines that is not technologically and economically feasible to store in underground mines or non-prime farmland.

4) Where a post-mining land use different from a pre-mining land use is proposed alternate post-mining land uses may be approved by the Department after considering the relationship of the intended uses to the existing landuse policies and plans and the comments of any owner of the surface, and land use agency having jurisdiction over the land.

RESPONSE: **The table below shows the planned changes from pre-mine to post-mining land uses. All acreage for the refuse area will be reclaimed as low capability lands. Acid or toxic material area will be treated with lime and covered with 42 inches of subsoil and six inches of topsoil (rooting media) and non-acid/toxic areas will be covered with an average of 12 inches of soil. Fish and wildlife habitat will be the land use and trees will be planted in random blocks for the areas outside the refuse disposal area. The steeper side slopes will be vegetated with warm season grasses and the top of the refuse disposal area which will have a flatter slope will be vegetated with cool season grasses. The landowner is in agreement with this conversion from forestry and cropland to fish and wildlife habitat for the areas affected by the surface facility. These changes in land use do not present any actual or probable hazard to the public health and safety, nor do they pose any threat to water diminution or pollution. The changes will allow for recovery of the coal resources and will facilitate practicable and reasonable land management in the future.**

Land Uses	Pre-Mining Area	Post Mining Area
Cropland	**101.49**	**0.00**
Pasture Land	**0.00**	**0.00**
Grazing Land	**00.00**	**0.00**
Forestry	**122.71**	**0.00**
Residential	**1.52**	**0.00**
Industrial, Commercial	**4.06**	**0.00**
Recreation	**0.00**	**0.00**
Fish and Wildlife - Water	**0.00**	**3.67**
Fish & Wildlife - Herbaceous (Cool Season Grasses)	**0.00**	**117.45**
Fish & Wildlife – Herbaceous (Warm Season Grasses)	**0.00**	**91.08**
Fish & Wildlife - Woody	**0.00**	**17.58**
Fish & Wildlife - Wetland	**0.00**	**0**
TOTAL	**229.78**	**229.78**

Provide a discussion explaining the consideration which has been given to making all of the proposed surface mining activities consistent with surface owner plans and applicable State and local land use plans and programs.

3) If the applicant's fish and wildlife plan finds it impracticable to provide for enhancement of fish and wildlife and related environmental values, the applicant shall provide a statement which establishes why it is not practical to achieve enhancement.

RESPONSE: **The fish and wildlife plan in this section is practicable and will provide for the enhancement of fish and wildlife and related environmental values.**

B) The applicant shall provide a statement explaining how impact control measures, management techniques, and monitoring methods will be utilized to protect or enhance the following, if they are to be affected by the proposed surface coal mining and reclamation operations:

1) Threatened or endangered species of plants or animals listed by the Secretary of the United States Department of the Interior (Secretary) under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) and their critical habitats.

RESPONSE: **No federal threatened or endangered species, whether listed or proposed for listing, are known to occur within the permit area. Similarly, no associated critical habitats designated under 16 USC 1531 et seq. are present within the permit area. The forested habitat in and adjacent to the permit area does provide potential habitat for the Indiana Bat. Although the Indiana Bat is not known to occur within Williamson County or near the project site, measures will be taken to comply with the Department policy for tree removal as discussed below.**

2) Species such as eagles, migratory birds or other animals protected by State or Federal law, and their habitats; or other species identified through the consultation process pursuant to 62 Ill. Adm. Code 1784.21; or

RESPONSE: **No species such as eagles, migratory birds, or other animals protected by State or Federal law are known to occur within the permit area. The possibility exists for certain migratory birds and eagles to utilize the project or adjacent area. Therefore, the Protection and Enhancement Plans have been prepared and are contained within Attachment II.8. Additionally, the offsite mitigation area for the project is proposing to convert crop fields into a forested stream and wetland mitigation area. This offsite mitigation area will provide alternate habitat for any species displaced by the project.**

3) Habitats of unusually high value for fish and wildlife, such as wetlands, riparian areas, cliffs supporting raptors, areas offering special shelter or protection, reproduction and nursery areas, and wintering areas.

RESPONSE: **Extensive efforts have been made to both avoid and minimize construction activities in areas designated as wetlands. Refer to Attachment II.9 for the report on the Wetland Assessment**

conditions. Also, to be included is a description of each engineering design assumption and calculation with a discussion of each alternative considered in selection design parameters and construction methods.

RESPONSE: **See "Report – Engineering Design Plan" Volume 2**

D) Submission of MSHA certification documents for a detailed design plan shall satisfy the requirements, in so far as, the MSHA informational and design standard requirements are duplicative of the requirements.

RESPONSE: **The "Report – Engineering Design Plan" has been submitted to MSHA.**

5) Area closure or abandonment.

A) Describe all reclamation efforts to be expended to satisfy the requirements of abandonment. If an exemption request is to be made, it should be included.

1) Include the timing to meet the final grading and revegetation requirements.
2) Include a description of the final graded slopes, and the type of seed and seeding.
3) Explain final coverage of treatment of toxic areas and locate all borrow pits.

RESPONSE: **If temporary cessation of the operation occurs, grading will be completed to meet the appropriate requirements, with exception of areas delineated in any grading extension requests. Drainage control structures will be maintained to insure they continue to function properly. All surface and groundwater monitoring will continue according to the approved plans during any temporary cessation.**

When permanent cessation of operations occurs, final reclamation of the mine site will be completed in accordance with the approved reclamation plan and the permit conditions developed in accordance with Chapter I, Section 1817, 62 Illinois Administrative Code. Disturbed areas will be graded to conform to the approved configuration and slopes required to support the post-mining land use. Refer Part V.1.F. for a discussion of the final coverage of toxic areas. Soil materials required for the reclamation effort will be obtained from stockpiled soils removed in advance of the mining operations or borrow areas in the refuse disposal area. Borrow areas used as sources for cover material will be graded to approximate original contour to blend into the surrounding topography and revegetated in accordance with the proved post-mining land use plan. Soil materials will be replaced and vegetation established in accordance with the approved post-mining land uses. All surface and groundwater monitoring will continue until the agencies with authority over this function approve discontinuing the monitoring.

B) Describe in detail a rehabilitation design plan for each siltation structure, diversion, impoundment and treatment facility to be implemented and completed prior to abandonment. Any departures from detailed design plan requirements must be designated as such and be accompanied by supporting documentation.

3) Plan-profile and cross-sectional drawings of the existing stream shall be provided showing the following information:
   a) Stream bed and significant drops,
   b) Water surface at low flow,
   c) Water surface at the 100 year and 2 year flood event.
   Include the calculated flow rate (cfs) and velocity (ft/sec) at the representative locations for low flow and the 100-year flood conditions.

4) Describe the habitat of the existing stream including the following information at a minimum:
   a) Channelization or other disturbances,
   b) Shade provided by stream bank vegetation, c) Stream substrate composition,
   d) Steepness and elevation of the banks,
   e) Riparian vegetation (species, relative abundance),
   f) Aquatic vegetation (species, relative abundance),
   g) Potential Indiana bat habitat shall be addressed with a plan to prevent "taking" of the animal during breeding seasons.

C) The following design and construction plan information shall be provided for TEMPORARY STREAM CHANNEL DIVERSIONS. If none are proposed, indicate N/A.

RESPONSE: **N/A. Temporary stream channel diversions are not proposed.**

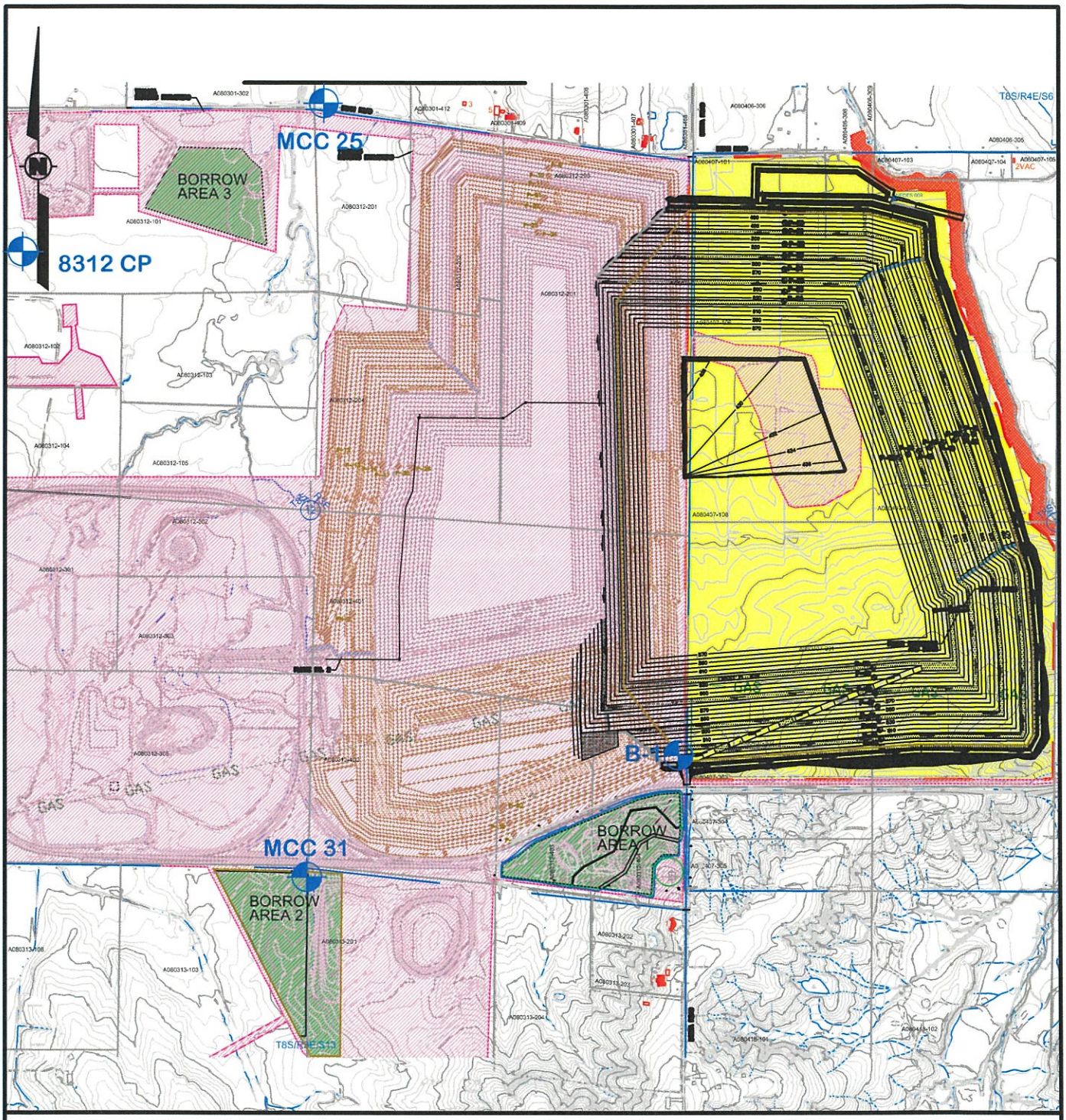
1) The following estimated construction planting dates shall be provided:
   a) Begin construction _____.
   b) End construction _____.
   c) Begin planting _____.
   Give a detailed description of the construction practices to be followed, and the equipment to be employed.

2) After stabilization of the temporary diversion and prior to diversion of the existing stream into the temporary stream channel, the applicant will be required to contact the Department and gain approval. The applicant shall provide an estimation of the date when erosion control structures and vegetation will be sufficiently established to allow diversion of the water into the temporary channel.

3) Discuss the erosion control practices to be followed during construction of the temporary diversion and the features of the proposed channel which will help minimize erosion of the stream banks in the future. Discuss the necessity, if any, of using a stilling basin to aid in reducing siltation.

4) Discuss the impacts the temporary diversion ditch will have on downstream water quality, biological communities and water users and describe a monitoring program to measure these impacts.

R09948



SCALE

1000 0 1000 2000 FEET

Alliance Consulting, Inc.
Engineers
Constructors
Scientists

BECKLEY, WV (304) 255-0491
CANONSBURG, PA (724) 745-3630
SUMMERSVILLE, WV (304) 883-2360

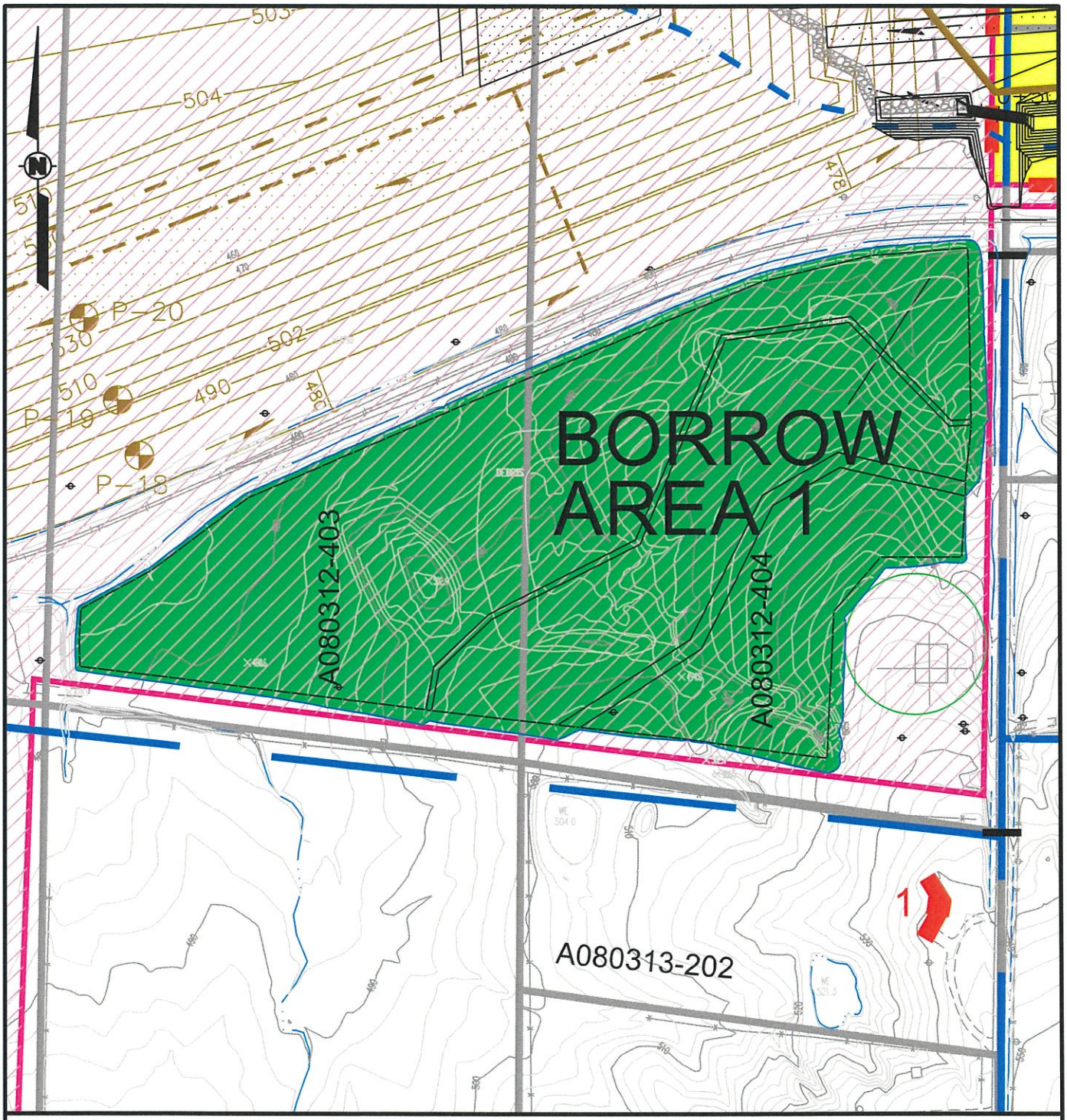
SOIL BORROW AREA LOCATION MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

PREPARED FOR

WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	DSM	12/16/14
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B12-271-A6		



SCALE

200 0 200 400 FEET

13.19 ACRES

305,987 YD^3 CUT

Alliance Consulting, Inc.

Engineers
Constructors
Scientists

BECKLEY, WV (304) 255-0491
CANONSBURG, PA (724) 745-3630
SUMMERSVILLE, WV (304) 883-2360

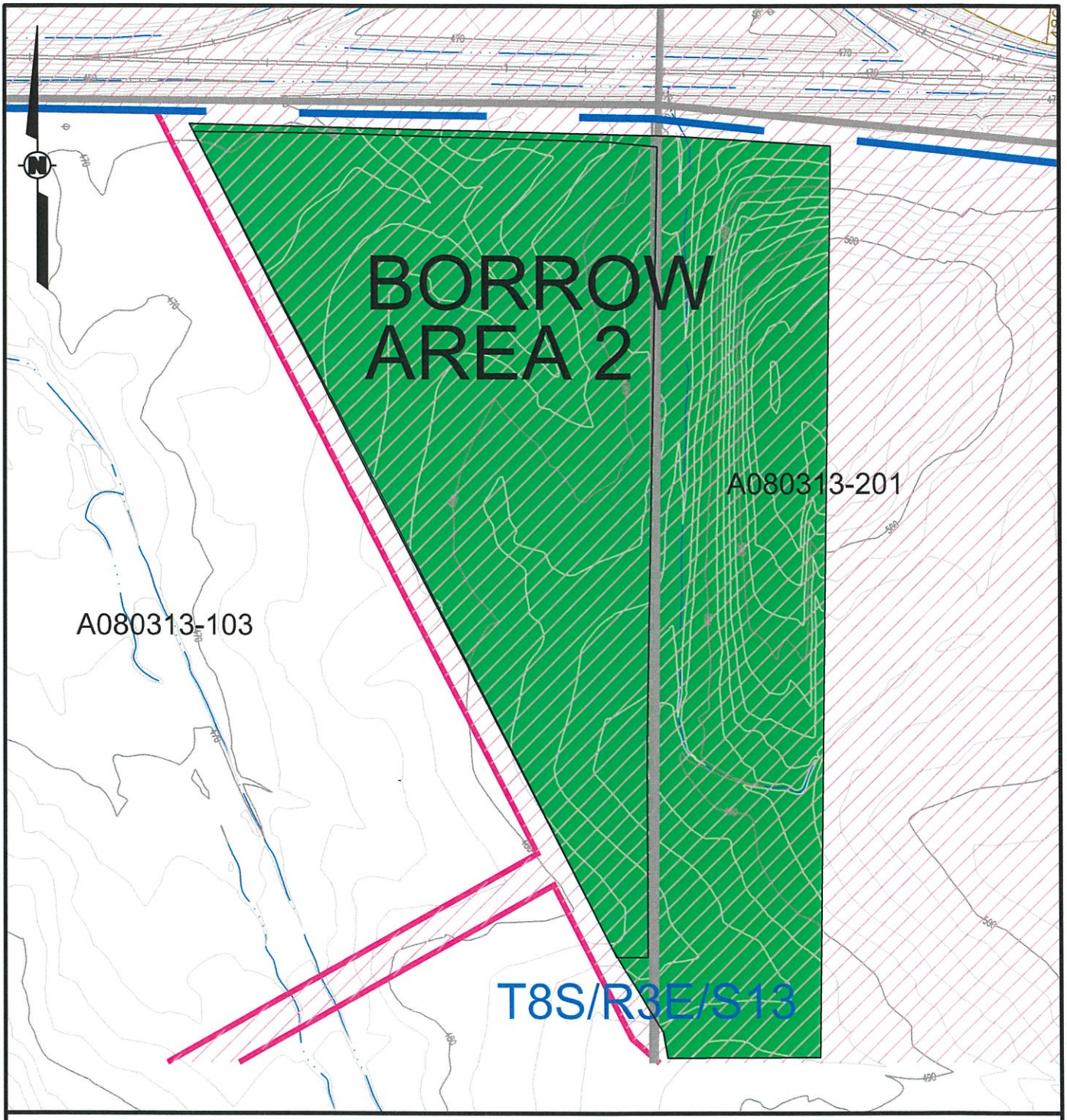
BORROW AREA 1

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

PREPARED FOR

WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	DSM	12/16/14
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B12-271-A7		



SCALE

200 0 200 400 FEET

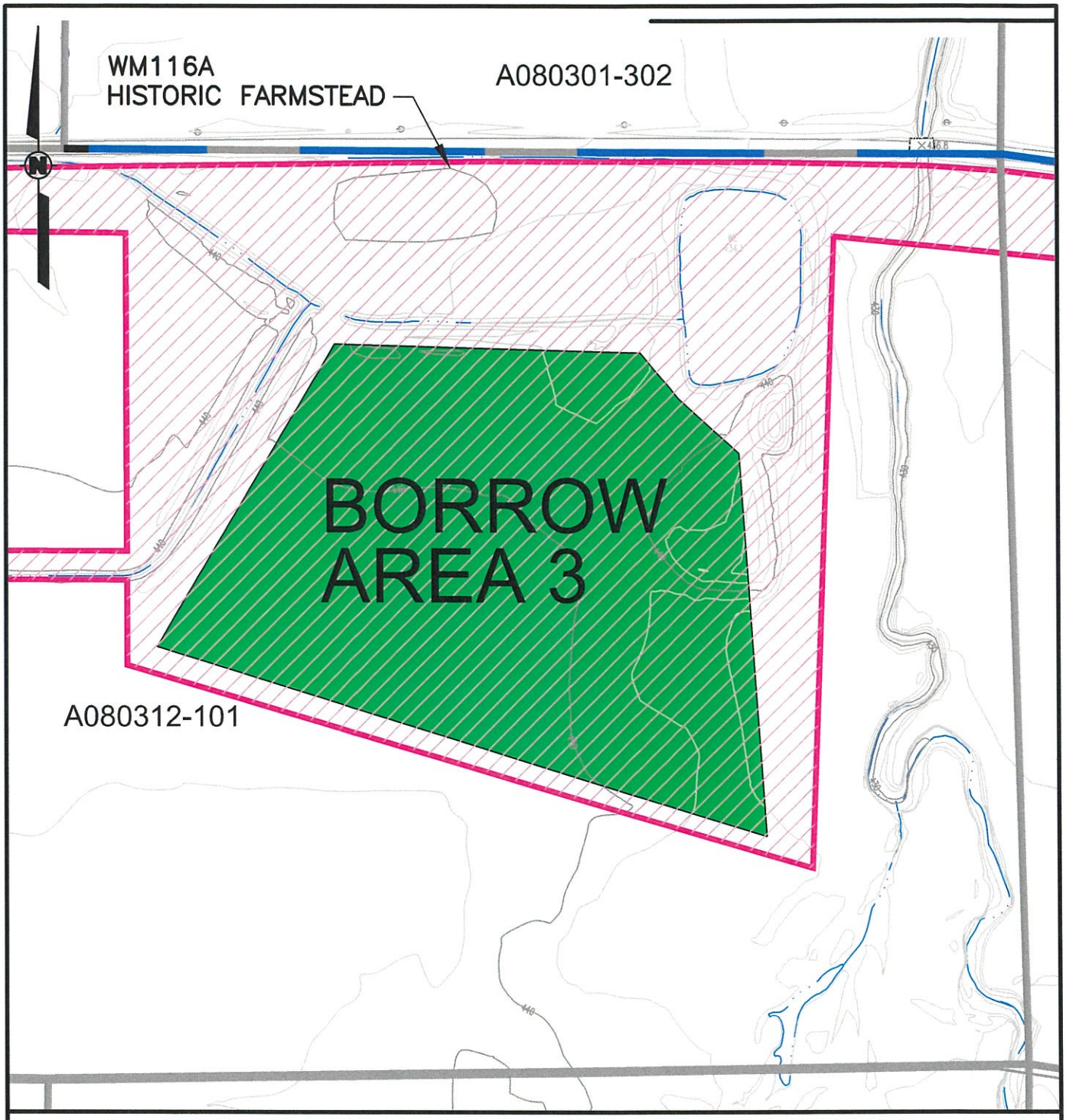
16.78 ACRES
7.9' OF CUT
213,867 YD^3

Alliance Consulting, Inc.
Engineers
Constructors
Scientists
BECKLEY, WV (304) 255-0491
CANONSBURG, PA (724) 745-3630
SUMMERSVILLE, WV (304) 883-2360

BORROW AREA 2

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA
PREPARED FOR
WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	DSM	12/16/14
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B12-271-A8		



SCALE

200 0 200 400 FEET

9.23 ACRES
7.9' OF CUT
117,639 YD^3

Alliance Consulting, Inc.
Engineers
Constructors
Scientists

BECKLEY, WV (304) 255-0491
CANONSBURG, PA (724) 745-3630
SUMMERSVILLE, WV (304) 883-2360

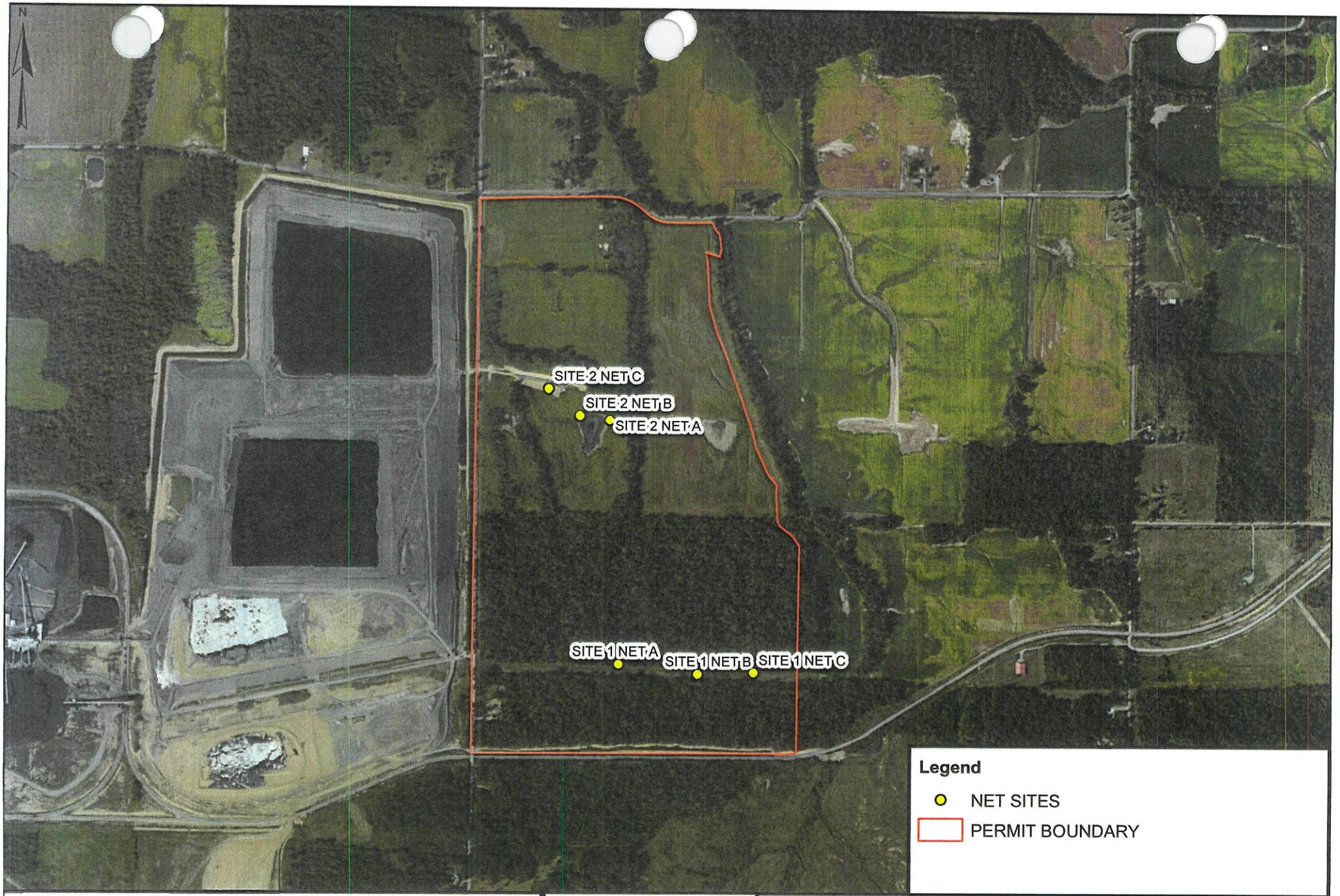
BORROW AREA 3

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

PREPARED FOR

WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	DSM	12/16/14
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B12-271-A9		



REFERENCE:

ArcGIS map service aerial imagery, retrieved 3/18/14
Available at: http://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

1 inch = 1,000 feet

0 500 1,000 2,000 3,000 Feet

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

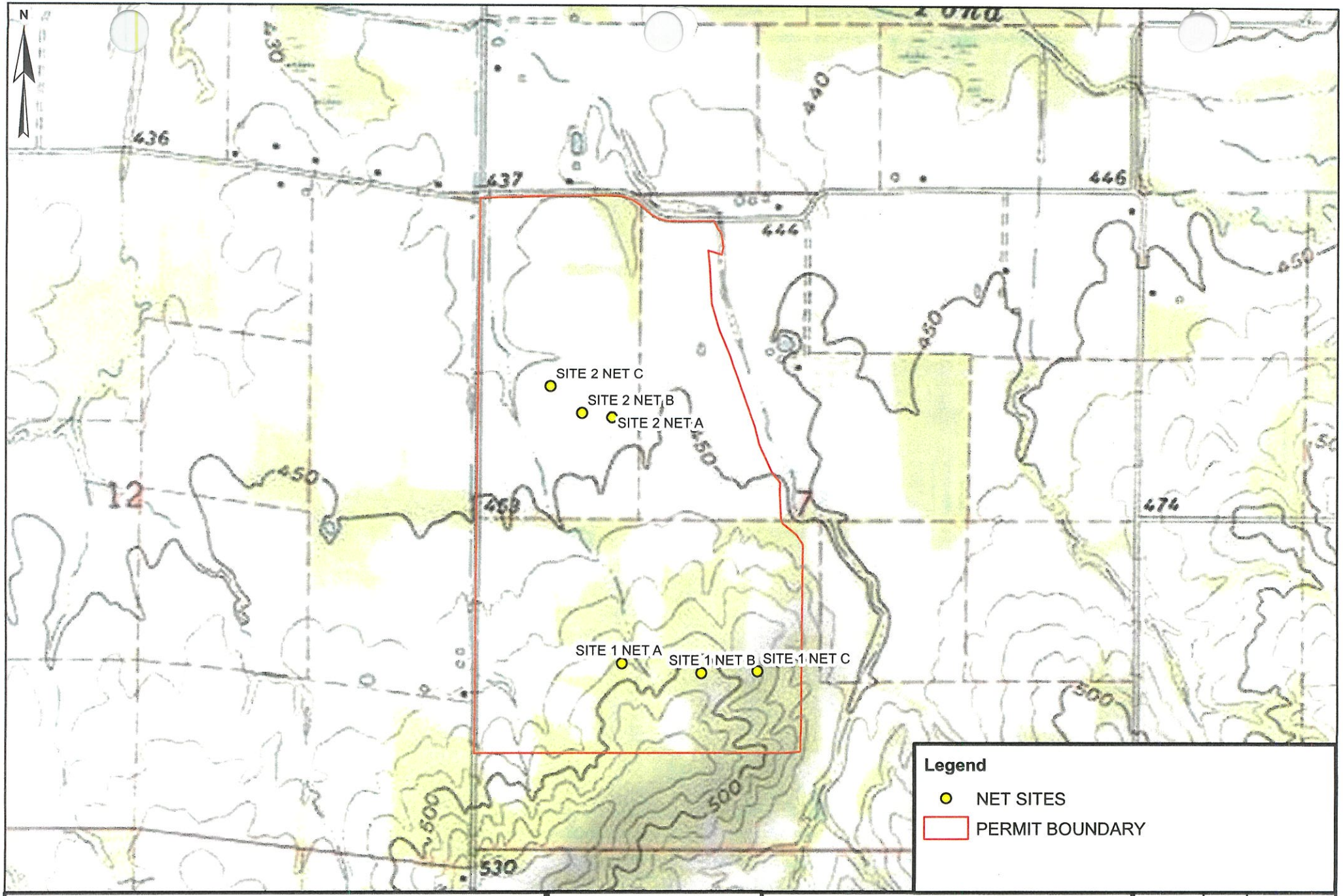
MIST NET LOCATION MAP

EAST OF DWINA
BAT SURVEY
PREPARED FOR
SUGAR CAMP ENERGY, LLC
P.O. BOX 357
JOHNSTON CITY, IL 62951

DRAWN BY	HD	8/12/14
CHECKED BY	BAH	8/12/14
APPROVED BY		

DRAWING NUMBER
B14-445-A2

R009952



REFERENCE:

ArcGIS map service, USA topo maps (USGS topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

1 inch = 1,000 feet

0 500 1,000 2,000 3,000 Feet

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

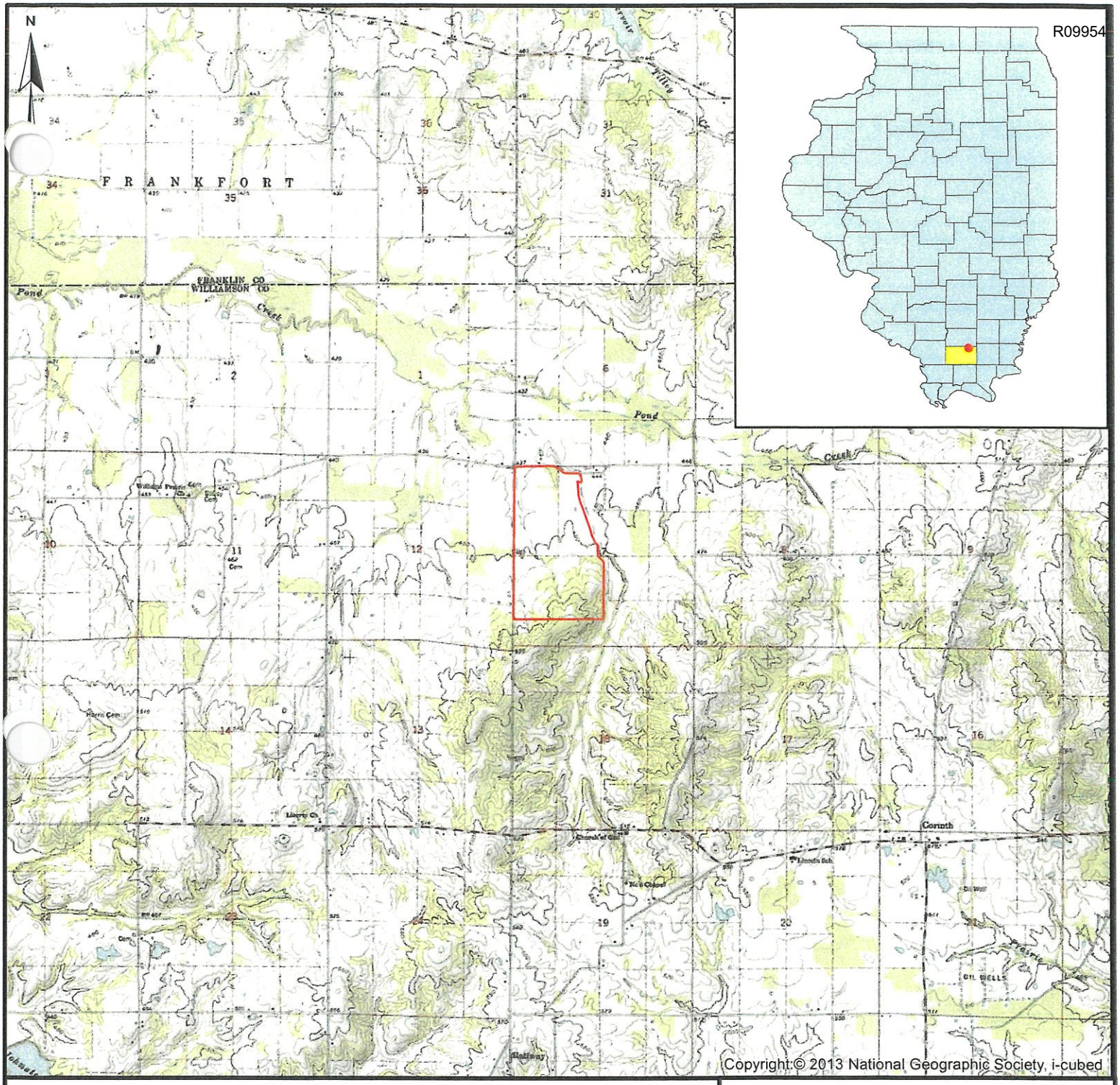
PROJECT TOPOGRAPHIC MAP

EAST OF DWINA
BAT SURVEY
PREPARED FOR
SUGAR CAMP ENERGY, LLC
P.O. BOX 357
JOHNSTON CITY, IL 62951

DRAWN BY	HD	8/12/14
CHECKED BY	BAH	8/12/14
APPROVED BY		

DRAWING NUMBER
B14-445-A3

RECEIVED 2014 DEC 29 P 12:53



REFERENCE:

ArcGIS map service, USA topo maps (USGS topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

0 2,000 4,000 8,000 Feet

Legend

PERMIT BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

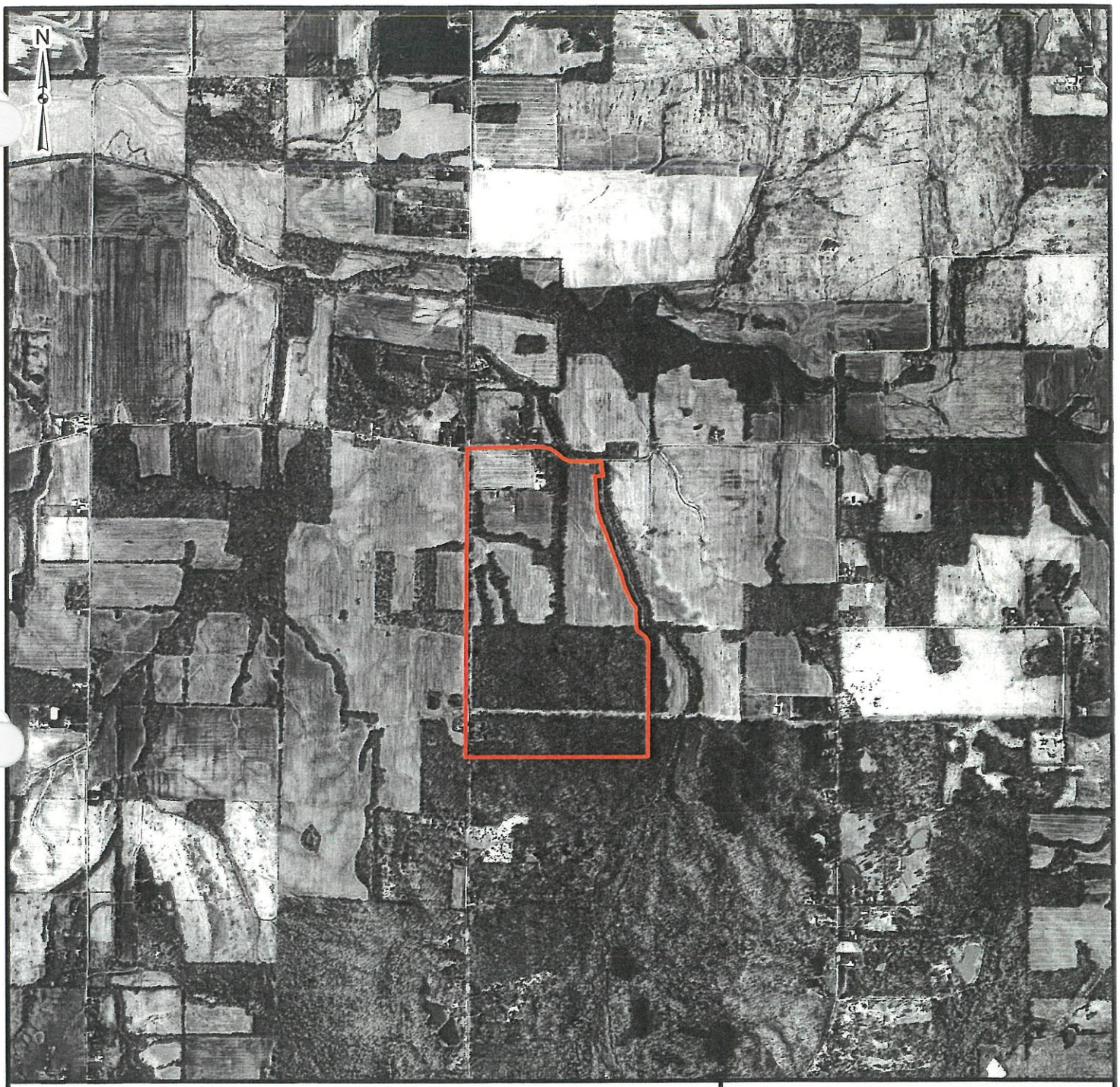
PROJECT LOCATION MAP

EAST OF DWINA
REFUSE AREA

PREPARED FOR
WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

DRAWN BY	DR	8/21/14
CHECKED BY	BH	8/21/14
APPROVED BY		

DRAWING NUMBER
B14-445-A4



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)

0 1,000 2,000 4,000 Feet

Legend

PERMIT 417 BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

AERIAL LOCATION MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A2		



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)
STREAMS FROM THE NATIONAL HYDROGRAPHY DATASET (NHD)
WETLANDS FROM THE NATIONAL WETLAND INVENTORY (NWI)

0 500 1,000 2,000 3,000 Feet

Legend

- PERMIT 417 BOUNDARY
- NHD STREAMS
- NWI WETLANDS

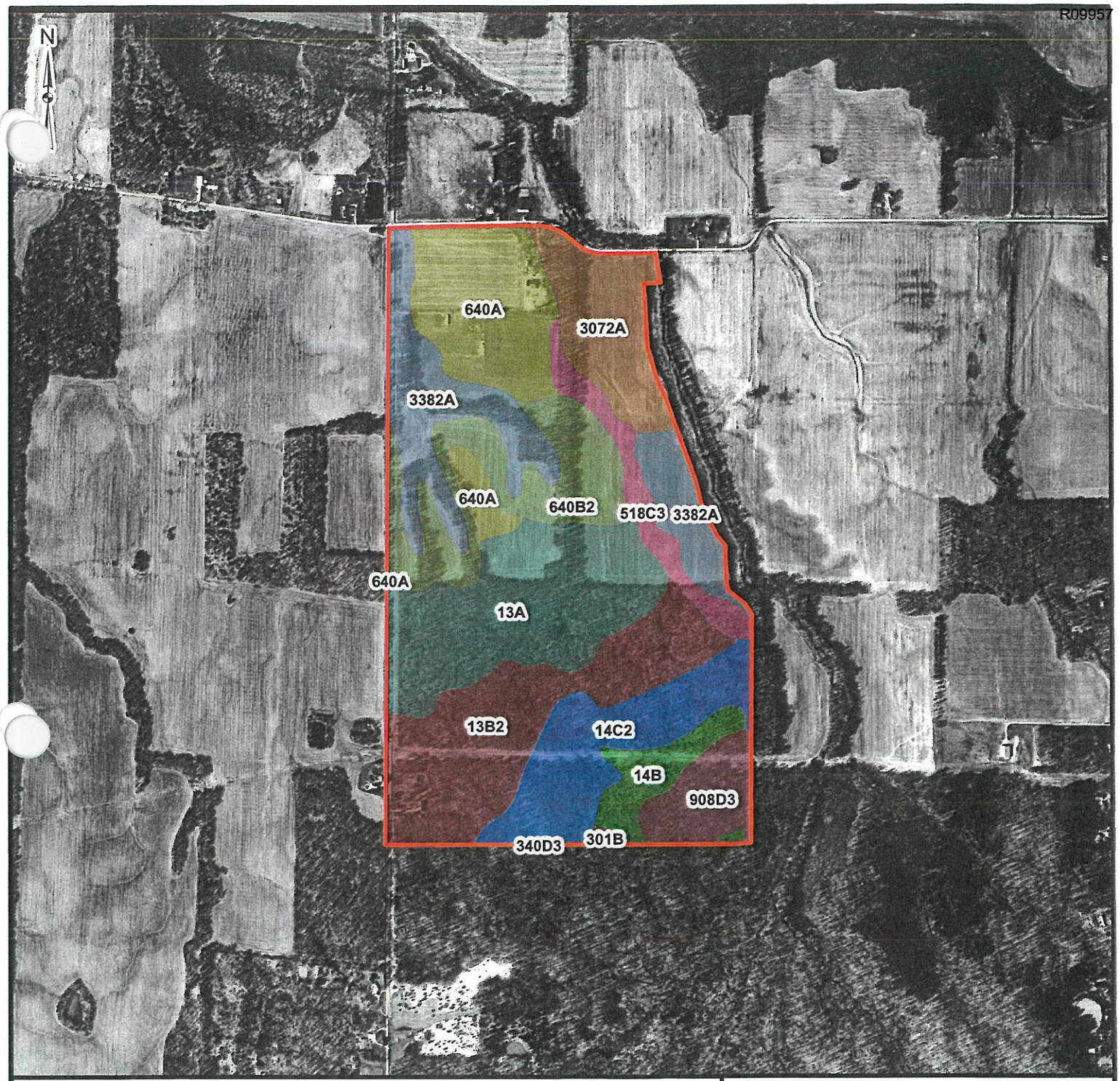
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

NATIONAL WETLAND INVENTORY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A3		

R09957



REFERENCE:

AERIAL IS A 2005 DOQQ CREATED BY THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)

0 500 1,000 2,000 3,000 Feet

Legend

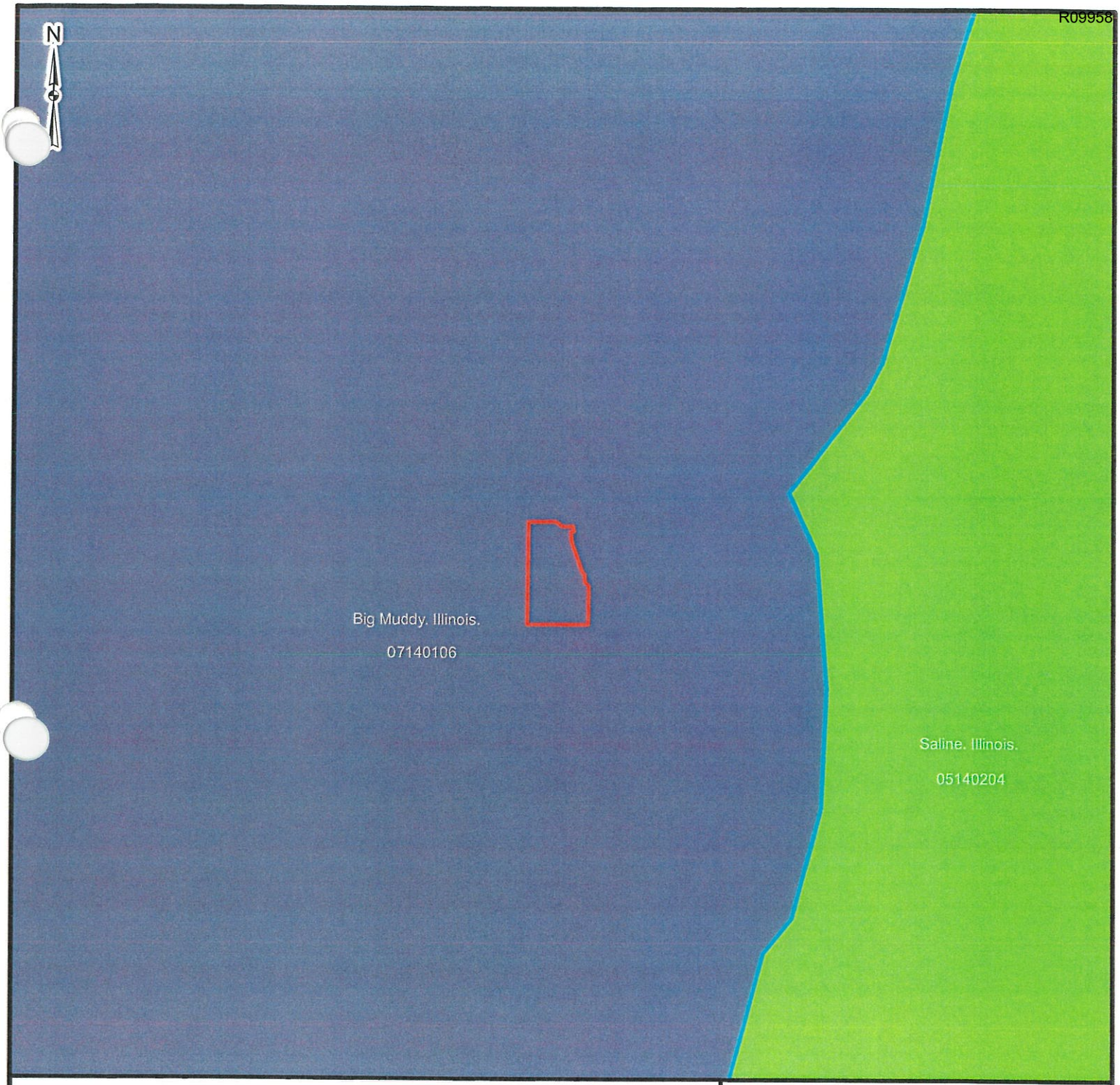
PERMIT 417 BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

SOILS MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	11/10/09
CHECKED BY	BAH	11/10/09
APPROVED BY	BAH	11/10/09
DRAWING NUMBER		FIGURE NUMBER
B08-467-A4		



REFERENCE:

8 DIGIT HYDROLOGIC UNIT CODE (HUC) OF THE BIG MUDDY AND SALINE RIVER WATERSHEDS

SCALE

0 4,000 8,000 12,000 Feet

Legend

PERMIT 417 BOUNDARY

8 DIGIT HUC

Big Muddy, Illinois

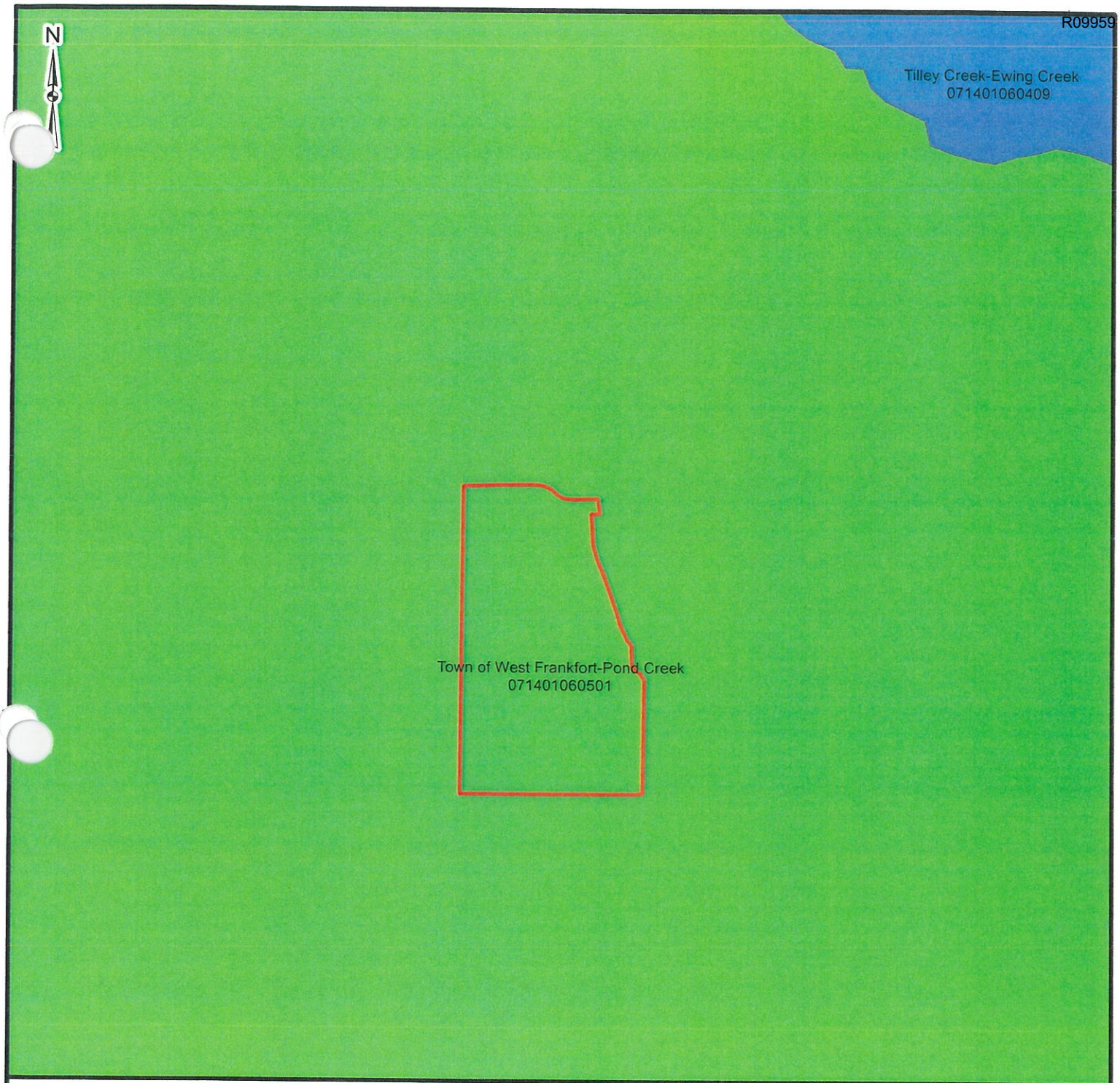
Saline, Illinois

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

8 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	03/23/11
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A6		



REFERENCE:
12 DIGIT HYDROLOGIC UNIT CODE (HUC) OF TILLEY CREEK-EWING CREEK AND TOWN OF WEST FRANKFORT-POND CREEK WATERSHEDS

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

12 DIGIT HUC

Tilley Creek-Ewing Creek

Town of West Frankfort-Pond Creek

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

12 DIGIT HUC MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A7		



REFERENCE:

PITSBURG IL., DOQQ

SCALE

0 1,000 2,000 4,000 6,000 Feet

Legend

PERMIT 417 BOUNDARY

FLOODPLAIN

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

FLOODPLAIN MAP

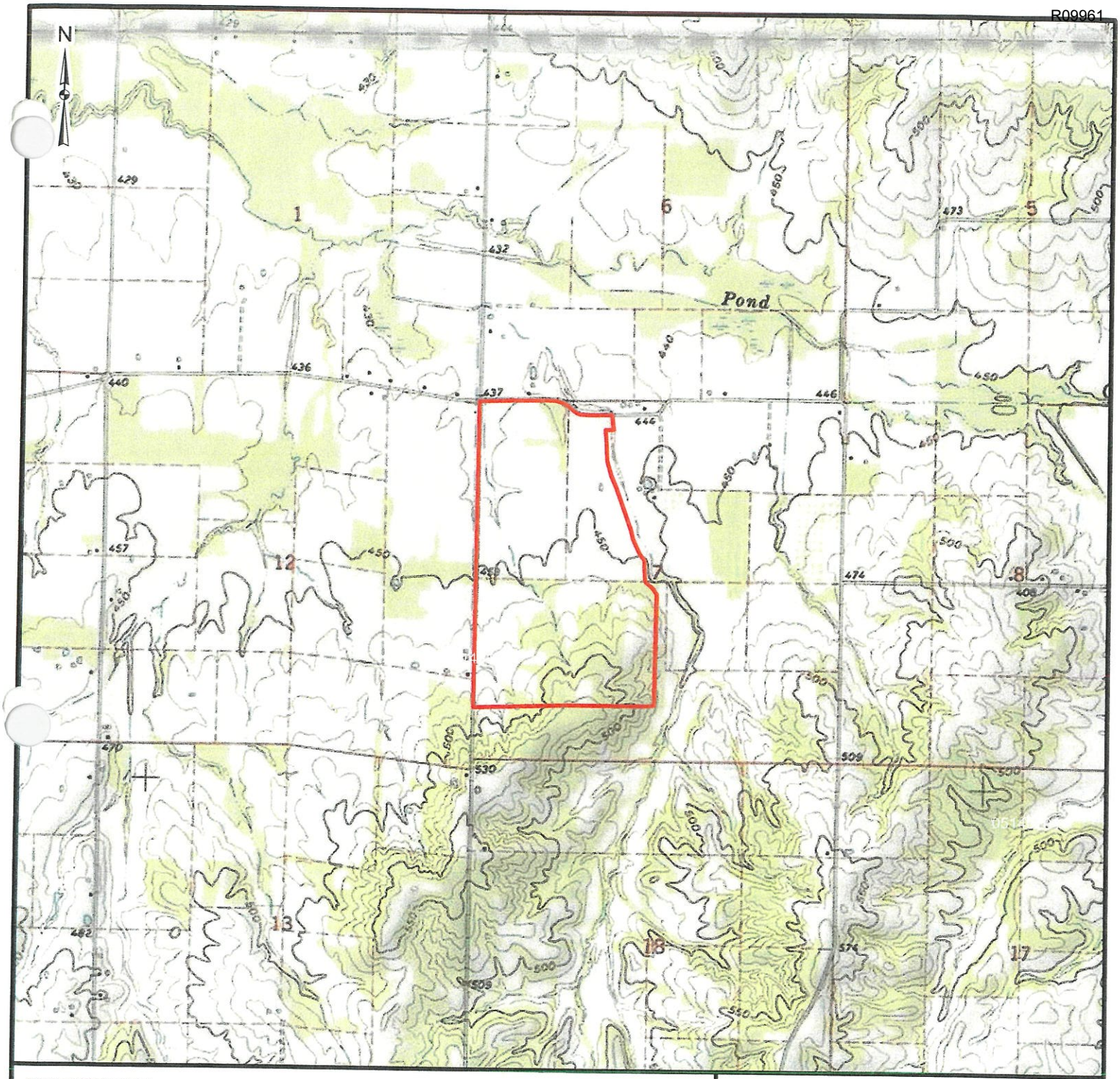
POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	MDM	02/11/10
CHECKED BY	MDM	02/11/10
APPROVED BY	TSB	02/11/10
DRAWING NUMBER		FIGURE NUMBER
B08-467-A8		

R09961



REFERENCE:

ArcGIS map service, USA topo maps (USGS 1:24,000 topographic maps)
http://goto.arcgisonline.com/maps/usa_topo_maps

0 1,000 2,000 3,000 Feet

Legend

PERMIT 417 BOUNDARY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
124 PHILPOTT LANE
BEAVER, WV 25813
(304) 255-0491

TOPO MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3
PREPARED FOR
WILLIAMSON ENERGY, LLC.
JOHNSTON CITY, ILLINOIS

DRAWN BY	ACL	11/29/11
CHECKED BY	ACL	11/29/11
APPROVED BY		
DRAWING NUMBER		FIGURE NUMBER
B08-467-A13		

3001-15
part 11

R09962

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

AUG 02 2019

REVIEWER: SAB

RESPONSE TO IDNR COMPLETENESS REVIEW DATED OCTOBER 24, 2014

PROPOSED PERMIT NO. 417

VOLUME 2 OF 2 (PROPOSED PERMIT NO. 417, PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3 - MSHA SUBMITTAL PLAN)

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B12-271-1413
NOVEMBER 2014

ENGINEERING DESIGN PLAN
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

TABLE OF CONTENTS

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: SAB

		PAGE
1.0 INTRODUCTION		1
2.0 EXISTING SITE CONDITIONS		2
2.1	Site Characteristics	2
2.2	Geology	2
3.0 MINING OPERATIONS AND COAL REFUSE PRODUCTION		2
3.1	Mining Operations	2
3.2	Coal Refuse Production	3
4.0 SUBSURFACE EXPLORATION		3
5.0 FIELD AND LABORATORY TESTING		4
5.1	Soil	4
5.2	Coarse Coal Refuse	4
5.3	Fine Coal Refuse	5
5.4	Piezo-Seismic Cone Penetration Testing	5
6.0 COAL REFUSE DISPOSAL PLAN		5
6.1	Site Preparation	6
6.2	Phase 9 Embankment	7
6.3	Phase 10 Embankment	8
6.4	Phase 8 Embankment	8
6.5	Phase 11 Embankment	8
6.6	Phase 12 Embankment	9
6.7	Abandonment Plan	10
7.0 ENGINEERING ANALYSES		11

TABLE OF CONTENTS (continued)

7.1	Hydrologic and Hydraulic Analyses	11
7.2	Slope Stability Analyses	12
8.0	SUMMARY	13
9.0	CERTIFICATION OF PLAN	14

APPENDIX A – GUIDELINE TECHNICAL SPECIFICATIONS

APPENDIX B – CALCULATION BRIEF

APPENDIX C – SOIL BORINGS AND LABORATORY TESTS

APPENDIX D – ANALYSIS OF 8 INCH GAS PIPELINE

FIGURES

LIST OF FIGURES

FIGURE NO.	DRAWING NO.	TITLE
1	B12-271-T1	Title Sheet
2	B12-271-M1	Existing Conditions Map
3	B12-271-M2	Surface Drainage Map
4	B12-271-M5	Phase 9 Plan
5	B12-271-M7	Phase 10 Plan
6	B12-271-M8	Phase 11 Plan
7	B12-271-M13	Phase 12 Plan
8	B12-271-E2	Pond No. 1 – Plan and Sections
9	B12-271-M16	Abandonment Plan
10	B12-271-M14	Section A-A
11	B12-271-M15	Section B-B
12	B12-271-M11	Slope Stability Section (C-C Through E-E)
13	B12-271-M4	Miscellaneous Details
14	B12-271-M9	Decant Installation and Uniform Section Mat Details
15	B12-271-E3	Gas Pipeline Filter Diaphragm Design
16	B12-271-B1	USBR Type VI Impact Basin Detail

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 0 2 2019
REVIEWER: SAB

ENGINEERING DESIGN PLAN
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

1.0 INTRODUCTION

Plans have been developed for the expansion of an existing coarse and fine coal refuse disposal facility, Impoundment ID No. IL 08-03141-02, located near Johnston City in Williamson County, Illinois. The proposed coal refuse disposal facility expansion will provide disposal capacity for both coarse and fine coal refuse produced by the Pond Creek #1 Mine, Federal Mine ID No. 11-03141, coal preparation plant located approximately 0.25 mile west of the proposed facility. The location of the site is just southwest of the intersection of Dwina Road and Dean Road. The facility will expand to the east of Dwina Road as shown on Figure No. 1.

The plan, as presented herein, provides for the disposal of approximately 15.3 years of coarse coal refuse and 12.0 years of fine coal refuse based on production rates provided by Williamson Energy, LLC (Williamson Energy). The facility shall be constructed in four phases of coarse coal refuse embankment construction and concurrently with Phase 8 as previously proposed[1]. At the beginning of construction of the proposed phase, fine coal refuse shall be disposed in the existing phases of the impoundment[1] Impoundment ID No. IL08-03141-02 (Phases 2A, 5A, and 7).

The proposed facility has been designed as a high hazard impoundment using the Probable Maximum Flood (PMF) storm event. The facility has been designed to be capable of storing the runoff associated with the design storm event. The stored runoff volume, as well as operational water, shall be evacuated using pumps with an independent power source throughout construction of proposed Phases 9, 10, and 11 and until the decant pipe for Phase 12 has been installed and becomes active.

Proposed and existing combination, sedimentation, and perimeter ditches, access road gutters and bench gutters will be used to convey storm runoff away from the embankment in a controlled manner. The ditches have been designed for routing the runoff associated with the 100-year, 6-hour recurrence interval storm event. A proposed sedimentation pond will be constructed north of the proposed impoundment.

This report presents the design drawings, Guideline Technical Specifications (Appendix A), Calculations (Appendix B), Soil Borings and Laboratory Tests (Appendix C), and Analysis of 8-inch Gas Line (Appendix D) necessary for the design and construction of the embankment.

---

[1] Alliance Consulting, Inc. report entitled "Plan Modification Mach #1 Mine, Coal Refuse Disposal Facility No. 2, Phases 2A, 5A, 7, and 8, Impoundment ID No. IL08-3141-02" prepared for Mach Mining, LLC, Johnston City, Illinois, dated October 2011.

2.0 EXISTING SITE CONDITIONS

2.1 Site Characteristics

The general area of the proposed impoundment has previously been used for agricultural purposes and has relatively flat to mild slopes to the ridgeline at approximate Elevation 572. The surrounding landscape is characterized by extensive agricultural and rural residential land use. Regionally, the proposed permit area is located on the southern shelf of the Illinois Basin in the Mt. Vernon Hill Country physiographic division. Surrounding landforms are the results of both Wisconsinian glaciations and normal degradation processes such as weathering, mass wasting, and stream erosion. Surrounding topography is characterized by generally flat ridge tops, moderately steep hill slopes and broad flat valley floors associated with major streams. The local drainage pattern is dendritic reflecting the regional generally horizontal bedrock stratigraphy. The total relief of the facilities footprint is approximately 32 feet ranging from approximately 436' to 468' above mean seal level (based on aerial photography).

Glacial deposits of the Carmi Member of the Equality Formation, consisting of quiet water lake silt and clay, constituted the original surface materials within the proposed permit area.

2.2 Geology

The proposed permit area is underlain by lower Pennsylvanian age rocks consisting of shale, sandstone, and siltstone with minor underclay, coal and limestone. These sequences reflect fluctuating shorelines, deltas, and shallow seas indicating deltaic, fluvial, and coal swamp depositional environments. These bedrock units can be highly variable in thickness and continuity. Mississippian rocks unconformably underlie the Pennsylvanian, however, they do not outcrop in the subject area and were not penetrated during exploration drilling.

The major stratigraphic marker is the Herrin No. 6 coal which is generally uniform and continuous in the subject area and occurs at approximate Elevation 10 beneath the proposed refuse disposal facility. Shale and sandstone units in the subject area exhibit a high degree of lateral facies changes and interbedding. The Herrin No. 6 seam is described as a normal bright-banded coal with a lower portion that contains a prominent claystone parting. The base of the Herrin No. 6 exhibits an undulating surface with a general structural trend toward the north-northeast dipping approximately 60 feet per mile. No major faults or other structural anomalies are known to be present within the proposed permit.

3.0 MINING OPERATIONS

3.1 Mining Operations

The Herrin No. 6 coal seam (average Elevation 10 feet above mean sea level) has been mined by both longwall and conventional mining techniques beneath the footprint area of the proposed facility. No proposed underlying mining will occur during or after construction of the proposed phases, therefore, the majority of subsidence has already occurred and is not expected to impact construction of the new phases.

Concerning breakthrough potential, the Bureau of Mines Information Circular 8741 recommends an overburden thickness equal to 60 times the extraction height for total extraction mining. The lowest level of the subsided pool area is approximately Elevation 420, and the bottom of coal seam is at average Elevation 10 feet with an extraction height of 6.5 feet. Therefore, the existing overburden thickness is greater than the recommended thickness and there is no significant potential for a catastrophic breakthrough of fine coal refuse slurry into the mine to occur.

Concerning the 8-inch gas pipeline, the previous mining induced a stress in areas of the pipeline due to subsidence. The analysis of the pipeline (Appendix D) was conducted by Kiefner and Associates, Inc. to ensure the impacts from subsidence, and the proposed overburden will not exceed the allowable stress limits of the pipeline.

Based on these conditions and recommended guidelines, it is expected that no adverse effects shall impact the stability or breakthrough potential of the impoundments.

3.2 Coal Refuse Production

Based on current plant operation information provided by Williamson Energy Mining, the following annual production quantities were used in the design (see Calculations in Appendix B).

- Coarse Coal Refuse 2,568,200 cubic yards/year
- Fine Coal Refuse 2,064,400 cubic yards/year

4.0 SUBSURFACE EXPLORATION

During the month of July 2012, a new subsurface exploration program was conducted within the footprint of the proposed East of Dwina embankment. The intent of the program was to obtain soil samples to define the conditions and engineering characteristics relative to the construction and operation of the fine coal refuse slurry disposal impoundment. The soil borings and laboratory test results report can be found in Appendix C. In addition to the new soil borings, the results of a previous subsurface exploration program performed by Holcomb Foundation Engineering Co. (Holcomb) indicate the following:

- Sample number, type, standard penetration test blow counts, and depth;
- An overall description of the consistency, color and character of the soil; and,
- Indication of the observed groundwater level in the boreholes at the time of drilling.

Generally, the soils encountered beneath the dam footprint consist of brown and gray silty clay with sand and pebbles. The thickness of the soil varied from 11' to 70' while the surface elevation for the borings varied from Elevation 440.0± to Elevation 488.0±. Each of the borings was terminated at the top of the bedrock.

Groundwater was encountered in one (1) of the twenty-two (22) borings (i.e. No. D2). Following drilling, the depth from the ground surface to groundwater level varied from 8 to 25 feet or from Elevation 415.0± to Elevation 480.0± in the borings.

5.0 FIELD AND LABORATORY TESTING

5.1 Soil

Samples of the soils obtained during the subsurface exploration program from Boring Nos. D1 and D2 were used for laboratory testing. The scope of the testing is discussed below.

Visual classification tests were performed by Holcomb on the split spoon samples obtained during drilling. Samples from the borings represent the foundation conditions for the proposed embankment. Additional testing performed on the borings included the following:

- Atterberg Limits Test – Atterberg Limits tests were performed on a sample from Boring Nos. D1 and D2.
- Consolidation Test – A consolidation test was performed on Boring No. D1.
- Shear Strength Test – A consolidated, undrained triaxial shear strength test with pore pressure measurements was performed on a Shelby tube sample from Boring Nos. D1 and D2.

5.2 Coarse Coal Refuse

The proposed embankment shall be constructed with coarse coal refuse. The coarse coal refuse used to construct the embankment has previously been sampled from the Pond Creek #1 Mine coal processing plant for baseline laboratory testing. The scope of the testing is discussed below.

- Grain Size Analysis – A grain size analysis was performed on the coarse coal refuse sample.
- Shear Strength Test – A consolidated, undrained triaxial shear strength test with pore pressure measurements was performed on re-molded samples of the coarse coal refuse. Material from the sample was re-molded to a density equivalent to approximately 95 percent of Standard Proctor maximum dry density.
- Permeability – A constant head permeability test was performed on a re-molded sample to determine the permeability characteristics of the coarse coal refuse for the embankment construction. The sample was compacted to approximately 95 percent of the Standard Proctor maximum dry density.
- Compaction Test – A Standard Proctor compaction test was performed on the coarse coal refuse sample.

A grain size analysis, moisture content and compaction testing are tested monthly to verify the properties of the coarse coal refuse.



5.3 Fine Coal Refuse

Two fine coal refuse bulk samples were obtained from the South Pond (Phase 2) for laboratory testing. The scope of the testing is discussed below and the results are presented in Appendix I[2] (under separate cover).

- Moisture Content – Moisture contents were performed on the two fine coal refuse samples.
- Grain-size Analysis – Grain size distribution analysis was performed on the two fine coal refuse samples (sieve and hydrometer).
- Atterburg Limits – Atterberg Limit tests were performed on the two fine coal refuse samples.
- Specific Gravity – Specific gravity tests were performed on the two fine coal refuse samples.
- Shear Strength – Six consolidated – undrained triaxial tests were run on remolded fine coal refuse samples. These six tests included moisture content and total and dry density determinations.

5.4 Piezo-Seismic Cone Penetration Testing

- Fifteen piezo-seismic cone penetration soundings were performed at the Pond Creek site to measure tip stress, sleeve stress, pore water pressure, and shear wave velocities. The testing was used to correlate index and strength parameters for the coarse coal refuse and foundation soil and for use in a deformation analysis.
- The testing data and results are presented in Appendix I[2] (under separate cover).

6.0 COAL REFUSE DISPOSAL PLAN

The proposed plan provides disposal capacity for approximately 15.3 years of coarse and 12.0 years of fine coal refuse production beyond the currently approved Phase 2A, 5A, and 7 plan[1]. The plan has been developed in accordance with prudent engineering principles and practices and current Mine Safety and Health Administration (MSHA) design criteria for coal refuse disposal facilities. It is intended that the construction of the facility be monitored by experienced persons knowledgeable of the design, specifications and regulatory requirements.
A brief description of the disposal plan is as follows:

1. Sedimentation control for the construction of the embankment shall be provided by existing and proposed sedimentation ponds and ditches. Bench gutters and conveyance ditches shall be constructed to route the runoff from the embankment area to the sedimentation ditches.

[2]GAI Consulting, Inc. report entitled "Response to MSHA Comment Nos. 1, 3, 7 and 8, Pond Creek Mine No. 1, Coal Refuse Disposal Facility No. 2, Phases 3 and 7, Impoundment ID No. 1211-IL08-03141-02, Williamson Energy, LLC, Mach Mining Company, Williamson County, Illinois," prepared for Alliance Consulting, Inc. Project C090403.01, May 2009.

2. The proposed impoundment will be constructed to the east of the existing facility and match the constructed embankment levels of the existing Phases. Phase 8, as previously proposed[1], will be constructed concurrently with the proposed phases to raise the entire crest of existing Phases 2A, 5A, and 7. The order of construction and timing plan are detailed in Appendix B.

3. Fine coal refuse slurry will continue to be pumped into the Phase 2A and 5A impoundments upon commencement of construction. The discharge line(s) shall be moved to result in a relatively uniform surface of fines throughout the impoundment and to minimize the depth of any water impounded directly against the embankment slope. Generally, a delta of fine coal refuse shall be maintained along the embankment slope.

4. Operational pump(s) and discharge line(s) shall be maintained to remove clarified water and normal rainfall from the impoundment. The facility has been designed to store the runoff associated with a PMF design storm event. A decant pipe has been specified to evacuate the design storm runoff for Phase 12 after the crest elevation reaches 626. Additional pumps with independent power supplies (diesel motors or generators) will be kept on site and used to evacuate storm water for all phases until final dam crest elevation is reached, and the decant is operational.

5. An internal drainage system located within the embankment shall be installed to aid in controlling the phreatic level within the embankment. Animal guards shall be installed on all internal drain outlets to prevent vector infiltration.

6.1 Site Preparation

Prior to embankment construction, Williamson Energy will begin preparing the ground surface. These items include clearing the site, stripping topsoil, compaction of a clay liner, construction of a sediment ditch and sediment control pond, abandonment of roadway, and excavation of an incised starter cell. Pertinent construction items include:

1. Preparation of the Disposal Area – Prior to construction, the site will be cleared, grubbed, and graded. Topsoil will be removed and stockpiled for reclamation use at abandonment. A four foot compacted clay liner will be prepared beneath all areas of the facility and associated drainage structures before embankment construction can begin. Information pertaining to preparing the embankment surface can be found in the Guideline Technical Specifications (Appendix A). Temporary sediment control structures, such as silt fencing, straw bales, etc. shall be used until the permanent sediment control structures are installed.

2. Sediment Control Structures – During site preparation, a sediment/perimeter ditch and sediment control pond will be constructed at the location shown on Figure No. 3 to control runoff of the proposed impoundment. These structures have been sized in accordance with the guidelines of the Illinois Department of Natural Resources. Details of the sediment control structures can be found on Figure Nos. 8, 13, and 14.

3. Incised Starter Cell – An incised starter cell will be excavated during site preparation. The cell shall have a four foot compacted clay liner base. The cell will provide an additional 200,000 cubic yards of fines disposal. The incised cell is shown at Figure No. 4.

4. Roadway Abandonment – Williamson Energy has secured the right to abandon a section of Dwina Road. Prior to embankment construction, sections of the road that underlay the embankment shall be removed and re-compacted.

6.2 Phase 9 Embankment

The Phase 9 embankment will be built adjacent to existing Facility No. 2 to elevation 500. The embankment shall be constructed using coarse coal refuse from the Pond Creek #1 Mine preparation plant. The location of the embankment is shown in plan on Figure No. 4 and cross section of Figure Nos. 10 and 11, and requires approximately 1.24 years of coarse coal refuse production to construct. Pertinent construction items include:

1. Coarse Coal Refuse Disposal – Phase 9 involves constructing an embankment to Elevation 500 using coarse coal refuse. The upstream and downstream slopes of the embankment shall be constructed on a grade of 3H:1V. Embankment material shall be compacted to 95 percent of Standard Proctor maximum dry density. Prior to construction, the paved surface of Dwina Road that will underlay the embankment shall be removed and soil recompacted. Williamson Energy has secured the right to abandon this section of public roadway.

2. Fine Coal Refuse Disposal – Fine coal refuse slurry will continue to be pumped into the Phase 2A, 5A, and 7 impoundments until the maximum fines level is reached, as outlined in the approved plan[1]. The Phase 9 embankment must be constructed to a minimum elevation of 461.4 at that time to maintain control of the design storm. Periodic relocation of the slurry discharge line shall be performed to promote a more uniform distribution of the fine coal refuse and to minimize the depth of clarified water impounded directly against the embankment slope.

3. Pump Installation – An operational pump, of sufficient capacity to remove clarified water and normal precipitation, and associated discharge lines shall be used during construction. The pumps shall discharge into proposed Pond No. 1. Additional pumps will be kept available on site to evacuate 90 percent of the design storm in 10 days or less.

4. Surface Drainage –Bench gutters shall be constructed as shown on Figure No. 4, to collect and convey surface water runoff to the flumes. Temporary flumes shall be constructed to convey flow from bench gutters. Ditch details are presented on Figure No. 13.

6.3 Phase 10 Embankment

Phase 10 is a downstream embankment that will raise the Phase 9 crest from Elevation 500 to Elevation 538 and match the Phase 5A and 7 crests. The location of the embankment is shown in plan on Figure No. 5 and cross section of Figure Nos. 10 and 11, and requires approximately 0.92 years of coarse coal refuse production to construct. Pertinent construction items include:

1. Coarse Coal Refuse Disposal – Phase 10 involves constructing a downstream embankment to Elevation 538 using coarse coal refuse. The upstream and downstream slopes of the embankment shall be constructed on a grade of 3H:1V. Embankment material shall be compacted to 95 percent of Standard Proctor maximum dry density. Prior to construction, the any additional paved surface of Dwina Road that will underlay the embankment shall be removed and recompacted.

2. Fine Coal Refuse Disposal – Fine coal refuse slurry will continue to be pumped into the East of Dwina impoundment. Periodic relocation of the slurry discharge line shall be performed to promote a more uniform distribution of the fine coal refuse and to minimize the depth of clarified water impounded directly against the embankment slope.

3. Surface Drainage –Bench gutters shall be constructed as shown on Figure No. 5, to collect and convey surface water runoff to the flumes. Temporary flumes will be constructed to convey flow from benches to the sediment ditches. Ditch details are presented on Figure No. 13.

4. Pump Installation – An operational pump, of sufficient capacity to remove clarified water and normal precipitation, and associated discharge lines shall be used during construction. The pumps shall discharge into proposed Pond No. 1. Additional pumps will be kept available on site to evacuate 90 percent of the design storm in 10 days or less.

6.4 Phase 8 Embankment

Phase 8 is an upstream stage approved under separate cover[1], which is shown in plan on Figure No. 6, and cross section on Figure No. 11, requires approximately 2.32 years of coarse coal refuse production to construct. Phase 8 will raise the Phase 2A, 5A, and 7 crests 50 feet from Elevation 538 to Elevation 588. Phase 8 shall be constructed in accordance with the approved plan[1]. During construction fines will be disposed in the Phase 9/10 cell.

6.5 Phase 11 Embankment

Phase 11 is a downstream embankment that will raise the Phase 10 embankment to elevation 588 and match the Phase 8 crest. The location of the embankment is shown in plan on Figure No. 6 and cross section of Figure Nos. 10 and 11, and requires approximately 4.44 years of coarse coal refuse production to construct. Pertinent construction items include:

1. Coarse Coal Refuse Disposal – Phase 11 involves constructing an embankment to Elevation 588 using coarse coal refuse. The upstream and downstream slopes of the embankment shall be constructed on a grade of 3H:1V. Embankment material shall be compacted to 95 percent of Standard Proctor maximum dry density. Prior to construction, any remaining paved surface of Dwina Road that will underlay the embankment shall be removed and recompacted. The Phase 11 embankment should first be constructed to elevation 549 to ensure there will be storage available to continue fines disposal during construction, and as outlined in Appendix B. Phase 11 will then be constructed to final elevation 588.

2. Fine Coal Refuse Disposal – Fine coal refuse slurry will continue to be pumped into the Phase 9/10 impoundments until the maximum fines level is reached, at which time fines disposal in the Phase 8 will begin. Fines disposal will continue in Phase 8 until the maximum fines level is reached. At that time fines disposal will resume in the Phase 9/10 impoundment. To maintain control of the design storm, the embankment must be constructed to Elevation 549 at that time. Periodic relocation of the slurry discharge line shall be performed to promote a more uniform distribution of the fine coal refuse and to minimize the depth of clarified water impounded directly against the embankment slope.

3. Filter Diaphragm – A filter diaphragm shall be installed on the existing 8" gas pipeline prior to embankment construction at the location shown on Figure No. 6. Details for the filter may be found on Figure No. 15.

4. Pump Installation – An operational pump, of sufficient capacity to remove clarified water and normal precipitation, and associated discharge lines shall be used during construction. The pumps shall discharge into proposed Pond No. 1. Additional pumps will be kept available on site to evacuate 90 percent of the design storm in 10 days or less.

5. Surface Drainage –Bench gutters shall be constructed as shown on Figure No. 6, to collect and convey surface water runoff to the flumes. Flume Nos. 3, 4, 5, and 6 will be constructed as shown to convey flow from the benches. Ditch details are presented on Figure No. 13.

6. Instrumentation – Piezometer Nos. P-29 through P-48 shall be installed during Phase 11 construction at the locations shown on Figure No. 6. The proposed piezometer tip elevations are presented on Figure No. 12 and the piezometer installation detail is presented on Figure No.13.

6.6 Phase 12 Embankment

The Phase 12 embankment will raise the Phase 11 embankment to elevation 626. The upstream embankment shall be constructed using coarse coal refuse from the Pond Creek #1 Mine preparation plant. The location of the embankment is shown in plan on Figure No. 7 and cross section of Figure Nos. 10 and 11, and requires approximately 1.51 years of coarse coal refuse production to construct. Safety precautions and safe working practices for upstream construction



can be found in Appendix A. However, prior to Phase 12 construction, it its recommended that Williamson Energy, LLC should construct the Phase 8 abandonment cap as outlined in Section 6.7 and Appendix B. Pertinent construction items include:

1. Coarse Coal Refuse Disposal – Phase 12 involves constructing an upstream embankment to Elevation 626 using coarse coal refuse. The upstream and downstream slopes of the embankment shall be constructed on a grade of 3H:1V. Embankment material shall be compacted to 95 percent of Standard Proctor maximum dry density.

2. Fine Coal Refuse Disposal – Fine coal refuse slurry will continue to be pumped into the impoundments until the maximum fines level is reached, at which time fines disposal in the Phase 8 will begin. Periodic relocation of the slurry discharge line shall be performed to promote a more uniform distribution of the fine coal refuse and to minimize the depth of clarified water impounded directly against the embankment slope.

3. Surface Drainage –Bench gutters shall be constructed as shown on Figure No. 7, to collect and convey surface water runoff to the flumes. Drainage details are presented on Figure No. 13.

4. Instrumentation – Piezometer Nos. P-49 through P-54 shall be installed during Phase 12 construction at the locations shown on Figure No. 9. The proposed piezometer tip elevations are presented on Figure No. 12 and the piezometer installation detail is presented on Figure No. 13.

5. Decant Pipe - Construction of the decant pipe shall be performed concurrent with the construction of the Phase 12 embankment. The installation includes excavating a trench into the embankment and placing HDPE pipe and appurtenant structures (drop inlet, ditch, filter and drainage diaphragm and outlet drain). The drop inlet shall be extended vertically to Elevation 619.2 by adding the appropriate length of 28-inch diameter DR 17 HDPE pipe to the HDPE elbow attached to the transport section of the decant pipe. The decant pipe shall be installed in accordance with the details presented on Figure No. 13. The principle spillway/decant pipe is capable of routing the runoff from a 72-hour duration PMF rainfall with 3 feet of freeboard and evacuating greater than 90 percent in less than 10 days. Sufficient pumps shall be maintained for use to dewater the Phase 12 cell until the decant is installed and fines reach a level to activate the decant. However, if Williamson Energy, LLC elects to begin abandonment capping of the Phase 12 cell immediately after embankment construction is complete, they may choose not to install the decant, and continue to evacuate stored water by pumping.

6.7 Abandonment Plan

An abandonment grading plan has been provided on Figure No. 9. Briefly, the impounding capability shall be eliminated by filling the impoundment with coarse coal refuse. The final embankment configuration and perimeter ditch drains shall be constructed to drain as per the



lines and grades shown on Figure No. 9 and the entire site shall be soil covered and seeded in accordance with the Illinois reclamation permit. The plan shall be reevaluated prior to abandonment based on actual coal refuse production rates, existing site conditions and embankment configuration, and revised if necessary. Pertinent to construction items of the caps include:

1. Phase 8 Abandonment – Phase 8 abandonment construction shall begin after completing the Phase 11 embankment. Guidelines for safety precautions for upstream construction can be found in Appendix A. Due to the characteristics of the fine coal refuse and past capping experiences at the site, the Phase 8 abandonment cap was designed to have a planned displacement of fines from the Phase 8 cell to the Phase 11 cell. This will be done by excavating a portion of the Phase 8 crest between the cells to elevation 583, which is one foot above the fines level in the Phase 8 cell. The location of the excavation is shown on Figure No. 6. The Phase 11 fines level will be at approximate elevation 538. The excavated notch will be five feet below the crests of Phase 8 and Phase 11. Capping of Phase 8 should begin over the north side of the impoundment (old Phase 5/5A cells) and then begin along the west and south embankments of Phase 8 and progress to the east to ensure that the fines will be displaced to the Phase 11 cell. Phase 8 will require approximately 1.80 years of coarse coal refuse construction to complete.

2. Phase 12 Abandonment – It is recommended that Phase 12 abandonment begin immediately after construction of the Phase 12 embankment is complete since there will not be any cell available to transfer displaced fines. The fines level in the impoundment will be low enough to allow for displacement of fines during construction. Williamson Energy, LLC will need to investigate another option for disposal of fines at this time. Under this option, Williamson Energy should construct "rings" around the facility to the abandonment configuration approximately 100 feet wide. This method of abandonment will require approximately 3.01 years of coarse coal refuse to construct. However, Williamson Energy may choose to begin construction of the cap when the fines have reached the maximum level in the facility. Under this option, Williamson Energy should begin stockpiling coarse refuse for construction of the cap at a time when sufficient consolidation of the fine coal refuse has occurred to allow for minimal displacement to occur.

7.0 ENGINEERING ANALYSES

In support of the plan, engineering analyses included slope stability analyses and the hydrologic and hydraulic studies for the impoundment and surface drainage facilities. The calculations describing the design assumptions, methodology and results are included in Appendix B.

7.1 Hydrologic and Hydraulic Analyses

The proposed facility has been evaluated using storm criteria for high hazard dams. The impoundment shall be capable of storing the runoff associated with a PMF design storm event plus three feet of freeboard.

Evacuation of the stored water shall be accomplished by pumping for all phases up to Phase 12 until the decant pipe is active. The required pumping capacity is based on storing the runoff and evacuating 90 percent of the runoff associated with one design storm event within 10 days. Pumps with an independent power source (diesel motor or generator) and associated discharge lines and connections will be kept on site to evacuate the storage storm runoff. Required pumping capacities and existing on site capability has been defined in Appendix B.

Evacuation of the stored runoff shall be accomplished by means of a decant pipe for the Phase 12 impoundment after the final embankment crest elevation is reached. The required pipe size is based on evacuating 90% of the runoff associated with one design storm event within 10 days. The surface drainage facilities, including road and bench gutters, flumes, and perimeter Ditches PD-1 and PD-2 have been sized to convey runoff associated with the 100-year, 6-hour recurrence interval storm event. All permanent facilities have been designed with appropriate protection to minimize the potential for channel erosion. Details for the surface drainage facilities are presented on Figure Nos. 13 and 14.

7.2 Slope Stability Analyses

Slope stability analyses have been performed for the upstream and downstream slopes of the embankments using PCSTABL5, a computerized version of the modified Bishop Method of Slices, developed by Purdue University and the Indiana State Highway Commission. The critical potential failure surfaces, minimum factors of safety, and material properties used in the slope stability analyses are presented on Figure No. 12 and in the calculation brief.

Slope stability was analyzed for static loading conditions for the downstream and upstream embankment slopes. Effective properties for the coal refuse and existing soil were used. The phreatic level used in the stability analyses was based on the highest allowable level within the embankment that will create a minimum static factor of safety of 1.5. Internal drain locations were established based on top flow line calculations performed on a transformed section that would be below the maximum phreatic line used in the stability analysis for Phase 11 and 12. Phases 9 and 10 were evaluated having a top flow line based on no internal drain in use as it will not be installed until Phase 11. The transformed section was based on the horizontal permeability of the embankment material being nine times greater than the vertical permeability. The engineering properties of the embankment material were based on laboratory test results and our experience with similar materials.

A seismic stability, post-earthquake liquefaction, and permanent deformation analysis was performed by GAI Consultants, Inc. for the proposed plan. The analysis will be provided for review under separate cover.

The most critical potential long-term failure surfaces, as shown on Figure No. 12, are summarized below:

STAGE	CASE	MINIMUM STATIC F.S.
Phase 9	Downstream Upstream	1.80 1.73
Phase 10	Downstream Upstream	1.52 1.73
Phase 11	Downstream Upstream	1.60 1.84
Phase 12	Downstream Upstream	1.52 1.51

As indicated in the above table, the computed factors of safety meet the minimum requirements (1.5 for the static case).

8.0 SUMMARY

The design plans for the proposed Pond Creek #1 Mine Coal Refuse Disposal Facility No. 2 expansion are based on the subsurface exploration program, field and laboratory testing, and the engineering analyses as described.

The plan should provide disposal for approximately 15.3 years of coarse coal refuse and 12.0 years of fine coal refuse.

9.0 CERTIFICATION OF PLAN

I, Claudio E. Yon, P.E., certify[3] the plan entitled "Engineering Design Plan, Volume 2 of 2, Permit # 417, (MSHA Submittal Plan), Proposed Coal Refuse Disposal Facility No. 2, Williamson County, IL" was developed in accordance with prudent engineering principles and practices, and applicable Mine Safety and Health Administration and Illinois Department of Natural Resources design criteria.

SIGNED: _____
Claudio E. Yon, P.E.

DATE: November 14, 2014
ALLIANCE CONSULTING, INC.

[3] The term "certify," as used herein, is defined as follows: "An Engineer's certification of conditions is a declaration of professional judgment. It does not constitute a warranty or guarantee, either expressed or implied, nor does it relieve any other party of their responsibility to abide by contract documents, applicable codes, standards, regulations and ordinances."

APPENDIX A

GUIDELINE AND TECHNICAL SPECS

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

TABLE OF CONTENTS

		PAGE
INTRODUCTION		A-1
1.0 SITE PREPARATION		A-2
1.01	Surface Sealing/Proofrolling	A-2
1.02	Stripping and Topsoil Removal	A-2
1.03	Surface Sealing/Proofrolling	A-2
1.04	Subsidence Crack Repair	A-3
2.0 EMBANKMENT CONSTRUCTION		A-3
2.01	General	A-3
2.02	Gas Pipeline Filter Diaphragm	A-3
2.03	Coarse Coal Refuse Placement and Compaction	A-4
2.04	Construction Procedures	A-5
2.05	Safety Precautions and Safe Working Practices	A-6
2.06	Keying and Benching	A-7
2.07	Survey Control	A-7
2.08	Subsurface Drains	A-7
2.09	Standpipe Piezometers	A-8
2.10	Refuse Haul and Access Road Construction	A-8
2.11	Quality Control	A-9
3.0 FINE COAL REFUSE DISPOSAL		A-9
3.01	General	A-9
3.02	Clarified Water Removal	A-9
3.03	Decant Installation	A-9
3.04	Pipe Installation	A-10
3.05	Drop Inlet	A-10
3.06	Trash Rack	A-11
3.07	Filter and Drainage Diaphragm	A-11



APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
Table of Contents (Continued)

4.0 SUBSURFACE EXPLORATION A-12

4.01 General A-12
4.02 Benches and Bench Gutters A-12
4.03 Flumes A-12
4.04 Access Road Gutters A-12
4.05 Rock Riprap A-12
4.06 Uniform Section Mat A-13

5.0 REVEGETATION OF COMPLETED AREAS A-14

6.0 MONITORING AND MAINTENANCE A-14

6.01 Piezometers and Impoundment Level A-14
6.02 General Observations A-14
6.03 Upstream Construction Observations A-15
6.04 Maintenance A-15
6.05 Data Review A-16

7.0 DRAWINGS A-17

APPENDIX A

GUIDELINE TECHNICAL SPECIFICATIONS
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

INTRODUCTION

These specifications are intended to serve as guidelines for the construction of the Pond Creek No. 1 Mine Refuse Disposal Facility No. 2 to serve Williamson Energy, LLC's (Williamson Energy) coal preparation plant in Williamson County, Illinois. The information contained herein, including the accompanying drawings which illustrate the disposal plan, is sufficiently detailed to provide Williamson Energy with the technical guidance required to perform coal refuse disposal operations in a manner consistent with the design assumptions and sound engineering practice. These specifications are intended to be supplemented with periodic site visits by persons knowledgeable of the design in order to conduct inspections of the construction procedures, conduct field tests and, if necessary, obtain samples and perform laboratory testing.

The specifications have been prepared to aid Williamson Energy in the design, planning, and construction of the specific project. Its scope is limited to the project and location described herein and represents our understanding of the significant aspects relevant to the planned operations. If there are any differences in location and/or design features, the modification should be reviewed to determine if revision of conclusions or recommendations is required.

This refuse disposal plan provides for the expansion of Facility No. 2 by the construction of an incised soil starter embankment with three subsequent downstream embankment stages, and one upstream embankment stage utilizing coarse coal refuse to form an impoundment for the disposal of fine coal refuse slurry. The disposal plan for the facility will provide approximately 15.3 years of coarse and 12.0 years of fine coal refuse disposal capacity based on refuse production rates determined by Williamson Energy.

Briefly, the work items required in the coal refuse disposal plan include:

1. Site Preparation - In areas of embankment construction, the site preparation items include topsoil stripping and stockpiling and proofrolling/sealing. During the disposal operations, benching of each lift of material into existing slopes shall be required as well as scarifying previously compacted surfaces.

2. Embankment Construction – The proposed expansion plan provides for a soil starter embankment, 3 downstream coarse coal refuse embankment stages, and one upstream coarse coal refuse embankment shall be constructed to provide disposal capacity for approximately 15.3 years of coarse coal refuse, and 12.0 years of fine coal refuse.



3. Subsurface Drainage – An internal drainage system (rock gravels, perforated pipe, and geotextile) shall be installed in the Phase 12 embankment to aid in controlling the phreatic level.

4. Fine Coal Refuse Disposal – At the beginning of construction, fine coal refuse will continue to be disposed of in the existing Phase 2A, 5A, and 7 impoundments. Fines disposal will continue as outlined in Appendix B. A water pumping system shall be used to remove excess clarified slurry water and precipitation from the impoundment.

5. Surface Drainage Facilities - To control and direct surface water runoff from the embankment, access road bench gutters, flumes, perimeter/sediment ditches and conveyance ditches shall be constructed concurrent with construction operations.

6. Abandonment – An abandonment grading plan has been provided. The plan shall be re-evaluated prior to abandonment based on actual coal refuse production rates, existing site conditions and embankment configuration, and revised if necessary.

7. Revegetation - To control erosion and provide an acceptable post mining land use, all completed embankment surfaces shall be revegetated in accordance with Williamson Energy's Mine Permit.

8. Monitoring and Maintenance - A program of regular monitoring and maintenance of the disposal operations is described herein.

1.0 SITE PREPARATION

1.01 General

Site preparation shall be required beneath all areas of the refuse disposal facility.

1.02 Stripping and Topsoil Removal

Stripping and stockpiling of topsoil and root matter are required to provide an adequate foundation for facility construction. All topsoil shall be removed prior to embankment, impoundment, and road construction. The stripped topsoil shall be stockpiled. Stockpile areas for topsoil are presented on the drawings. As areas are prepared for final reclamation, topsoil may be removed from future disposal areas and hauled directly to areas being reclaimed.

1.03 Surface Sealing/Proofrolling

The footprint of all embankment stages and the entire impoundment area shall be proofrolled following stripping and topsoil removal to seal and compact the foundation soils. A minimum of three passes shall be made over each area using a large sheepsfoot roller or rubber-tired equipment (i.e. loaded truck) to produce a minimum 95 percent of the maximum dry density attainable by the Standard Proctor method of compaction (ASTM D 698).



Before being backfilled with compacted coarse coal refuse or compacted earthfill, the surface shall be inspected to determine whether any mine spoil or excessively wet or soft soils are present at the bottom of the excavation. Any soft or wet soils shall be removed to a minimum depth of 2 feet below the previously excavated surface and replaced with coarse coal refuse. The over-excavated area shall be backfilled with silty, clayey soil, placed in 8-inch lifts, and compacted to 95 percent of the Standard Proctor maximum dry density (ASTM D 698).

1.04 Subsidence Crack Repair

All substantial subsidence effects of longwall mining underlying the proposed embankments should have previously occurred by the time construction of the proposed phases commences. Should subsidence surface cracks appear, the area shall be excavated to a depth of at least four feet, proof rolled, and backfilled and sealed with compacted coarse coal refuse placed to the compaction standard in these specifications. In the event that extensive, deep cracking is discovered, a cutoff trench will be extended to bedrock through the affected areas. The trench will be located beneath the underdrain alignment where applicable. If it is discovered that a cutoff trench needed, a specific design will be submitted for approval prior to its construction.

2.0 EMBANKMENT CONSTRUCTION

2.01 General

To provide storage capacity for approximately 15.3 years of coarse and 12.0 years of fine coal refuse, an incised soil starter embankment, 3 downstream coarse coal refuse embankment stages, and one upstream embankment stage shall be constructed as shown on the drawings.

Sediment control shall be provided by the existing/proposed ponds. Perimeter ditches shall be constructed to convey surface runoff to the sediment ponds.

2.02 Gas Pipeline Filter Diaphragm

a. General - A filter diaphragm shall be installed at the location shown on Drawing No. B12-271-M8 and in detail on Drawing No. B12-271-E3, to minimize internal erosion (piping) along the pipeline. Extreme caution should be used when working in areas of the gas pipeline.

b. Material - The diaphragm shall be constructed of crushed, hard, angular sandstone aggregate within the following gradation range and wrapped entirely in "Geotex 501" filter fabric or an equivalent approved by the Engineer.

Sieve Size	Percent Finer
1-1/2-inch	100

Sieve Size	Percent Finer
1-inch	66.7
3/8-inch	0 - 5

c. Filter and Drainage Diaphragm Outlet Drain - To convey seepage collected by the filter and drainage diaphragm to a surface drainage ditch, an outlet drain shall be constructed, as shown on B12-271-M8. The drain shall be constructed in accordance with the detail presented on Drawing No. B12-271-E3.

Gradation testing shall be performed on compacted samples of the coarse coal refuse and gravel prior to installation of the filter drainage diaphragm to verify the parameters used in the design of the diaphragm.

2.03 Coarse Coal Refuse Placement and Compaction

a. Lines and Grades – Coarse coal refuse shall be placed to the lines and grades shown on the drawings for the various stages. Control for placement can be established from the coordinate system provided on the drawing.

b. Material – Run-of-plant coarse coal refuse shall be spread in lifts not more than one foot thick when compacted. Material that is too wet to be properly compacted shall be spread and graded to facilitate drainage. Upon drying to within the acceptable moisture content range, compaction may proceed.

c. Placement and Compaction – The placement and compaction of the soil shall be in accordance with the procedures for the coarse coal refuse discussed in Section 2.03.d and 2.03.e of these guidelines technical specifications. The maximum compacted lift thickness shall not exceed 8 inches.

d. Compaction: The coarse coal refuse in the impounding embankment shall be spread in layers having a thickness of 1 foot or less. The material shall be compacted by routing heavy equipment (dozers and trucks, etc.) over it or utilizing specialized compaction equipment to attain the specified degree of compaction. No special compaction procedures are anticipated to be required to provide resulting densities which are consistent with those used in the design. A field density testing program shall be conducted during the placement operations to determine the actual dry density being achieved. A compacted dry density of at least 95 percent of the maximum dry density achieved with a Standard Proctor test (ASTM D 698) shall be required for all coarse coal refuse placed within the impounding embankment.

Field density testing of the foundation soil and coarse coal refuse placed in the embankment areas shall be performed to confirm that the compactive effort employed is yielding an in-place dry density of at least 95 percent of the maximum density obtainable by the Standard Proctor Compaction Method (ASTM D698). Density testing shall be performed at equivalent frequencies of one test per 2,000 cubic yards of material placed and compacted and at least one



test for each lift. Locations, elevations, and dates of the tests shall be recorded and maintained for documentation purposes. The moisture at time of compaction shall be within the range of optimum moisture by -2 percent to +3 percent. If in-place dry densities are observed to be less than that required, additional compaction shall be performed on the effective test area and the area retested. Such work shall continue until satisfactory results are obtained.

At least one Standard Proctor test of the material shall be verified for every 20 field density tests performed. Additionally, should mining or preparation plant operations change such that a change in refuse material properties is anticipated, the Proctor shall be verified.

2.04 Construction Procedures

The work surface shall be advanced upward in nearly horizontal layers. To minimize penetration of precipitation, the work surface shall be sloped and backbladed as the material is spread. No fill shall be placed on frozen material. If the surface where fill is to be placed is frozen, the frozen material shall be removed over an area where one day's refuse will be placed prior to placement of a new lift. The frozen material shall be stored until it is thawed and then replaced. Surface material in the impounding embankment too wet to support construction equipment shall be removed to expose drier material prior to placement of the next refuse layer. After drying, these wet materials can be reused in the embankment. As the level of the embankment is raised, it shall be graded smoothly to the contours shown on the plans. Additional considerations for upstream construction are as follows:

1. Alternate between upstream and downstream construction when possible to allow excess pore pressures to dissipate. The rate of placement for advancing push-out material is critical;
    - Rapid placement of push-out material during construction of the upstream push-out results in excess pore pressures.
    - Excessive pore pressure reduces the residual strength between the particles of the push-out material.
    - Loss of strength results in instability problems.
2. Pump the water level down as much as possible, for as long as possible, to expose the slurry delta, prior to initiating push-outs.
3. The initial lift shall be of sufficient thickness to support the construction equipment. Generally, the top of the initial push-out should be maintained within 5 feet of the pool level.
4. If pumping of the fill material is observed due to excess pore pressures, fill placement will halt until the excess pore pressures dissipate.
5. Spread construction out across full length or width of the push-out. Do not concentrate placement in one area.
6. Monitor Pore pressures – use pneumatic or vibrating wire piezometers.
7. A detail plan should be developed and followed for the construction of the upstream push-out. The coarse refuse placement procedures should proceed in a systematic manner.



8. All push-outs shall begin at the left or right abutment against solid ground.
9. Grade controls shall be maintained at all times.

2.05 Safety Precautions and Safe Working Practices

The following safety guidelines should be exercised regarding upstream construction:

1. Safety meetings shall be conducted and procedures discussed on a weekly basis, education and training is essential. Operators will be aware of the proper procedure for advancing the push-out.
2. All equipment operators working on or near the impoundment area shall be given additional hazard training. The safety procedures with regards to upstream construction shall be reviewed, along with all existing equipment and material handling safety policies.
3. Equipment operators shall always exercise caution during upstream construction, especially when a new push-out is started. They should be cognizant that the initial pad of a push-out will likely contain soft areas, and that differential settlement or other movements could cause the subgrade to become unstable. Accordingly, equipment operators shall continually examine the work area for unsafe conditions.
4. Oversight by knowledgeable personnel – preferably a person who is familiar with mechanics of upstream construction and can recognize and immediately have corrected unsafe work practices and conditions.
5. Use a spotter to watch for settlement cracks and slumps.
6. Use equipment operators who are experienced in this type of work. Required initial push-out lift thickness is not intuitive. Inexperienced equipment operators, especially contractors who are used to working in other settings, sometimes think thicker lifts are better, and may not understand that excessively thick lifts can result in cracking and rapid sinking of the push-out into the impoundment.
7. Equipment operators shall continually check for cracks in the push-out area. If a crack is detected, the operator will not proceed past the crack for any reason. Cracking of the push-out material is a sign of movement and potential instability. Push-out areas on the pool side on the pool of the crack shall be allowed time to settle before additional coarse coal refuse is gradually worked out over the cracked area.
8. Develop an exclusion zone for trucks, scrapers, and compactors until a firm base is established;
    - Exclusion zone 50-100 feet back from leading edge of push-out.
    - Clearly mark the zone with cones, stakes or barrels.
9. Trucks shall not travel or dump near the edge of an upstream push-out because the refuse may give way. Trucks shall dump a safe distance back from the edge and the material shall be pushed toward the pool by a dozer.
10. Use low ground pressure (LGP) track dozers.
11. Dozer operators shall not operate parallel to the edge of a push-out; dozers will always be operated perpendicular to the edge. Dozer operators must take extreme care not to get too close to the edge of the push-out.

12. Dozer tracks shall be offset when returning back to stockpile.
13. Dozers shall not contain a "submarine kit", thick break resistant windows, or brush guards over the windows.
14. Dozer operators will wear life vests during construction of initial push-out.
15. The dozer shall not push a full blade of material completely into the pool; the blade should be "double loaded". A berm of coarse refuse material, approximately 3 to 6 feet high, measured on the same plane that the dozer is pushing, shall be left in-place on the front edge of the lift leading into the pool to insure that the dozer has sufficient refuse beneath it for support. Subsequent dozer pushes into the pool shall push the existing berm into the pool, leaving a berm in its place, lessening the chance of the operator getting the dozer too close to the pool area.
16. For safety purposes, a minimum of two dozers shall be used during the construction of a push-out. The dozer operators shall sequence their push patterns, such that only one operator is near the upstream edge of the push-out during fill placement. The dozer operators shall be in visual sight of each other at all times.
17. Two way radios or similar devices shall be used by equipment operators during construction, so that if potential hazards are observed they can be quickly communicated to other operators.
18. A work skiff w/oars and life jackets is recommended (proper access and training should be provided).
19. A floatation ring attached to a rope, a throw back or other similar devise shall be maintained near the push-out area.
20. Material will only be pushed into the pool in daylight under good visibility conditions.

2.06 Keying and Benching

To tie new coarse refuse fill adequately into the existing embankment surfaces, any previously placed coarse refuse slopes shall be benched as each lift of the new fill is placed. Tie-in construction shall extend into the previously placed embankment a minimum of 4 feet or until acceptable compacted material is encountered.

2.07 Survey Control

Survey control shall include establishment of permanent monuments outside of, but adjacent to the refuse disposal facility limits. This control shall be used for the management of day-to-day operations.

2.08 Subsurface Drains

a. General – To minimize the possible rise in the phreatic level as the impoundment level rises, internal under drains shall be installed within the embankment. The drains shall consist of an HDPE perforated pipe embedded in non-calcareous gravel wrapped entirely with geotextile. A detail for the installation can be found

on Drawing No. B12-271-M4. The approximate alignment and elevations of the drains are indicated on the drawings.

b. Rock Gravel – Competent, durable clean gravel in the size range of 3/8 to 1½ inches shall be used in the drains. The gravel shall consist of non-acid, non-toxic, non-calcareous rock that will not slake in water or degrade to soil material during the life of the facility, and which is free of coal, clay or other non-durable material.

c. Pipe – The pipe used in the internal drain shall be perforated high-density polyethylene pipe. The perforations shall be in accordance with the detail on Drawing No. B12-271-M4.

d. Filter Fabric – The filter fabric shall be "Geotex 501" manufactured by Propex Fabrics, Inc., or an approved equivalent geotextile that is ultraviolet stabilized to resist deterioration. The filter fabric shall be protected from ultraviolet exposure during storage.

e. Installation – Details pertaining to the internal drains are presented on Drawing No. B12-271-M4. As shown on the drawing, the gravel shall be wrapped entirely with filter fabric with a minimum 2-foot overlap. Perforations shall be 3/8 inch diameter holes located at the intervals shown on Drawing No. B12-271-M4.

The installation of the underdrains shall be monitored by the engineer responsible for certifying the construction of the embankment or by a qualified person designated by the engineer.

2.09 Standpipe Piezometers

Standpipe piezometers shall be installed at the locations shown on the drawings and in accordance with the detail on Drawing No. B12-271-M4. Clean concrete sand may be substituted for the pea gravel if the latter is difficult to obtain. The perforated section of the piezometer pipe shall be wrapped with filter fabric. Bentonite seals shall be placed immediately above the perforated section and just below the ground surface to isolate the piezometer tip from potential perched water tables and minimize any influence associated with surface water.

2.10 Refuse Haul and Access Road Construction

An access haul road shall be extended to refuse facility operations as shown on the drawings. Throughout each stage of construction, access roads on the refuse pile shall be constructed to provide routes for equipment hauling coarse coal refuse. Variations of road width or grade may be acceptable based upon site-specific considerations. These roads are to be located, utilized, and maintained so as to not adversely affect the integrity of the impoundment structure.

2.11 Quality Control

Field density testing of natural soil and coarse coal refuse placed in the embankment areas shall be performed to confirm that the compactive effort employed is yielding an in-place density of at least 95 percent of the maximum density obtainable by the Standard Proctor Compaction Method (ASTM D 698). Density testing shall be performed at equivalent frequencies of one test per 2,000 cubic yards of material placed and compacted and at least one test for each lift. Locations, elevations and dates of the tests shall be recorded and maintained for documentation purposes. The moisture at time of compaction shall be within the range of optimum moisture by -2 percent to +3 percent. If in-place densities are observed to be less than that required, additional compaction shall be performed on the effective test area and the area retested. Such work shall continue until satisfactory results are obtained.

3.0 FINE COAL REFUSE DISPOSAL

3.01 General

Fine coal refuse will continue to be pumped into the constructed Phase 2A, 5A, and 7 cell at the beginning of construction. Disposal of fines shall continue as outlined in Appendix B. The slurry line(s) shall be periodically moved along the embankment perimeter to maintain a relatively uniform fines level within the impoundment and to promote sealing of the coarse coal refuse in the impounding embankment, reducing seepage. Discharge shall initiate on the impoundment cell bottom and continue on fine coal refuse beaches as the slurry settles. In no case shall direct discharge onto embankment slopes be allowed.

3.02 Clarified Water Removal

Clarified water from the slurry impoundment shall be removed by a pumping system and directed into the proposed perimeter ditch system. The water level in the impoundment shall be maintained as low as practicable.

3.03 Decant Installation

a. General - To aid in maintaining a normal pool elevation in the impoundment and to provide a mechanism to evacuate stored storm runoff, an HDPE decant pipe shall be installed at the elevations shown on Drawing No. B12-271-M13, and according to the details shown on Drawing No. B12-271-M9. The decants shall discharge into a ditch that will convey flow to a bench gutter, and rout the discharge to the sediment ditches and pond.

b. Decant Pipe – The pipe used for decant construction shall be 28 inch diameter DR 17 HDPE. The pipe joints shall be welded (fused) all around and pressure tested. Pressures used for the testing shall be for the maximum anticipated static water head. The pipe shall be tested prior to backfilling to facilitate repair or welding. End caps used for the pressure testing shall be welded sufficiently to withstand the



test pressures. A pressure relief valve and pressure gauge shall be mounted on the downstream end of the pipe. The pipe shall maintain the constant test pressure for a minimum time period of two hours. No leakage is recommended, so extreme care shall be taken to account for any water added to or discharged from the pipe to maintain the specified test pressures. Records of the testing shall be maintained. Safety precautions for conducting the pressure testing shall be in accordance with current MSHA and OSHA guidelines.

3.04 Pipe Installation

a. General - The decant pipe shall be installed on an adequate foundation in a manner to minimize differential settlement and excessive seepage along the outside of the pipe. All pipe installation shall be supervised by qualified personnel familiar with the intent of the design and knowledge of proper installation procedures.

b. Alignment - The pipe shall be placed concurrent with Phase 12 construction, at the location shown on Drawing No. B12-271-M13. Compacted fill used to level the pipe subgrade and form the bedding shall be a minimum of 6 inches thick, but shall not exceed approximately 2 feet beneath the pipe invert. Compaction shall be achieved in accordance with the detail presented on Drawing No. B12-271-M9 and Section 3.04.d of these specifications.

c. Pipe Connections - To provide a water-tight seal, the joints shall be welded (fused) sufficiently to withstand the design internal water pressure (6.5 psi, minimum) without leakage.

d. Backfilling - The backfill envelope, as shown on Drawing No. B12-271-M9, shall be raised uniformly on both sides of the pipe in 6-inch thick layers (8-inch thick loose lifts) and compacted to a density greater than or equal to 100 percent Standard Proctor maximum dry density (ASTM D 698) within -2 to +3 percent of the optimum water content. The bedding material shall be shaped to embed the HDPE pipe a minimum of 4 inches. One field density test (minimum) shall be performed for every 200 cubic yards of backfill placed and compacted with at least one test per lift.

e. Materials for Backfill - Materials used for backfilling shall consist of coarse coal refuse, free of any particles larger than 3 inches in any dimension.

3.05 Drop Inlet

a. General - To facilitate the installation of the trash rack and to prevent fines from entering the decant pipe, a drop inlet fabricated out of a 28-inch diameter SDR 21 HDPE elbow shall be used for Phase 12. The elbow shall be fuse welded to the decant transport section and to the drop inlet riser.

b. Riser- The riser used to extend the drop inlets shall be 28-inch outside diameter, DR 17 HDPE pipe, flange fitted at one end to facilitate connection to the trash rack. The riser connections shall be in accordance with the manufacturer's recommendations.

3.06 Trash Rack

a. General - To prevent large particles from entering and possibly clogging the decant pipe, a trash rack design has been provided in Appendix B. The trash rack shall be bolted to the riser pipe and can be removed for extension of the decant pipe. The trash rack may be fabricated with readily available parts.

b. Material - Materials required for the trash rack include 1 inch by 1 inch by 1/8-inch angle irons, No. 4 rebar, and 1/8-inch thick steel plate. Details of the trash racks are shown on Drawing No. B12-271-M9. The trash rack shall be flange fitted and bolted to the riser flange.

c. Paint - The trash rack shall be protected with rust-resistant paint after fabrication. The trash rack shall be inspected periodically and any damage repaired accordingly.

3.07 Filter and Drainage Diaphragm

a. General - A filter diaphragm shall be installed, as shown in plan on Drawing No. B12-271-M13 and in detail on Drawing No. B12-271-M9, to minimize internal erosion (piping) along the decant.

b. Material - The diaphragm shall be constructed of crushed, hard, angular sandstone aggregate within the following gradation range and wrapped entirely in "Geotex 501" filter fabric or an equivalent approved by the Engineer.

Sieve Size	Percent Finer
1-1/2-inch	100
1-inch	66.7
3/8-inch	0-5

c. Filter and Drainage Diaphragm Outlet Drain - To convey seepage collected by the filter and drainage diaphragm to a surface drainage ditch, an outlet drain shall be constructed, as shown on Drawing No. B12-271-M13. The drain shall be constructed in accordance with the detail presented on Drawing No. B12-271-M9.

Gradation testing shall be performed on compacted samples of the coarse coal refuse and gravel prior to installation of the filter drainage diaphragm to verify the parameters used in the design of the diaphragm.



4.0 SURFACE WATER DRAINAGE FACILITIES

4.01 General

A system of perimeter/sediment ditches, benches, access road gutters and conveyance ditches (Flume Nos. 1 through 6) shall be constructed to control surface runoff and minimize erosion. All runoff collected from the embankment area will be directed toward proposed perimeter/sediment ditches located beyond the toe of the embankment slopes. The perimeter ditches convey the flow to the existing/proposed sedimentation ponds.

4.02 Benches and Bench Gutters

Benches are provided to aid in controlling runoff and slope erosion. Permanent benches shall slope at about 3 percent toward a gutter at their upstream edge and at about one percent toward the conveyance ditches where the runoff will discharge. Details for the bench gutter are shown in Drawing No. B12-271-M4. The final gutters shall be lined with soil and seeded to reduce erosion.

Benches of an interim nature during facility construction shall be maintained as described in Section 6.03 of these specifications. Care shall be taken during grading to avoid development of ponding locations or excessive gradients.

4.03 Flumes

To convey runoff from the embankment and slopes to the perimeter ditches, Flume Nos. 1 through 6 shall be constructed. The ditch locations are shown on the drawings and details presented on Drawing No. B12-271-M4 and B12-271-M9. The final ditches shall be lined with the erosion protection specified on Drawing No. B12-271-M4. Temporary flumes shall be maintained in coarse refuse and/or soil and be constructed according to the details on Drawing No. B12-271-M4. Any erosion damage sustained shall be immediately repaired.

4.04 Access Road Gutters

Surface runoff intercepted by haul roads shall be kept off the road surface and in gutters on the uphill side. The roadway shall slope toward the gutter with the gutter approximately the same gradient as the haul or access road. Permanent gutters shall be provided at abandonment with erosion protection (riprap) as shown in detail on Drawing No. B12-271-M4.

4.05 Rock Riprap

Where rock riprap protection is required in ditches and gutters because of high flow velocity, the riprap must have the following characteristics:



a. Material - Riprap shall be hard, durable cobbles and boulders of sandstone or limestone in the sizes specified on the details.

b. Size Gradation - Riprap size shall be predominantly in the range specified on Drawing No. B12-271-M4. Smaller stones and cobbles shall be used to fill the voids between larger pieces.

c. Subgrade Preparation - The riprap subgrade shall be well compacted before riprap is placed. A layer of "Geotex 501" filter fabric, or approved equivalent, shall be placed on the subgrade prior to the riprap placement.

d. Riprap Placement - Riprap shall be spread to the thickness required in a single lift.

e. Grouted Riprap - The grout shall be a sand-cement mixture, proportioned to result in a minimum 28-day compressive strength of 2000 psi. The grouted riprap lining shall be underlain by a layer of "Geotex 501" filter fabric or approved equivalent. The stones shall be placed on the prepared slope and thoroughly moistened. Any excess fines shall be sluiced to the underside of the stone blanket before grouting. The grout may be delivered to the site by any means that will assure uniformity and prevent segregation of the particles. If penetration of grout is to be obtained by gravity flow into the voids, the grout shall be spaded or rodded to completely fill the voids in the stone blanket. If pressure grouting is used, care shall be taken to avoid unseating the stones. Penetration of the grout shall be a minimum of 12 inches. For a smooth surface, grout shall fill the void spaces to within 1/2-inch of the surface. Weep holes shall be provided through the blanket. A weep hole detail is presented on Drawing No. B12-271-M9.

Grout shall be placed only when the temperature is above 35 degrees Fahrenheit and rising. It shall be protected from freezing and cured the same as for concrete. After grouting is completed, no weight shall be placed on the grouted riprap until the grout has cured properly.

4.06 Uniform Section Mat

a. Material – In lieu of riprap, permanent drainage structures with high flow velocities shall use a 4 inch thick Armorform, or equivalent, uniform section mat. The mat shall be keyed 18 inches (minimum) along both edges of the ditch and at the upstream end of each section. The mat shall be underlain with Geotex 501 filter fabric and installed in accordance with the manufacturer's recommendations. Weep holes and anchor bolts shall be provided at the intervals show and in accordance with the detail on Drawing No. B12-271-M4.

b. Grout – The grout shall be a pumpable fine aggregate concrete (structural grout) proportioned to result in a minimum 28-day compressive strength of 3000 pounds per square inch (psi). A pozzolan grade fly ash may be substituted for

up to 35 percent of the cement. Fine aggregate concrete consistency should be in the 9 – 11 second range when passed through the 3/4 inch orifice of the standard flow cone described in ASTM C-939-93. Tests utilizing a concrete slump cone are not appropriate. The grouted mat shall be protected from freezing and damage as described in Section 4.04.e above.

5.0 REVEGETATION OF COMPLETED AREAS

Revegetation of coarse coal refuse slopes can be accomplished by placing a cover of natural soil or other materials capable of supporting vegetation and subsequent planting to establish a continuous stand of vegetation. Soil cover and vegetation shall be in accordance with the Illinois reclamation permit.

6.0 MONITORING AND MAINTENANCE

6.01 Piezometers and Impoundment Level

Water level readings from the piezometers and the impoundment level shall be recorded at 7-day intervals and compared to the levels used in the design. The piezometers shall be flushed on an annual basis to ensure they are functioning properly. Should the piezometers become damaged during operations, they shall be repaired or replaced. Maximum piezometer water levels used in the design of the embankments are shown on Drawing No. B12-271-M11. The phreatic levels shown are based on an estimated maximum surface to maintain a minimum slope stability factor of 1.5 for the static condition, and 1.2 for the post-earthquake condition. Exceedance of the phreatic levels shown does not necessarily mean that the slope stability has been reduced to unacceptable levels. It does mean that maximum anticipated phreatic levels have been exceeded and that action in the form of reevaluation of the slope stability, reduction of the amount of water in the impoundment, reduction in the rate of embankment construction, installation of additional piezometers, or other remedial measures may be required.

Pneumatic or vibrating wire piezometers shall be monitored before and during construction of an upstream push-out. If unacceptable pore pressures are observed, the information shall be reported to the engineer and the operator. Equipment and personnel should be moved to another work area until the pore pressures have dissipated to an acceptable level. Results of the inspection shall be documented.

6.02 General Observations

Observations of the embankment and its appurtenant structures shall be made at 7-day intervals and immediately following any unusual events such as floods, heavy rainfalls, abnormal structural behavior, subsidence cracking, etc. Any unusual features shall be reported immediately to the engineer responsible for certifying the construction.



a. Embankment Slopes - Any irregularities such as scarps, wet areas, or vegetation disturbance shall be recorded.

b. Working Disposal Surface - Irregularities shall be recorded.

c. Access Road Gutters and Discharge Channels - General condition of channels, soil erosion adjacent to or beneath riprap and seeded slopes, blockage by debris, etc. shall be noted.

d. Vicinity of the Embankment - General conditions throughout the area of the embankment shall be observed to note any changes which could be associated with the behavior of the embankment and its foundation.

6.03 Upstream Construction Observations

Monitoring and inspection of the upstream construction area should be performed by a qualified person who is familiar with upstream construction methods and risks. Prior to and during initial push-out construction, this person should inspect the refuse embankment and the area of the upstream construction. The inspection should focus on identifying conditions that could affect the safety of the equipment operators as well as conditions that could affect the safety of the embankment. These include the following conditions:

- Development of cracks with vertical displacement or scarps in the vicinity of the push-out (the orientation and shape of the cracks may indicate shearing rather than differential settlement)
- Excessive pumping of the push-out surface
- Excessive bulging of the fine refuse delta (e.g., bulge or displacement height in excess of the push-out lift level) where work is being performed
- A situation posing a threat that the embankment could be overtopped by water or slurry
- Sudden or major subsidence of the embankment crest
- Longitudinal or transverse cracking of the embankment crest
- Major sliding/failure of upstream or downstream embankment slopes or abutment slopes adjacent to the embankments
- Unusual seepage from areas of the downstream face or from the toe of the embankment
- Unusual conditions of the embankment downstream slopes that develop during upstream construction
- Significant landslides within the impoundment area

6.04 Maintenance

The following maintenance shall be performed regularly:



a. Routine Maintenance - Maintenance, including replacement or patching of grouted riprap, regrading temporary bench and haul road gutters, backfilling of erosion rills and gullies, removal of debris from the ditches at the site, etc. shall be performed.

b. Maintenance After Unusual Meteorological Events (Heavy Precipitation Events and Floods). - The most important maintenance tasks at these times are the timely backfilling of all erosion scarps and slumps and the repair and improvement of drainage systems and riprap.

c. Maintenance After Abnormal Changes in the Behavior of the Structure - If abnormal behavior of any portion of the embankment is observed, qualified persons knowledgeable of the facility design characteristics shall be advised immediately and any recommended maintenance measures undertaken.

6.05 Data Review

All facility performance data and data obtained during periodic inspections and maintenance shall be reviewed by qualified persons knowledgeable of the facility construction and disposal requirements, including the design recommendations presented in these documents.

7.0 DRAWINGS

The following drawings shall form a part of these specifications:

FIGURE NO.	DRAWING NO.	TITLE
1	B12-271-T1	Title Sheet
2	B12-271-M1	Existing Conditions Map
3	B12-271-M2	Surface Drainage Map
4	B12-271-M5	Phase 9 Plan
5	B12-271-M7	Phase 10 Plan
6	B12-271-M8	Phase 11 Plan
7	B12-271-M13	Phase 12 Plan
8	B12-271-E2	Pond No. 1 – Plan and Sections
9	B12-271-M16	Abandonment Plan
10	B12-271-M14	Section A-A
11	B12-271-M15	Section B-B
12	B12-271-M11	Slope Stability Section (H-H Through J-J)
13	B12-271-M4	Miscellaneous Details
14	B12-271-M9	Decant Installation and Uniform Section Mat Details
15	B12-271-E3	Gas Pipeline Filter Diaphragm Design
16	B12-271-B1	USBR Type VI Impact Basin Detail

APPENDIX B

CALCULATION BRIEF

APPENDIX B

CALCULATION BRIEF
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

TABLE OF CONTENTS

TOPIC	PAGE
Production Rates	1
Excavation Volumes	2
Embankment Volumes	3
Impoundment Volumes	10
Accumulative Elevation – Area – Storage Curves	17
Embankment Construction and Fines Level Schedule	19
Surface Drainage Structures	30
Typical Bench Gutter	33
Typical Access Road Gutter	40
Pond and Sediment Ditch Capacity	47
Culvert C-1	67
Typical Perimeter Ditch	74
Temporary Conveyance Ditch	81
Typical Flume	88
USM Anchor Bolt Design	98
Internal Drainage System	100
Phreatic Level Calculations	100
Pipe Size Calculations	104
Perforations	106
Filter Fabric and Gravel	107
Structural Capacity	112
Animal Guards	116
Pump Capacity Calculations	119
Decant Pipe Design	126
Phase 12 Decant Drawdown Analysis	127
Trash Rack	152
USBR Impact Basin Design	152A
Slope Stability Analyses	153

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 8/19/2011 CHKD. BY: DATE:
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: CCR AND FCR PRODUCTION RATES

Production rates based on information provided by Mach Mining on 8/19/2011.
Clean coal production rate increased to 7 million tons/year from 6 million tons/year.
Ratios and unit weights are unchanged.

7,000,000 tons clean coal per year
Recovery ratio (clean coal / raw coal) = 55%
CCR weighs 117 PCF, FCR weighs 58 PCF
CCR to FCR ratio by weight = 3.11 : 1
CCR to FCR ratio by volume = 1.54 : 1, conservatively using 1.24 : 1
Conservatively assume CCR weighs 125 PCF, and FCR weighs 50 PCF

Total Refuse Production = 7,000,000 TPY (0.45/0.55) =	5,727,272.73 TPY
FCR Production = 5,727,272.73 TPY (1/(3.11+1)) =	1,393,497.01 TPY
CCR Production = (5,727,272.73 - 1,393,497.01) TPY =	4,333,775.71 TPY

FCR Production = 1,393,497.01 TPY (2000 lb/ton) / (50 PCF) =	55,739,880.56 CF/Yr
CCR Production = 4,333,775.71 TPY (2000 lb/ton) / (125 PCF) =	69,340,411.41 CF/Yr

Check CCR to FCR Ratio - (69,340,411.41 / 55,739,880.56) = 1.24

For timing and staging calculations (rounded to nearest 1,000 CF and 100 CY) use:

FCR Production Rate =	55,740,000 CF/Yr	=	2,064,400 CY/Yr
CCR Production Rate =	69,340,000 CF/Yr	=	2,568,200 CY/Yr

Sediment Ditch Volume Report Tue Feb 07 14:46:10 2012
Comparing Grid: //Aci-acad/caddrawings/12002/EX-GND.grd
and Grid: //Aci-acad/caddrawings/12002/SEDIMENT-DITCH.grd
Grid corner locations: 357469.33,425587.49 to 363694.33,431047.49
Grid resolution X: 1245, Y: 1092 Grid cell size X: 5.00, Y: 5.00
Area in Cut : 390,339.0 S.F., 8.96 Acres
Area in Fill: 689,560.5 S.F., 15.83 Acres
Total inclusion area: 1,079,899.5 S.F., 24.79 Acres
Cut to Fill ratio: 1.22
Average Cut Depth: 13.39 Average Fill Depth: 6.21
Max Cut Depth: 40.84 Max Fill Depth: 18.10
Cut (C.Y.) / Area (acres): 7808.43
Fill (C.Y.) / Area (acres): 6395.30
Cut volume: 5,226,644.2 C.F., 193,579.41 C.Y.
Fill volume: 4,280,752.7 C.F., 158,546.40 C.Y.

Incised Cell Excavation Volume Report Tue May 21 15:10:06 2013
Comparing Grid: //Aci-acad/caddrawings/12495/SUPPORT/EAST-EX-GND.grd
and Grid: //Aci-acad/caddrawings/12495/SUPPORT/INCISED-CELL-EXC.grd
Grid corner locations: 359676.46,425896.34 to 363776.46,431171.34
Grid resolution X: 820, Y: 1055 Grid cell size X: 5.00, Y: 5.00
Area in Cut : 858,748.2 S.F., 19.71 Acres
Area in Fill: 15.0 S.F., 0.00 Acres
Total inclusion area: 858,763.3 S.F., 19.71 Acres
Cut to Fill ratio: 10986436.74
Average Cut Depth: 9.37 Average Fill Depth: 0.05
Max Cut Depth: 13.92 Max Fill Depth: 0.36
Cut (C.Y.) / Area (acres): 15112.90
Fill (C.Y.) / Area (acres): 0.00
Cut volume: 8,044,466.9 C.F., 297,943.22 C.Y.
Fill volume: 0.7 C.F., 0.03 C.Y.

Pond No. 1 Excavation Volume Report Tue Jun 11 09:17:18 2013
Comparing Grid: //Aci-acad/caddrawings/12495/SUPPORT/POND-ORIG-GND.grd
and Grid: //Aci-acad/caddrawings/12495/SUPPORT/POND.grd
Grid corner locations: 360456.72,430150.20 to 362344.72,430680.20
Grid resolution X: 944, Y: 265 Grid cell size X: 2.00, Y: 2.00
Area in Cut : 159,398.2 S.F., 3.66 Acres
Area in Fill: 96,563.8 S.F., 2.22 Acres
Total inclusion area: 255,962.0 S.F., 5.88 Acres
Cut to Fill ratio: 4.23
Average Cut Depth: 8.17 Average Fill Depth: 3.19
Max Cut Depth: 10.97 Max Fill Depth: 8.65
Cut (C.Y.) / Area (acres): 8207.09
Fill (C.Y.) / Area (acres): 1940.53
Cut volume: 1,302,088.7 C.F., 48,225.51 C.Y.
Fill volume: 307,873.4 C.F., 11,402.72 C.Y.

Phase 9 Volumes by elevation zone Tue Nov 13 10:50:56 2012

Zone 432.00 to 452.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 13,418,566.7 C.F., 496,983.95 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 13,418,566.7 C.F., 496,983.95 C.Y.

Zone 452.00 to 472.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 28,720,663.8 C.F., 1,063,728.29 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 42,139,230.5 C.F., 1,560,712.24 C.Y.

Zone 472.00 to 492.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 33,048,326.0 C.F., 1,224,012.07 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 75,187,556.5 C.F., 2,784,724.31 C.Y.

Zone 492.00 to 500.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 10,504,586.3 C.F., 389,058.75 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 85,692,142.8 C.F., 3,173,783.07 C.Y.

Phase 10 Volumes by elevation zone Tue Nov 13 11:04:01 2012

Zone 432.00 to 452.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 3,487,317.2 C.F., 129,159.90 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 3,487,317.2 C.F., 129,159.90 C.Y.

Zone 452.00 to 472.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 7,565,655.6 C.F., 280,209.47 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 11,052,972.8 C.F., 409,369.36 C.Y.

Zone 472.00 to 492.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 10,567,953.7 C.F., 391,405.69 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 21,620,926.5 C.F., 800,775.06 C.Y.

Zone 492.00 to 512.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 21,869,179.5 C.F., 809,969.61 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 43,490,105.9 C.F., 1,610,744.66 C.Y.

Zone 512.00 to 532.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 18,013,600.8 C.F., 667,170.40 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 61,503,706.7 C.F., 2,277,915.06 C.Y.

Zone 532.00 to 538.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 2,552,241.3 C.F., 94,527.45 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 64,055,948.0 C.F., 2,372,442.52 C.Y.

Phase 11 Volumes by elevation zone Tue Nov 13 11:08:46 2012

Zone 432.00 to 452.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 15,034,957.1 C.F., 556,850.26 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 15,034,957.1 C.F., 556,850.26 C.Y.

Zone 452.00 to 472.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 30,360,745.3 C.F., 1,124,472.05 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 45,395,702.4 C.F., 1,681,322.31 C.Y.

Zone 472.00 to 492.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 43,275,795.4 C.F., 1,602,807.24 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 88,671,497.9 C.F., 3,284,129.55 C.Y.

Zone 492.00 to 512.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 54,853,114.8 C.F., 2,031,596.85 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 143,524,612.7 C.F., 5,315,726.40 C.Y.

Zone 512.00 to 532.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 56,180,919.6 C.F., 2,080,774.80 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 199,705,532.3 C.F., 7,396,501.19 C.Y.

Zone 532.00 to 552.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 52,856,781.3 C.F., 1,957,658.57 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 252,562,313.6 C.F., 9,354,159.76 C.Y.

Zone 552.00 to 572.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 37,660,626.5 C.F., 1,394,838.02 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 290,222,940.0 C.F., 10,748,997.78 C.Y.

Zone 572.00 to 588.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 17,882,703.5 C.F., 662,322.35 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 308,105,643.6 C.F., 11,411,320.13 C.Y.

Phase 12 (40 foot Crest - El. 600) Volumes by elevation zone
Tue Jun 04 15:35:43 2013

Zone 550.00 to 560.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,617,833.4 C.F., 208,067.90 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,617,833.4 C.F., 208,067.90 C.Y.

Zone 560.00 to 570.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,773,855.6 C.F., 213,846.50 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 11,391,689.0 C.F., 421,914.41 C.Y.

Zone 570.00 to 580.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,926,840.6 C.F., 219,512.62 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 17,318,529.7 C.F., 641,427.03 C.Y.

Zone 580.00 to 590.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 6,985,785.8 C.F., 258,732.81 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 24,304,315.5 C.F., 900,159.83 C.Y.

Zone 590.00 to 600.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 7,173,752.1 C.F., 265,694.52 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 31,478,067.6 C.F., 1,165,854.36 C.Y.

Phase 12 (40 foot Crest - El. 615) Volumes by elevation zone
Wed Jun 05 11:26:01 2013

Zone 560.00 to 570.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 7,783,847.8 C.F., 288,290.66 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 7,783,847.8 C.F., 288,290.66 C.Y.

Zone 570.00 to 580.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 8,005,622.9 C.F., 296,504.55 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 15,789,470.6 C.F., 584,795.21 C.Y.

Zone 580.00 to 590.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 8,223,934.4 C.F., 304,590.16 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 24,013,405.1 C.F., 889,385.37 C.Y.

Zone 590.00 to 600.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 8,444,835.2 C.F., 312,771.67 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 32,458,240.3 C.F., 1,202,157.05 C.Y.

Zone 600.00 to 610.00
Cut volume : 2.3 C.F., 0.09 C.Y.
Fill volume: 9,782,921.2 C.F., 362,330.41 C.Y.
Running total:
Cut volume : 2.3 C.F., 0.09 C.Y.
Fill volume: 42,241,161.5 C.F., 1,564,487.46 C.Y.

Zone 610.00 to 620.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 2,721,724.5 C.F., 100,804.61 C.Y.
Running total:
Cut volume : 2.3 C.F., 0.09 C.Y.
Fill volume: 44,962,886.0 C.F., 1,665,292.07 C.Y.

Phase 12 (Crest El. 626) Volumes by elevation zone
Wed Jun 05 14:11:36 2013

Zone 570.00 to 580.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 4,631,669.8 C.F., 171,543.33 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 4,631,669.8 C.F., 171,543.33 C.Y.

Zone 580.00 to 590.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 4,769,707.6 C.F., 176,655.84 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 9,401,377.4 C.F., 348,199.16 C.Y.

Zone 590.00 to 600.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 4,905,026.3 C.F., 181,667.64 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 14,306,403.6 C.F., 529,866.80 C.Y.

Zone 600.00 to 610.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,040,121.8 C.F., 186,671.18 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 19,346,525.4 C.F., 716,537.98 C.Y.

Zone 610.00 to 620.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 6,444,007.8 C.F., 238,666.96 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 25,790,533.2 C.F., 955,204.94 C.Y.

Zone 620.00 to 626.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 2,771,652.4 C.F., 102,653.79 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 28,562,185.7 C.F., 1,057,858.73 C.Y.

Phase 8 Abandonment Volume Report Thu May 23 14:03:03 2013
Comparing Grid: //Aci-acad/caddrawings/12495/SUPPORT/PHASE8-ABANDON-EX-GND.grd
and Grid: //Aci-acad/caddrawings/12495/SUPPORT/PHASE8-ABANDONMENT.grd
Grid corner locations: 357986.91,425937.04 to 359966.91,430452.04
Grid resolution X: 396, Y: 903 Grid cell size X: 5.00, Y: 5.00
Area in Cut : 0.0 S.F., 0.00 Acres
Area in Fill: 4,283,188.1 S.F., 98.33 Acres
Total inclusion area: 4,283,188.1 S.F., 98.33 Acres
Cut to Fill ratio: 0.00
Average Fill Depth: 29.18
Max Fill Depth: 38.00
Cut (C.Y.) / Area (acres): 0.00
Fill (C.Y.) / Area (acres): 47069.08
Cut volume: 0.0 C.F., 0.00 C.Y.
Fill volume: 124,962,220.3 C.F., 4,628,230.38 C.Y.

Phase 12 Abandonment Volume Report Wed Jun 05 15:26:59 2013
Comparing Grid: //Aci-acad/caddrawings/12495/SUPPORT/PHASE12-ABANDON-EX-GND.grd
and Grid: //Aci-acad/caddrawings/12495/SUPPORT/PHASE12-ABANDONMENT.grd
Grid corner locations: 359560.72,426209.48 to 362830.72,430359.48
Grid resolution X: 327, Y: 415 Grid cell size X: 10.00, Y: 10.00
Area in Cut : 185,713.2 S.F., 4.26 Acres
Area in Fill: 5,289,710.3 S.F., 121.44 Acres
Total inclusion area: 5,475,423.4 S.F., 125.70 Acres
Cut to Fill ratio: 0.00
Average Cut Depth: 0.05 Average Fill Depth: 39.50
Max Cut Depth: 0.13 Max Fill Depth: 51.00
Cut (C.Y.) / Area (acres): 2.84
Fill (C.Y.) / Area (acres): 61572.78
Cut volume: 9,644.2 C.F., 357.19 C.Y.
Fill volume: 208,969,245.3 C.F., 7,739,601.68 C.Y.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - INCISED CELL

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
428	0.762						
		1.83	1.00	1.83	1.83	79,579.76	2,947.40
429	2.892						
		4.57	1.00	4.57	6.39	278,553.13	10,316.78
430	6.244						
		7.99	1.00	7.99	14.38	626,606.24	23,207.64
431	9.737						
		11.29	1.00	11.29	25.67	1,118,213.51	41,415.32
432	12.835						
		13.65	1.00	13.65	39.32	1,712,840.18	63,438.53
433	14.467						
		15.09	1.00	15.09	54.41	2,370,029.90	87,778.89
434	15.708						
		16.33	1.00	16.33	70.73	3,081,155.62	114,116.87
435	16.943						
		17.33	1.00	17.33	88.06	3,836,852.22	142,068.60
436	17.708						
		18.32	2.00	36.65	124.71	5,432,217.32	201,193.23
438	18.940						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 9

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
438	0.627						
		13.135	7.00	91.95	91.95	4,005,230.92	148,341.89
445	25.644						
		31.970	7.00	223.79	315.74	13,753,569.06	509,391.45
452	38.296						
		44.667	7.00	312.67	628.40	27,373,293.49	1,013,825.68
459	51.037						
		56.638	7.00	396.47	1,024.87	44,643,489.66	1,653,462.58
466	62.240						
		65.736	7.00	460.15	1,485.02	64,687,665.04	2,395,839.45
473	69.232						
		70.954	7.00	496.68	1,981.71	86,323,060.69	3,197,151.14
480	72.677						
		74.445	7.00	521.12	2,502.82	109,022,911.07	4,037,885.60
487	76.213						
		78.385	7.00	548.70	3,051.52	132,924,080.52	4,923,114.09
494	80.557						
		82.169	6.00	493.01	3,544.53	154,399,757.29	5,718,509.63
500	83.781						

Page No. 1 of 10011

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 10

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
500	83.284						
		84.738	4.00	338.95	338.95	14,764,714.27	546,841.27
504	86.192						
		87.320	4.00	349.28	688.23	29,979,368.50	1,110,346.98
508	88.448						
		89.568	4.00	358.27	1,046.50	45,585,618.41	1,688,356.24
512	90.687						
		91.810	4.00	367.24	1,413.74	61,582,505.69	2,280,833.54
516	92.932						
		94.075	4.00	376.30	1,790.04	77,974,090.13	2,887,929.26
520	95.217						
		96.363	4.00	385.45	2,175.49	94,764,887.96	3,509,792.15
524	97.509						
		98.675	4.00	394.70	2,570.19	111,957,554.81	4,146,576.10
528	99.842						
		101.01	4.00	404.06	2,974.25	129,556,260.80	4,798,454.09
532	102.187						
		103.92	6.00	623.49	3,597.74	156,717,641.52	5,804,357.09
538	105.645						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 11

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
538	108.856						
		108.71	5.00	543.55	543.55	23,676,972.66	876,924.91
543	110.564						
		112.12	5.00	560.58	1,104.13	48,098,859.24	1,781,328.12
548	113.669						
		116.23	5.00	576.15	1,680.28	73,193,127.48	2,710,856.57
553	118.793						
		118.88	5.00	591.91	2,272.19	98,976,803.31	3,665,807.53
558	119.972						
		121.58	5.00	607.88	2,880.08	125,456,208.67	4,646,526.24
563	123.182						
		124.81	5.00	624.05	3,504.13	152,689,648.36	5,655,931.35
568	126.439						
		128.09	5.00	640.45	4,144.56	180,537,098.94	6,686,559.22
573	129.733						
		131.40	5.00	657.01	4,801.57	209,156,598.11	7,746,540.60
578	133.073						
		136.40	10.00	1,364.08	6,165.61	268,578,873.59	9,947,180.50
588	139.734						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 12 (CREST EL. 600)

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
550	102.133						
		103.75	5.00	518.75	518.75	22,596,543.09	836,909.00
555	105.365						
		106.88	5.00	534.40	1,053.15	45,875,203.11	1,699,081.60
560	108.397						
		109.93	5.00	549.67	1,602.82	69,819,024.33	2,585,889.79
565	111.473						
		113.03	5.00	565.15	2,167.98	94,437,121.68	3,497,671.17
570	114.589						
		116.17	5.00	580.84	2,748.82	119,738,435.85	4,434,756.88
575	117.747						
		119.35	5.00	596.73	3,345.54	145,731,907.53	5,397,478.06
580	120.945						
		122.56	5.00	612.82	3,958.37	172,426,455.65	6,386,165.02
585	124.184						
		125.82	5.00	629.12	4,587.49	199,830,983.72	7,401,146.69
590	127.464						
		130.74	10.00	1,307.38	5,894.86	256,780,210.50	9,510,378.17
600	134.011						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 12 (CREST EL. 615)

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
560	90.540						
		92.35	6.00	554.10	554.10	24,136,752.82	893,953.81
566	94.161						
		95.88	6.00	575.31	1,129.41	49,197,151.87	1,822,116.74
572	97.608						
		99.37	6.00	596.19	1,725.61	75,167,397.86	2,783,977.68
578	101.124						
		102.91	6.00	617.45	2,343.06	102,063,693.60	3,780,136.80
584	104.695						
		106.51	6.00	639.05	2,982.11	129,900,872.77	4,811,143.44
590	108.323						
		110.17	6.00	661.03	3,643.14	158,696,204.54	5,877,600.17
596	112.019						
		113.89	6.00	683.35	4,326.49	188,461,854.70	6,980,067.95
602	115.764						
		117.67	6.00	706.01	5,032.49	219,215,488.64	8,119,090.32
608	119.572						
		121.77	7.00	852.36	5,884.86	256,344,296.87	9,494,233.22
615	123.960						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN

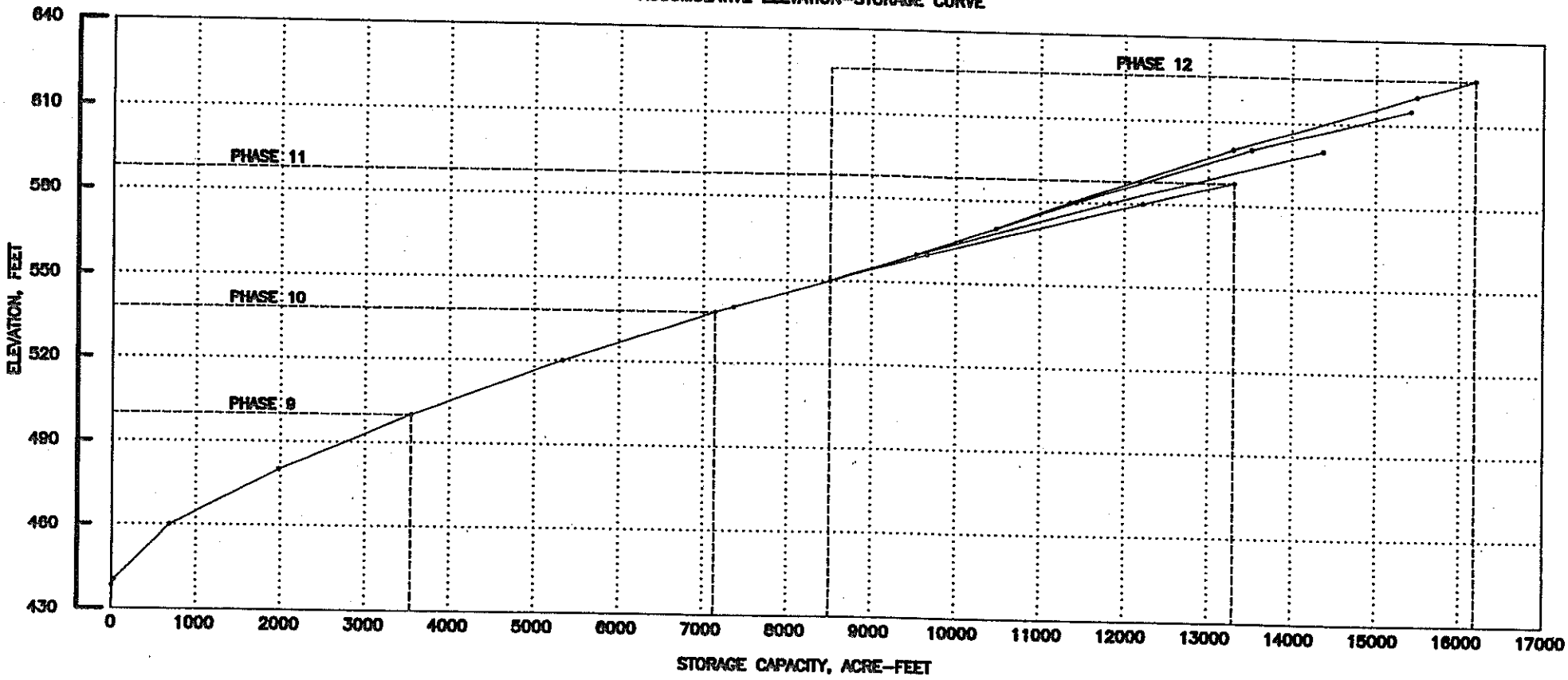
PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 12 (CREST EL. 626)

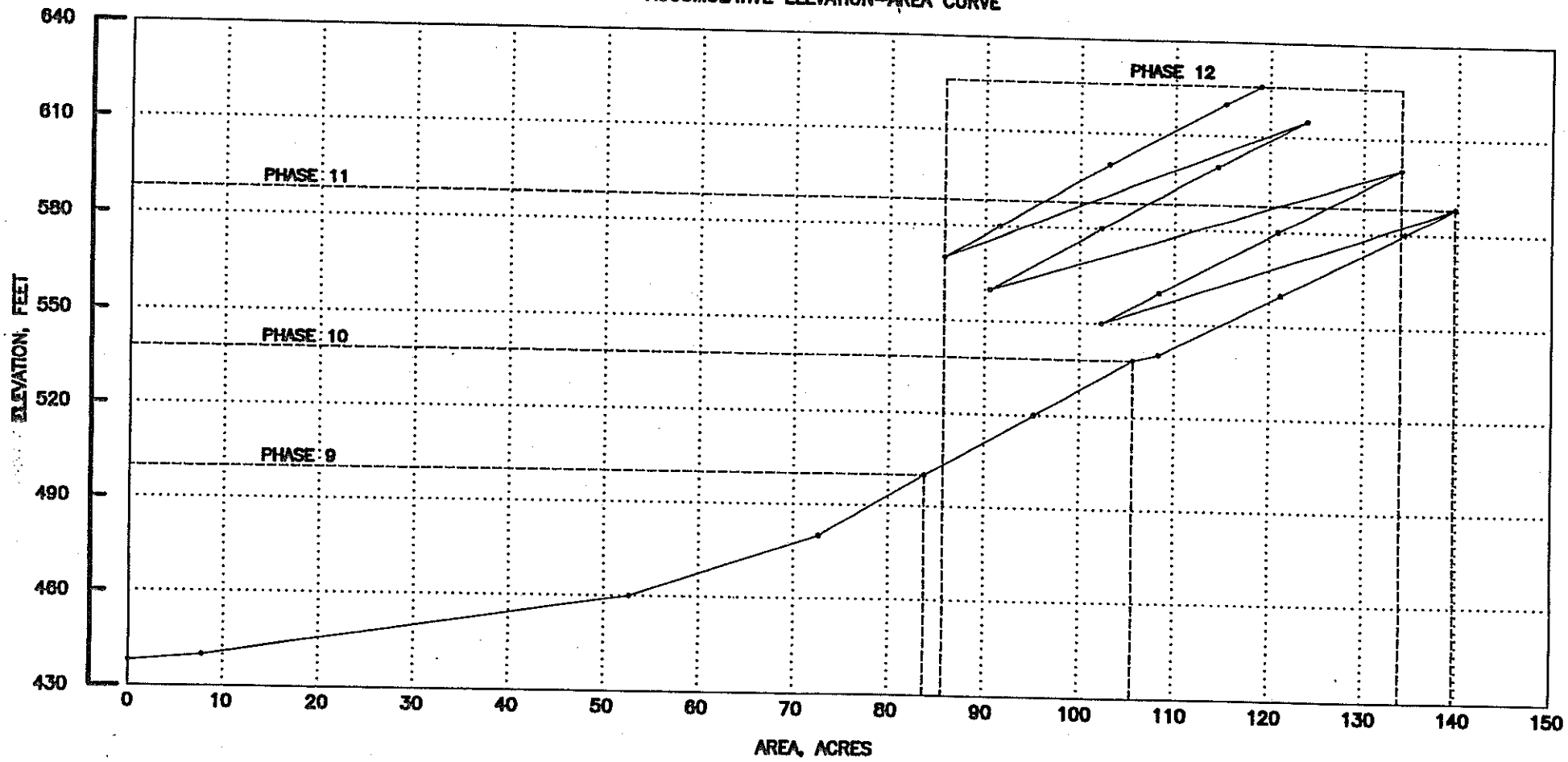
ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMULATIVE VOLUME C.F.	CUMMULATIVE VOLUME C.Y.
570	85.743						
		87.51	6.00	525.03	525.03	22,870,372.14	847,050.82
576	89.268						
		90.95	6.00	545.71	1,070.74	46,641,469.25	1,727,461.82
582	92.685						
		94.35	6.00	566.09	1,636.83	71,300,197.19	2,640,748.04
588	96.060						
		97.80	6.00	586.80	2,223.63	96,861,348.94	3,587,457.37
594	99.541						
		101.31	6.00	607.89	2,831.52	123,340,854.38	4,568,179.79
600	103.088						
		104.89	6.00	629.33	3,460.85	150,754,447.40	5,583,498.05
606	106.689						
		108.52	6.00	651.12	4,111.97	179,117,273.81	6,633,976.10
612	110.352						
		112.21	6.00	673.29	4,785.25	208,445,590.19	7,720,207.04
618	114.077						
		116.54	8.00	932.33	5,717.59	249,058,024.38	9,224,371.27
626	119.006						

PHASES 9 – 12

ACCUMULATIVE ELEVATION–STORAGE CURVE



PHASES 9 – 12
ACCUMULATIVE ELEVATION–AREA CURVE



Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/4/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 1 OF 11

DESCRIPTION: **Embankment Construction and Fines Level Schedule**

Based on the approved plan, the production rates are:

Coarse Production Rate = 2,568,200 CY/Yr
Fines Production Rate = 2,064,400 CY/Yr

The proposed plan and timing begins after construction of Phase 5A is complete. Estimates from the approved plan indicate the Phase 5A embankment will be complete - 7/19/2014

The fine coal refuse elevation in the Phase 7 cell will be 525.0 (maximum allowable for displacement due to upstream Phase 8 construction).
The fine coal refuse elevation in the Phase 2A cell will be 517.4. The remaining volume to max level (to allow for displacement) = 195,021.44 CY
The fine coal refuse elevation in the Phase 5A cell will be 499.8. The remaining volume to max level (to allow for displacement) = 403,497.99 CY
Total volume remaining in existing cells = 598,519.43 CY

Begin Phase 9 construction - 7/20/2014
Volume to construct = 3,173,783.07 CY
Time to construct = (3,173,783.07 / 2,568,200) = 1.2358 Yr
Fines produced during construction = (1.2358)(2,064,400) = 2,551,186.73 CY

Construction will be complete on - 10/14/2015

Max fines levels in Phases 2A, and 5A reached = (598,519.43 / 2,064,400) = 0.2899 Yr on 11/2/2014
At this time pumping will begin in the incised cell. Volume available in incised cell = 201,193.23 CY
Incised cell pumping will be complete = (201,193.23 / 2,064,400) = 0.0975 Yr on 12/8/2014
At this time pumping will begin in the Phase 9 cell.
Volume of coarse produced before pumping begins in Phase 9 cell =(0.2899+0.0975)(2,568,200)= 994,876.02 CY
Phase 9 will be constructed to elevation:

Elev.	Volume		
452.00	496,923.95		
X	994,876.02	X =	461.4
472.00	1,560,712.24		

Fines level at end of construction:
Remaining volume in incised cell (below original ground surface) = (297,943.22 - 201,193.23) = 93,749.99 CY
Volume pumped into Phase 9 cell = (2,551,186.73 - 598,519.43 - 201,193.23 - 93,749.99) = 1,657,724.08 CY
Fines level at end of construction:

Elev.	Volume			
466.00	1,653,462.58			
X	1,657,724.08	X =	466.0	< 492.0 (See sheet 2 of 8)
473.00	2,395,839.45			

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/4/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 2 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

At completion, Phase 9 available storage will be:
1 PMF Volume for Crest at El. 538 = (41")(1 ft / 12")(118.15 Ac)(43,560 ft² / Ac)(1 CY / 27 CF) = 651,269.06 CY (Conservatively using the Phase 10 crest area)
Max Storm Level = 500 - 3 ft Freeboard = 497
Storage vol. at El. 497 =

Elev.	Volume
494.00	4,923,114.09
497.00	X
500.00	5,718,509.53

X = 5,320,811.81 CY

Fines Volume Available = (5,320,811.81 - 651,269.06) = 4,669,542.75 CY
Phase 9 Max Fines Level =

Elev.	Volume
487.00	4,037,885.60
X	4,669,542.75
494.00	4,923,114.09

X = 492.0

Begin Phase 10 construction to El. 538 - 10/15/2015
Volume to construct = 2,372,442.52 CY
Time to construct = (2,372,442.52 / 2,568,200) = 0.9238 Yr
Phase 10 will be complete on - 9/16/2016

Fines produced = (0.9238)(2,064,400) = 1,907,043.98 CY
Phase 9 fines volume will be = (1,907,043.36 + 1,657,724.08) = 3,564,768.06 CY
Phase 9 fines level will be:

Elev.	Volume
480.00	3,197,151.14
X	3,564,768.06
487.00	4,037,885.60

X = 483.1 **< 492.0** **OK**

Phase 10 available storage will be:
1 PMF Volume for Crest at El. 588 = (41")(1 ft / 12")(157.43 Ac)(43,560 ft² / Ac)(1 CY / 27 CF) = 867,789.14 CY (Conservatively using the Phase 11 crest area)

Max Storm Level = 538 - 3 ft Freeboard = 535
Storage vol. at El. 535 =

Elev.	Volume
532.00	4,798,454.09
535.00	X
538.00	5,804,357.09

X = 5,301,405.59 CY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/4/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 3 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Fines Volume Available = (5,301,405.59 - 867,789.14) = 4,433,616.45 CY

Max Fines Level for Crest at El. 538 =

Elev.	Volume
528.00	4,146,576.10
X	4,433,616.45
532.00	4,798,454.09

X = 529.8

Begin North and South Buttress Construction - 9/17/2016
Volume to Construct = 161,248.01 CY (ref. approved plan)
Time to construct = (161,248.01 / 2,568,200) = 0.0628 Yr
Buttresses will be complete on - 10/10/2016

Fines Produced During Construction = (0.0628 x 2,064,400) = 129,616.23 CY
Phase 9 fines volume will be = (129,616.23 + 3,564,768.06) = 3,694,384.29 CY
Phase 9 fines level will be:

Elev.	Volume
480.00	3,197,151.14
X	3,694,384.29
487.00	4,037,885.60

X = 484.1 **< 529.8** **OK**

Phase 8 will first be constructed by a 25 foot crest raising lift to El. 563, with a 50 foot crest (ref. approved plan)
Begin Phase 8 Construction to El. 563 - 10/11/2016
Volume to Construct = 3,206,409.45 CY
Time to construct = (3,206,409.45 / 2,568,200) = 1.2485 Yr
Completion Date = 1/9/2018

Fines Produced During Construction = (1.2485 x 2,064,400) = 2,577,412.85 CY
Phase 9 remaining volume = (5,718,509.53 - 3,694,384.29) = 2,024,125.24 CY
Phase 10 fines volume will be = (2,577,412.85 - 2,024,125.24) = 553,287.60 CY
Phase 10 fines level will be:

Elev.	Volume
504.00	546,841.27
X	553,287.60
508.00	1,110,346.98

X = 504.0 **< 529.8** **OK**

At this time pumping should resume in the Phase 8 cell until the fines reach Elevation 547.5 (ref. approved plan).

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/4/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 4 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Begin Phase 11 Construction to El. 557.5- 1/10/2018 (Phase 11 should be constructed to El. 557.5 to ensure that fines storage remains available, see Sheet 5 of 8)

Volume pumped into Phase 8 = 2,564,061.69 CY (To Phase 8 max el. 547.5) Reached on - 4/9/2019 At this time pumping will resume in the Phase 10 cell
During filling of Phase 8 the volume of coarse produced = (2,564,061.69 / 2,064,400)(2,568,200) =
3,189,800.05 CY (Used to construct Phase 11)

Resume Phase 8 Construction to El. 588- 4/10/2019
Volume to construct = 2,740,353.00 CY
Time to construct = (2,740,353.00 / 2,568,200) = 1.0670 Yr
Phase 8 construction will be complete - 5/3/2020

Fines produced = (1.0670)(2,064,400) = 2,202,782.00 CY
Phase 10 fines volume will be = (2,202,782.00 + 553,287.60)= 2,756,069.60 CY
Phase 10 fines level will be:

Elev.	Volume
516.00	2,280,833.54
X	2,756,069.60
520.00	2,887,929.26

X = 519.1 **< 529.8** **OK**

Resume Phase 11 construction to El. 557.5 - 5/4/2020
Volume to complete = (9,762,998.31 - 3,189,800.05) = 6,573,198.26 CY
Time to construct = (6,573,198.26 / 2,568,200) = 2.5595 Yr
Phase 11 construction will be complete - 11/24/2022 (to El. 557.5)

Fines produced = (2.5595)(2,064,400) = 5,283,743.66 CY
Phase 10 remaining fines volume = (4,433,616.45 - 2,756,069.60) = 1,677,546.84 CY (To El. 529.8)
Phase 10 max fines reached on - 2/25/2021
At this time pumping will resume in the Phase 8 cell
Phase 8 remaining fines volume = 3,606,196.82 CY until max fines level 582.0 is reached (ref. approved plan)

Max fines levels in both cells will be filled. Check level of embankment construction to ensure there is fines disposal storage available.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/4/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 5 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Check level of embankment construction:
Coarse produced = (3,606,196.82 + 1,677,546.84) / 2,064,400 (2,568,200) = 6,573,198.26 CY
Volume of Phase 11 constructed = (6,573,198.26 + 3,189,800.05) = 9,762,998.31 CY
Phase 11 should be constructed to El.:

Elev.	Volume			
552.00	9,354,159.76			
X	9,762,998.31	X =	557.9	Say 557.5
572.00	10,748,997.78			

Phase 11 available storage will be:
1 PMF Volume for Crest at El. 557.5 = (41")(1 ft / 12")(157.43 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 867,789.14 CY (Conservatively using the Phase 11 crest area at El. 588)

Max Storm Level = 557.5 - 3 ft Freeboard = 554.5
Storage vol. at El. 554.5 =

Elev.	Volume			
553.00	2,710,856.57			
557.50	X	X =	3,570,312.43	CY
558.00	3,665,807.53			

Fines Volume Available = (3,570,312.43 - 867,789.14) = 2,702,523.29 CY
Max Fines Level for Crest at El. 557.5 =

Elev.	Volume		
548.00	1,781,328.12		
X	2,702,523.29	X =	553.0
553.00	2,710,856.57		

Continue Phase 11 construction to El. 588 - 11/25/2022
Remaining volume to construct = (11,411,320.13 - 9,762,998.31) = 1,648,321.82 CY
Time to construct = (1,648,321.82 / 2,568,200) = 0.6418 Yr

Phase 11 construction will be complete - 7/18/2023

Fines produced = (0.6418)(2,064,400) = 1,324,972.96 CY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 6 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Phase 10 fines volume will be = (1,324,972.96 + 4,433,616.45)= 5,758,589.41 CY

Phase 10 fines level will be:

Elev.	Volume				
532.00	4,798,454.09				
X	5,758,589.41	X =	537.7	< 553.0	OK
538.00	5,804,357.09				

Phase 11 available storage will be:

1 PMF Volume for Crest at El. 588 = (41")(1 ft / 12")(157.43 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 867,789.14 CY

Max Storm Level = 588 - 3 ft Freeboard = 585

Storage vol. at El. 585 =

Elev.	Volume			
578.00	7,746,540.60			
585.00	X	X =	9,286,988.53	CY
588.00	9,947,180.50			

Fines Volume Available = (9,286,988.53 - 867,789.14) = 8,419,199.39 CY

Max Fines Level for Crest at El. 588 =

Elev.	Volume		
578.00	7,746,540.60		
X	8,419,199.39	X =	581.1
588.00	9,947,180.50		

At this time, Mach will have time to cap Phase 8 before construction of Phase 12 begins. It is recommended that a planned displacement of fines will occur by lowering the section of the Phase 8 crest adjacent to the Phase 10/11 cell to El. 583. This will allow the displacement of fines during Phase 8 abandonment cap construction to displace into the active cell. The abandonment cap was assumed to submerge a depth of 22 feet (El. 560-582), and complete displacement of the fines would occur.

Begin Phase 8 abandonment cap - 7/19/2023
Volume to construct = 4,628,230.38 CY
Time to construct = (4,628,230.38 / 2,568,200) = 1.8021 Yr
Phase 8 cap will be complete on - 5/6/2025

Fines produced = (1.8021)(2,064,400) = 3,720,317.26 CY

Displaced volume = 3,084,159.64 CY (Ref. approved plan Phase 8 volumes El. 560 - 582)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 7 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Phase 10 volume remaining =(5,804,357.09 - 5,758,589.41) = 45,767.68 CY
Phase 11 volume will be = (3,720,317.26 + 3,084,159.64 - 45,767.68) = 6,758,709.22 CY
Phase 11 fines level will be:

Elev.	Volume
573.00	6,686,559.22
X	6,758,709.22
578.00	7,746,540.60

X = 573.3 < 581.1 OK

Phase 12 will be constructed in two stages similar to the Phase 5A and Phase 8 construction. The first stage will be constructed to El. 600, with a 40 foot crest.
Begin Phase 12 construction to El. 600 - 5/7/2025
Volume to construct = 1,165,854.36 CY
Time to construct = (1,165,854.36 / 2,568,200) = 0.4540 Yr
Construction will be complete on - 10/20/2025

Fines produced = (0.4540)(2,064,400) = 937,150.43 CY

Assuming coarse refuse submerged 23.3 feet (El. 550 - 573.3) to stabilize the embankment, and 100% displacement of the fines occurs, the volume of fines displaced from upstream construction will be = 494,353.57 CY (Triangulated from Phase 12 (Crest El. 600) embankment volumes)

The fines level after Phase 12 construction is complete will be:
Phase 12 volume at el. 573.3 =

Elev.	Volume
570.00	3,497,671.17
573.30	X
575.00	4,434,756.88

X = 4,116,147.74 CY

Displaced volume and fines produced = (937,150.43 + 494,353.57) = 1,431,504.00 CY
Total volume in the Phase 12 cell = (4,116,147.74 + 1,431,504.00) = 5,547,651.74 CY
Phase 12 fines level will be:

Elev.	Volume
580.00	5,397,478.06
X	5,547,651.74
585.00	6,386,165.02

X = 580.8 < 581.1 OK

Phase 12 available storage will be:
1 PMF Volume for Crest at El. 600 = (41")(1 ft / 12")(143.5 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 791,003.89 CY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 8 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Max Storm Level = 600 - 3 ft Freeboard = 597

Storage vol. at El. 597 =

Elev.	Volume
590.00	7,401,145.69
597.00	X
600.00	9,510,378.17

X = 8,877,608.43 CY

Fines Volume Available = (8,877,608.43 - 791,003.89) = 8,086,604.54 CY

Max Fines Level for Crest at El. 600 =

Elev.	Volume
590.00	7,401,145.69
X	8,086,604.54
600.00	9,510,378.17

X = 593.2

Continue Phase 12 construction to El. 615 - 10/21/2025

Volume to construct = 1,665,292.07 CY

Time to construct = (1,665,292.07 / 2,568,200) = 0.6484 Yr

Phase 12 will be complete on - 6/15/2026

Fines produced = (0.6484)(2,064,400) = 1,338,614.18 CY

Assuming coarse refuse submerged 20.8 feet (El. 560 - 580.8) to stabilize the embankment, and 100% displacement of the fines occurs, the volume of fines displaced from upstream construction will be = 609,162.42 CY (Triangulated from Phase 12 (Crest El. 615) embankment volumes)

The fines level after Phase 12 construction is complete will be:

Phase 12 volume at el. 580.8 =

Elev.	Volume
578.00	2,783,977.68
580.80	X
584.00	3,780,136.80

X = 3,248,851.94 CY (Ref. Impoundment volumes - Phase 12 Crest El. 615)

Displaced volume and fines produced = (1,338,614.18 + 609,162.42) = 1,947,776.60 CY

Total volume in the Phase 12 cell = (3,248,851.94 + 1,947,776.60) = 5,196,628.54 CY

Phase 12 fines level will be:

Elev.	Volume
590.00	4,811,143.44
X	5,196,628.54
596.00	5,877,600.17

X = 592.2 **< 593.2** **OK**

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 9 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Phase 12 available storage will be:
1 PMF Volume for Crest at El. 615 = (41")(1 ft / 12")(133.1 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 733,676.78 CY

Max Storm Level = 615 - 3 ft Freeboard = 612
Storage vol. at El. 612 =

Elev.	Volume
608.00	8,119,090.32
612.00	X
615.00	9,494,233.22

X = 8,904,886.26 CY

Fines Volume Available = (8,904,886.26 - 733,676.78) = 8,171,209.49 CY
Max Fines Level for Crest at El. 615 =

Elev.	Volume
608.00	8,119,090.32
X	8,171,209.49
615.00	9,494,233.22

X = 608.3

Continue Phase 12 construction to final El. 626 - 6/16/2026
Volume to construct = 1,057,858.73 CY
Time to construct = (1,057,858.73 / 2,568,200) = 0.4119 Yr
Phase 12 will be complete on - 11/13/2026

Fines produced = (0.4119)(2,064,400) = 850,340.15 CY

Assuming coarse refuse submerged 22.2 feet (El. 570 - 592.2) to stabilize the embankment, and 100% displacement of the fines occurs, the volume of fines displaced from upstream construction will be = 388,166.04 CY (Triangulated from Phase 12 (Crest El. 626) embankment volumes)

The fines level after Phase 12 construction is complete will be:
Phase 12 volume at el. 592.2 =

Elev.	Volume
588.00	2,640,748.04
592.20	X
594.00	3,587,457.37

X = 3,303,444.57 CY (Ref. Impoundment volumes - Phase 12 Crest El. 626)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWN DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 10 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule

Displaced volume and fines produced = (850,340.15 + 388,166.04) = 1,238,506.19 CY
Total volume in the Phase 12 cell = (3,303,444.57 + 1,238,506.19) = 4,541,950.76 CY
Phase 12 fines level will be:

Elev.	Volume				
594.00	3,587,457.37				
X	4,541,950.76	X =	599.8	< 608.3	OK
600.00	4,568,179.79				

Phase 12 available storage will be:
1 PMF Volume for Crest at El. 626 = (41")(1 ft / 12")(125.7 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 692,886.33 CY

Max Storm Level = 626 - 3 ft Freeboard = 623
Storage vol. at El. 623 =

Elev.	Volume			
618.00	7,720,207.04			
623.00	X	X =	8,660,309.68	CY
626.00	9,224,371.27			

Fines Volume Available = (8,660,309.68 - 692,886.33) = 7,967,423.35 CY
Max Fines Level for Crest at El. 626 =

Elev.	Volume		
618.00	7,720,207.04		
X	7,967,423.35	X =	619.3
626.00	9,224,371.27		

At this Mach should evaluate the method of abandonment for Phase 12. Electing to abandon the facility at the earliest available time should begin immediately after the Phase 12 embankment construction is complete. Mach will likely have to establish another means to dispose fine coal refuse under this option. If Mach elects to resume pumping fines until the maximum level is reached, they will likely need to stockpile coarse refuse material to use for abandonment at a time when enough consolidation of fine coal refuse has occurred that will allow them to construct the abandonment cap without causing a large displacement of fine coal refuse.

The following calculation for the remaining diposal life at the facility assumes that Mach will begin capping Phase 12 after the embankment is complete. The assumption of approximately 15 feet of submergence occurred was used for this calculation since the displacement and submergence level will change during capping.
If capping begins immediately after the embankment is complete, the decant will not be required to be constructed. Pumps may continue to be used to evacuate the design storm.

Volume to complete coarse cap = 7,739,601.68 CY
Life remaining = (7,739,601.68 / 2,566,200) = 3.0136 Yr
Abandonment cap completed on - 11/17/2029

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 5/21/2013 CHKD BY: BWM DATE: 6/6/13

PROJECT NAME: MACH MINING - FACILITY NO. 2 EXPANSION PLAN

PROJECT NO.: B12-495-1413 SHEET 11 OF 11

DESCRIPTION: Embankment Construction and Fines Level Schedule Summary

Date	Description	Time to Construct (Yr)	Max. Fines Level
7/20/2014	Begin Phase 9 Construction to El. 500	1.2358	
10/14/2015	Complete Phase 9 Construction to El. 500		492.0
10/15/2015	Begin Phase 10 Construction to El. 538	0.9238	
9/16/2016	Complete Phase 10 Construction to El. 538		529.8
9/17/2016	Begin North and South Buttress Construction	0.0628	
10/10/2016	Complete Buttress Construction		
10/11/2016	Begin Phase 8 Construction to El. 563	1.2485	
1/9/2018	Complete Phase 8 Construction to El. 563		547.5
1/10/2018	Begin Phase 11 Construction to El. 557.5	1.2420	
4/9/2019	Stop Phase 11 Construction		
4/10/2019	Resume Phase 8 Construction to El. 588	1.0670	
5/3/2020	Complete Phase 8 Construction to El. 588		582.0
5/4/2020	Resume Phase 11 Construction to El. 557.5	2.5595	
11/24/2022	Complete Phase 11 Construction to El. 557.5		553.0
11/25/2022	Continue Phase 11 Construction to El. 588	0.6418	
7/18/2023	Complete Phase 11 Construction to El. 588		581.1
7/19/2023	Begin Phase 8 Abandonment Cap	1.8021	
5/6/2025	Complete Phase 8 Abandonment Cap		
5/7/2025	Begin Phase 12 Construction to El. 600	0.4540	
10/20/2025	Complete Phase 12 Construction to El. 600		593.2
10/21/2025	Continue Phase 12 Construction to El. 615	0.6484	
6/15/2026	Complete Phase 12 Construction to El. 615		608.3
6/16/2026	Continue Phase 12 Construction to El. 626	0.4119	
11/13/2026	Complete Phase 12 Construction to El. 626		619.3
11/14/2026	Begin Phase 12 Abandonment Cap	3.0136	
11/17/2029	Phase 12 Abandonment Cap Complete		

Expansion plan will provide:
15.31 Yr of Coarse Refuse disposal beyond Phases 2A, 5A, and 7 of the approved plan.
12.01 Yr of Fine Refuse disposal beyond Phases 2A, 5A, and 7 of the approved plan.

Note - Volumes and disposal life includes Phase 8 of the approved plan and time to construct the Phase 8 and Phase 12 abandonment caps.

Page Nos. 30-32 have been removed

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Bench Gutter

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	BENCH



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	50.03	4.06

Structure Detail:

Structure #1 (Null)

BENCH

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.331	0.000	0.000	87.000	M	50.03	4.058
	Σ	**12.900**						**50.03**	**4.058**

Subwatershed Time of Concentration Details:

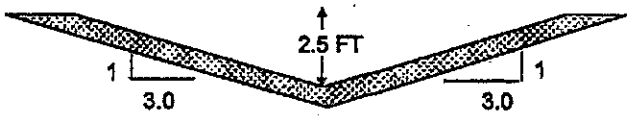
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	27.78	50.00	180.00	15.810	0.003
		8. Large gullies, diversions, and low flowing streams	0.50	12.53	2,506.00	2.120	0.328
#1	**1**	**Time of Concentration:**					**0.331**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL BENCH GUTTER

PEAK FLOW =	50.0	CFS
BOTTOM WIDTH =	0	FT
SIDE SLOPE 1 =	3.00:1	
SIDE SLOPE 2 =	3.00:1	
CHANNEL SLOPE =	0.005	FT/FT
MANNING'S N =	0.033	FT^(1/6)



OUTPUT:

TRIANGULAR DITCH

WETTED PERIMETER =	14.17	FT	DEPTH OF FLOW =	2.24	FT
AREA OF FLOW =	15.06	SQ.FT.	MEAN DEPTH =	1.12	FT
HYDRAULIC RADIUS, Rh =	1.06	FT	FROUDE NO. =	0.55	SUBCRITICAL
CALC. VELOCITY =	3.32	FPS			

FREEBOARD REQUIRED =	0.30	FT	(0+0.025vd^1/3)
TOTAL DEPTH =	2.5	FT	**ADDITIONAL FREEBOARD AVAILABLE BY SLOPE OF BENCH**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Access Road Gutter

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	GUTTER



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.700	1.700	10.61	0.67

Structure Detail:

Structure #1 (Null)

GUTTER

Subwatershed Hydrology Detail:

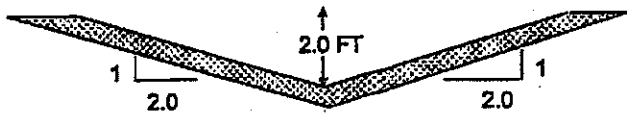
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1.700	0.000	0.000	0.000	87.000	M	10.61	0.666
	Σ	**1.700**						**10.61**	**0.666**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

ACCESS ROAD GUTTER DITCH DESIGN

PEAK FLOW =	10.61	CFS
BOTTOM WIDTH =	0	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.1	FT/FT
MANNING'S N =	0.035	FT^(1/6)



OUTPUT:

TRIANGULAR DITCH

WETTED PERIMETER =	3.86	FT	DEPTH OF FLOW =	0.86	FT
AREA OF FLOW =	1.49	SQ.FT.	MEAN DEPTH =	0.43	FT
HYDRAULIC RADIUS, Rh =	0.39	FT	FROUDE NO. =	1.91	SUPERCRITICAL
CALC. VELOCITY =	7.11	FPS			

FREEBOARD REQUIRED =	1.17	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	**2.0**	FT	

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	65.61	65.61

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	65.61	65.610
	Σ	**265.100**						**65.61**	**65.610**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	100.58	82.95

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	100.58	82.950
	Σ	**265.100**						**100.58**	**82.950**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

GENERAL INFORMATION
Permit No. **375 / 417**
Structure ID: **Sediment Pond No. 9**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in	
B.	Estimated Runoff Area:	**265.10**	acres	
C.	Estimated Distrubed Area:	**265.10**	acres	
D.	Runoff Coefficient:	**100.00**	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr stor	**27.34**	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	**26.51**	ac/ft	
G.	Pit Pumpage:	**2000.00**	gpm	
H.	Pit Pumpage Treatment:	**None**		
I.	Basin Volume (Required at Normal Pool*):	**58.27**	ac/ft	
	Basin Volume (Provided at Normal Pool):		ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (100yr/6hr):	-	acres	
L.	Diversion Ditching:	**None**		
M.	Inlet Elevation**:	**N/A**	feet	
	Outlet Elevation	**N/A**	feet	
	Outfall Elevation	**N/A**	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**		

Notes:

* Basin Volume Required = (0.416 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Pond Creek - Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413
DESCRIPTION:

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :

TOTAL AREA =	265.10	ACRES	DISTURBED AREA =	265.10	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	26.51	AC. FT.
10 YR - 24 HR RUNOFF VOL =	65.61	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	27.34	AC. FT.
PUMPAGE =	2000	GPM	PUMPAGE VOLUME =	4.42	AC. FT.
LINEAR FEET OF DITCHLINE =	8105	FEET	SEDIMENT CAPACITY REQD =	58.27	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	20.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	8		BARRIER SPACING =	1013.13	FEET
NUMBER OF BARRIERS =	7		TOP WIDTH (TOTAL) =	53.91	FEET
POOL AREA=	4.22	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	32.44	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.22	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	32.22	ACRE FEET
60% CLEANOUT DEPTH = 6.08 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 100.58 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	42.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.88	FEET
AREA OF FLOW =	38.70	SQ.FT.
VELOCITY =	2.60	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	53.91	FEET

Q ACTUAL = 100.64 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.88 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.48 FEET

POND CAPACITY REQUIRED:

(SEDIMENT CAPACITY REQD - SEDIMENT DITCH STORAGE AVAILABLE) = (56.83 - 32.22) = **26.05** AC. FT.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

SPILLWAY DISCHARGE CAPACITY

PROJECT NUMBER: B12-495-1413

CALCS BY: RPC

PROJECT NAME: Facility No. 2 Expansion Plan

CHECKED BY:

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)

REF.: (MESA MANUAL, Pg. 6.136)

WHERE:

COEFFICIENT C =	3
BOTTOM WIDTH L =	32
SIDE SLOPE Z1 =	2
SIDE SLOPE Z2 =	2
SPILLWAY INVERT EL. =	441

REF.: (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

ELEVATION (FEET)	HEAD (FEET)	Q CFS
441	0	0.00
Q (REQUIRED) = 1015 CFS		
442.5	1.5	189.59
443	2	298.68
443.5	2.5	426.91
(2) FREEBOARD		
444.5	3.5	738.60
445	4	921.60
445.5	4.5	1122.60
446	5	1341.64

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.58
BOTTOM WIDTH (ft), b=	32.00
CHANNEL SLOPE (%), So=	0.25
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	1.00
AREA OF FLOW (sq ft), A=	34.00
WETTED PERIMETER (ft), P=	36.47
HYDRAULIC RADIUS (ft), R=	0.93
VELOCITY OF FLOW (fps), V=	4.73
LINING PERIMETER (ft)=	41.47
TOP WIDTH (ft)=	40.47
FREEBOARD (ft)=	1.12
TOTAL DITCH DEPTH (ft), d=	2.12

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.15

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.11

TOTAL STRESS

t (psf) = 0.15
T (lb/ft) = 5.30

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.22
(lb/ft) = 7.96

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}(\tan(d)-So)$$ (psf)= 14.87

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.29

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.51 Tr,t (lb/ft) = 601.74

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

ANCHOR RESISTING STRESS

REMAINING RESISTANCE REQUIRED (psf)= -14.29 (lb/ft) = -593.78

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

Cw= 3.7

W (lbs)= 15.31

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

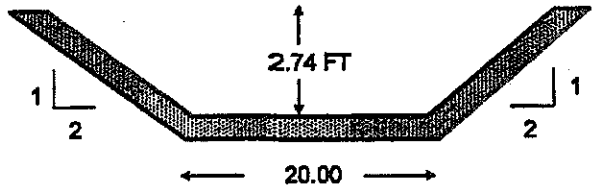
DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

INPUT: ***SPILLWAY SLOPE SECTION***

PEAK FLOW (REQ'D) =	100.58	CFS
BOTTOM WIDTH =	20.00	FT
SIDE SLOPES =	2.00:1	
CHANNEL SLOPE =	0.007	FT/FT
MANNING'S N =	0.015	FT^(1/6)



CHANNEL LINING :
USM

OUTPUT: ***TRAPEZOIDAL DITCH***

STARTING DEPTH = **0.0**
DEPTH OF FLOW = 0.74 FT

WETTED PERIMETER =	23.31	FT
AREA OF FLOW =	15.90	SQ.FT.
HYDRAULIC RADIUS, Rh =	0.68	FT
CALC. VELOCITY =	6.44	FPS
CALC. FLOW =	102.35	CFS

mean depth= 0.69
froude no.= 1.36 *SUPERCRITICAL*

FREEBOARD REQUIRED = 2.00 FT

TOTAL DEPTH = 2.74 FT USE **2.74**
TOTAL WIDTH = **30.96** FT

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.58
BOTTOM WIDTH (ft), b=	20.00
CHANNEL SLOPE (%), So=	0.70
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	0.74
AREA OF FLOW (sq ft), A=	15.90
WETTED PERIMETER (ft), P=	23.31
HYDRAULIC RADIUS (ft), R=	0.68
VELOCITY OF FLOW (fps), V=	6.42
LINING PERIMETER (ft)=	28.43
TOP WIDTH (ft)=	27.54
FREEBOARD (ft)=	1.15
TOTAL DITCH DEPTH (ft), d=	1.89

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.30

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.24

TOTAL STRESS

t (psf) = 0.30
T (lb/ft) = 6.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.45
(lb/ft) = 10.41

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}(\tan(d)-So)$$ (psf)= 14.75

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.18

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.29 Tr,t (lb/ft) = 406.14

ANCHOR RESISTING STRESS

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-485-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

REMAINING RESISTANCE REQUIRED (psf)= -13.84 (lb/ft) = -395.73

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw^{*}H^{*}Gw}{12^{*}Z^{\wedge}.33}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 11.33

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.67

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Culvert C-1

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	C-1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	64.400	64.400	287.84	20.50

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	64.400	0.179	0.000	0.000	87.000	M	287.84	20.503
	Σ	**64.400**						**287.84**	**20.503**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	810.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	964.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
#1	**1**	**Time of Concentration:**					**0.179**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Perimeter Ditch

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	PERIMETER DITCH



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	39.000	39.000	159.35	12.28

Structure Detail:

Structure #1 (Null)

PERIMETER DITCH

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	39.000	0.262	0.000	0.000	87.000	M	159.35	12.275
	Σ	**39.000**						**159.35**	**12.275**

Subwatershed Time of Concentration Details:

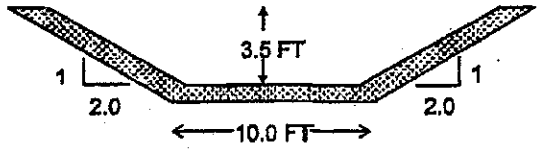
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	810.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	20.20	2,020.00	3.000	0.187
#1	**1**	**Time of Concentration:**					**0.262**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL PERIMETER DITCH

PEAK FLOW =	159.35	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.01	FT/FT
MANNING'S N =	0.045	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	20.43	FT	DEPTH OF FLOW =	2.33	FT
AREA OF FLOW =	34.21	SQ.FT.	MEAN DEPTH =	1.77	FT
HYDRAULIC RADIUS, Rh =	1.67	FT	FROUDE NO. =	0.62	SUBCRITICAL
CALC. VELOCITY =	4.66	FPS			

FREEBOARD REQUIRED =	1.15	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	3.5	FT	**CHANNEL LINING: SOIL AND GRASS**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Temporary Conveyance Ditch

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	TEMP



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	36.800	36.800	74.28	9.20

Structure Detail:

Structure #1 (Null)

TEMP

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	36.800	0.458	0.000	0.000	87.000	M	74.28	9.199
	Σ	**36.800**						**74.28**	**9.199**

Subwatershed Time of Concentration Details:

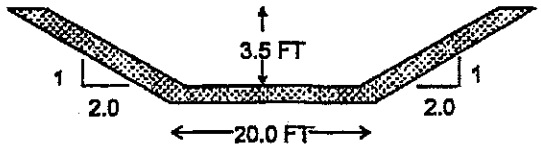
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	29.55	65.00	220.00	16.300	0.003
		8. Large gullies, diversions, and low flowing streams	0.72	30.00	4,164.35	2.540	0.455
#1	**1**	**Time of Concentration:**					**0.458**

CALCULATED BY: RPC 3/6/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

Temporary Conveyance Ditch

PEAK FLOW =	74.28	CFS
BOTTOM WIDTH =	20	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.0075	FT/FT
MANNING'S N =	0.069	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	26.60	FT	DEPTH OF FLOW =	1.48	FT
AREA OF FLOW =	33.87	SQ.FT.	MEAN DEPTH =	1.31	FT
HYDRAULIC RADIUS, Rh =	1.27	FT	FROUDE NO. =	0.34	SUBCRITICAL
CALC. VELOCITY =	2.19	FPS			

FREEBOARD REQUIRED =	2.06	FT	(2+0.025vd^1/3)
TOTAL DEPTH =	**3.5**	FT	**CHANNEL LINING: SOIL AND GRASS**

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Flume

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	FLUME



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	81.200	81.200	328.44	25.57

Structure Detail:

Structure #1 (Null)

FLUME

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	81.200	0.274	0.000	0.000	87.000	M	328.44	25.567
	Σ	**81.200**						**328.44**	**25.567**

Subwatershed Time of Concentration Details:

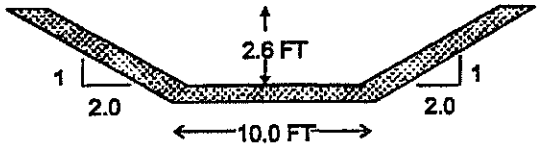
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	20.20	2,021.00	3.000	0.187
		8. Large gullies, diversions, and low flowing streams	25.79	180.00	698.00	15.230	0.012
#1	**1**	**Time of Concentration:**					**0.274**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL FLUME - USM DITCH DESIGN

PEAK FLOW =	328.44	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.33	FT/FT
MANNING'S N =	0.015	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	13.14	FT	DEPTH OF FLOW =	0.70	FT
AREA OF FLOW =	8.02	SQ.FT.	MEAN DEPTH =	0.63	FT
HYDRAULIC RADIUS, Rh =	0.61	FT	FROUDE NO. =	9.12	SUPERCRITICAL
CALC. VELOCITY =	40.94	FPS			

FREEBOARD REQUIRED =	1.91	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	2.6	FT	

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING TYPICAL FLUME

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	328.44
BOTTOM WIDTH (ft), b=	10.00
CHANNEL SLOPE (%), So=	33.00
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	0.63
AREA OF FLOW (sq ft), A=	7.09
WETTED PERIMETER (ft), P=	12.82
HYDRAULIC RADIUS (ft), R=	0.55
VELOCITY OF FLOW (fps), V=	38.36
LINING PERIMETER (ft)=	20.97
TOP WIDTH (ft)=	19.81
FREEBOARD (ft)=	1.82
TOTAL DITCH DEPTH (ft), d=	2.45

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 11.40

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 9.00

TOTAL STRESS

t (psf) = 11.40
T (lb/ft) = 146.08

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 17.09
(lb/ft) = 219.11

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\tan(d)-So\right)$$ (psf)= 6.06

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 4.58

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 5.29 Tr,t (lb/ft) = 110.97

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING TYPICAL FLUME

ANCHOR RESISTING STRESS

REMAINING RESISTANCE REQUIRED (psf)= 11.80 (lb/ft) = 108.14

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= 21.13

USE REBAR SPACING OF 20.00 20 ft MAXIMUM

RESISTANCE PROVIDED (psf)= 13.18

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 9.64

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 4.5 FT SPACING.
SEE ANCHOR BOLT SPACING SHEET FOR CALCULATIONS.

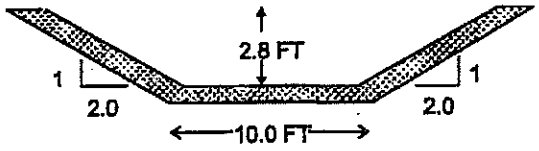
Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL FLUME - GROUTED RIPRAP DITCH DESIGN

PEAK FLOW =	328.44	CFS
BOTTOM WIDTH =	10	FT
SIDE SLOPE 1 =	2.00:1	
SIDE SLOPE 2 =	2.00:1	
CHANNEL SLOPE =	0.33	FT/FT
MANNING'S N =	0.035	FT^(1/6)



OUTPUT:

TRAPEZOIDAL DITCH

WETTED PERIMETER =	15.13	FT	DEPTH OF FLOW =	1.15	FT
AREA OF FLOW =	14.11	SQ.FT.	MEAN DEPTH =	0.97	FT
HYDRAULIC RADIUS, Rh =	0.93	FT	FROUDE NO. =	4.17	SUPERCRITICAL
CALC. VELOCITY =	23.28	FPS			

FREEBOARD REQUIRED =	1.61	FT	(1+0.025vd^1/3)
TOTAL DEPTH =	2.8	FT	

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: Mach No. 1 Mine, Facility No. 2 Expansion Plan

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: ANCHOR BOLT DESIGN

Lined Channel Anchor Bolt Capacity

Case: Cohesionless Soil

Factor	Value
γ = soil weight, PCF	130
Φ = effective angle of soil friction, degrees	33.7
D = Bolt anchorage depth, FT	4
z = trial distance to balance forces	
F_{TX} = Horizontal component of channel tractive force, LB	
α = channel slope, degrees	26.57
$Ka = \tan^2(45° - \Phi/2)$	0.28630
$Kp = \tan^2(45° + \Phi/2)$	3.49281
d = bolt diameter, feet	0.05208

Channel Slope (H:V)	α (degrees)
2 : 1	26.565
2.5 : 1	21.801
3 : 1	18.435
3.5 : 1	15.945
4 : 1	14.036

Bolt Φ (inches)	Bolt Φ (FT)
1/2	0.04167
5/8	0.05208
3/4	0.06250
1	0.08333

Σ Forces x = 0 Trial values, change these only!!

$F_{TX} + (\gamma D^2/2)(Ka-3Kp) + z\gamma D(3Kp-Ka) = 0$

For given D, Compute F_{TX} for trial z distance

$F_T = F_{TX}/\cos\alpha$

D (FT)	Bolt Φ (FT)	Trial z (FT)	F_{TX} (LB)	F_T (LB)	$(\gamma D^2/2)(Ka-3Kp)$	$z\gamma D(3Kp-Ka)$
4	0.05208	1.5	138	154	-552	414
4	0.05208	1.51	135	151	-552	417
4	0.05208	1.52	132	148	-552	420
4	0.05208	1.528	130	146	-552	422
4	**0.05208**	**1.53**	**130**	**145**	**-552**	**422**

Σ Moments = 0 (about bottom of bolt)

$F_{TX} + (\gamma z^2/3)(3Kp-Ka) = (\gamma D^2/6)(3Kp-Ka)$

For given D, use trial z and trial F_{TX} to make ΣM = 0

D (FT)	Bolt Φ (FT)	Trial z (FT)	Trial F_{TX} (LB)	F_T (LB)	$(\gamma z^2/3)(3Kp-Ka)$	$\gamma D^2/6)(3kp-Ka$	Σ M = ?
4	0.05208	1.5	138	154.3	51.8	184.0	5.8
4	0.05208	1.51	135	151.2	52.4	184.0	3.7
4	0.05208	1.52	132	148.1	53.1	184.0	1.6
4	**0.05208**	**1.528**	**130**	**145.7**	**53.7**	**184.0**	**0.0**
4	0.05208	1.53	130	145.0	53.8	184.0	-0.4

ΣFx balanced with ΣM=0 at z = 1.528, F_{TX} = 130 LBS

Notes:

1. F_T and F_{TX} multiplied by bolt Φ to get pounds on bolt
2. If it is impossible to make Σ M = 0, D is too short
3. The above analysis is for anchor bolts driven vertically - if bolts are driven perpendicular to the channel slope, then $F_T = F_{TX}$.

File: Channel Anchor Bolts - 1.xls, hlo, rev. 02/11/2011

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: Mach No. 1 Mine, Facility No. 2 Expansion Plan

PROJECT NO.: B12-495-1413 SHEET _____ OF _____

DESCRIPTION: ANCHOR BOLT SPACING

From Anchor Bolt Design Sheet:

Bolt Capacity = 130 lb / bolt

Bolts per Row = 4

Bolt Capacity = 130 x 4 = 520 lb / row

From Armorform Ditch Lining Sheets:

Typical Flume Ditch
Resistance Required = 108.14 lb / ft

Spacing = (520 / 108.14) = 4.81 ft

Use Bolt Row Spacing = 4.5 ft

Pond No. 1 Spillway Control Section
Resistance Required = 0 lb / ft

Spacing = (520 / 0) = 20.00 ft

Use Bolt Row Spacing = 20 ft (Maximum)

Pond No. 1 Spillway Slope Section
Resistance Required = 0 lb / ft

Spacing = (520 / 0) = 20.00 ft

Use Bolt Row Spacing = 20 ft (Maximum)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/13/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: **Mach No. 1 Mine, Facility No. 2 Expansion Plan**

PROJECT NO.: **B12-495-1413** SHEET 1 OF 1

DESCRIPTION: **Phreatic Line - Pool to Underdrain**
Phase 11 North and East Embankments

Ref: SM Note No. 7, Case V

Transformation Factor = $f_T = (k_y/k_x)^{1/2}$ = 0.3333

k_x = 0.0018 cm/sec
k_y = 0.0002 cm/sec
z_u = 3.00
z_d = 3.50

k_y/k_x = 0.1111

$y_o = (h^2 + d^2)^{1/2} - d$
$a = a_o = y_o/2$

$x_T = (y^2 - y_o^2)/(2y_o)$

$x_T = (f_T)(x_A)$
x_A = x distance on actual section
x_T = x distance on transformed section
y = y distance on both sections

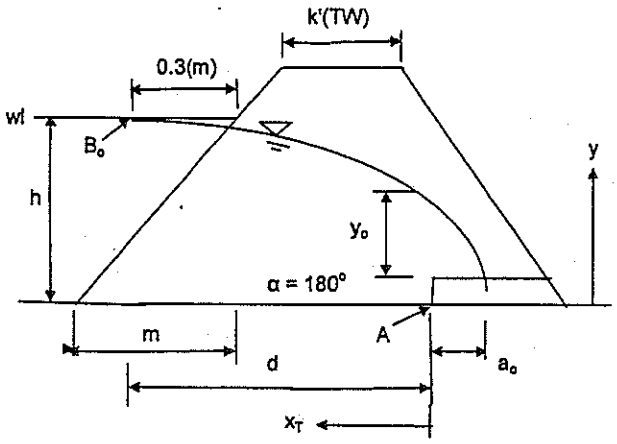
h (ft.)	d (ft.)	m (ft.)	0.3m (ft.)	y_o (ft.)	a_o (ft.)
146.0	146.80	146.00	43.8	60.24	30.12

Phreatic Line Coordinates

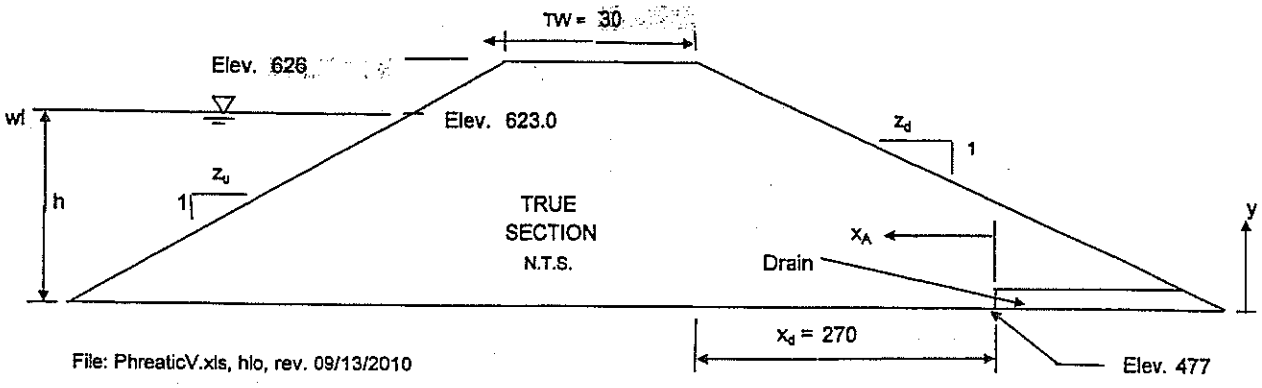
y (ft.)	x_T (ft.)	x_A (ft.)	Elev. (ft)
0.00	-30.12	-90.36	477.00
10.00	-29.29	-87.87	487.00
20.00	-26.80	-80.40	497.00
30.00	-22.65	-67.95	507.00
40.00	-16.84	-50.52	517.00
50.00	-9.37	-28.11	527.00
60.00	-0.24	-0.72	537.00
70.00	10.55	31.65	547.00
80.00	23.00	69.00	557.00
90.00	37.11	111.33	567.00
120.00	89.40	268.19	597.00
146.0	146.80	440.40	623.00

$k' = (k_v k_h)^{1/2}$ = 0.00060 cm/sec = 1.7008 ft/day
$q = k'(h^2)/(2d)$ = 123.4809 ft^3/day/ft = **0.6414** *gpm/ft*

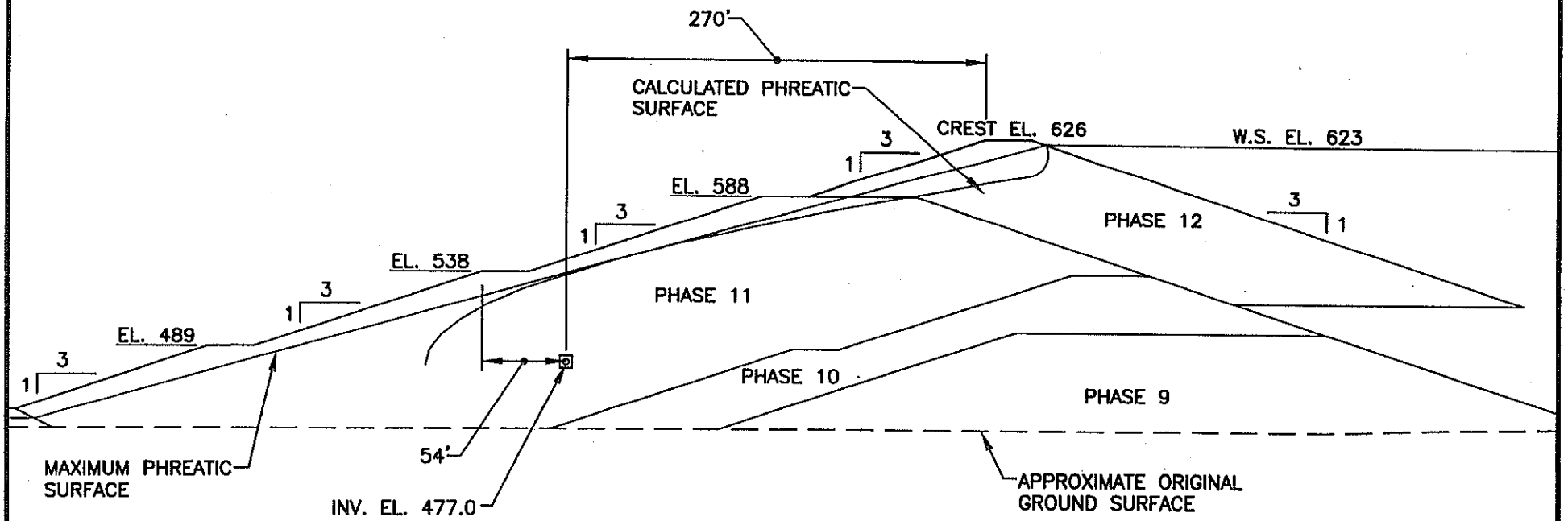
Note: $q = k'(h^2)/(2d)$ when $d < h$; $q = k'y_o$ when $d > h$ and $\alpha > 60°$, SM Note No. 7



TRANSFORMED SECTON
N.T.S.



File: PhreaticV.xls, hlo, rev. 09/13/2010



PHASE 12 SECTION C–C

1"=100'

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

INTERNAL DRAIN DESIGN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
PREPARED FOR
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	RPC	03/10/12
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		
B12-271-A1		

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/13/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: **Mach No. 1 Mine, Facility No. 2 Expansion Plan**

PROJECT NO.: **B12-495-1413** SHEET 1 OF 1

DESCRIPTION: **Phreatic Line - Pool to Underdrain**
Phase 11 South Embankment

Ref: SM Note No. 7, Case V

Transformation Factor = $f_T = (k_y/k_x)^{1/2}$ = 0.3333

k_x = 0.0018 cm/sec
k_y = 0.0002 cm/sec
z_u = 3.00
z_d = 3.80

k_y/k_x = 0.1111

$y_o = (h^2 + d^2)^{1/2} - d$
$a = a_o = y_o/2$

$x_T = (y^2 - y_o^2)/(2y_o)$

$x_T = (f_T)(x_A)$
x_A = x distance on actual section
x_T = x distance on transformed section
y = y distance on both sections

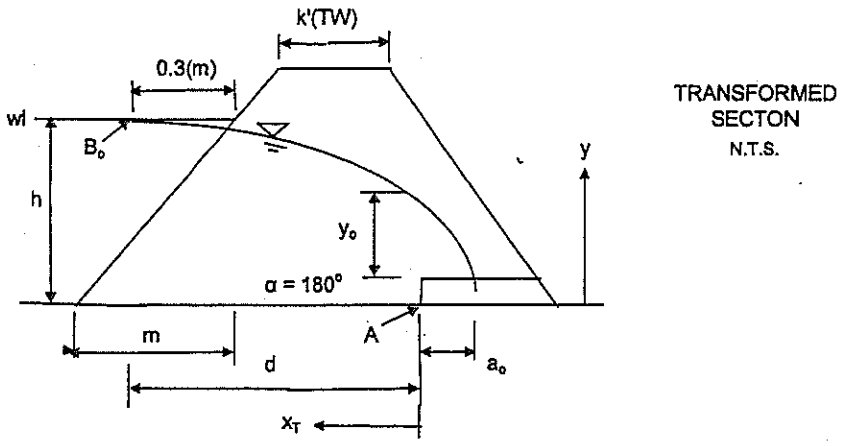
h (ft.)	d (ft.)	m (ft.)	0.3m (ft.)	y_o (ft.)	a_o (ft.)
109.9	112.64	109.90	32.97	44.73	22.37

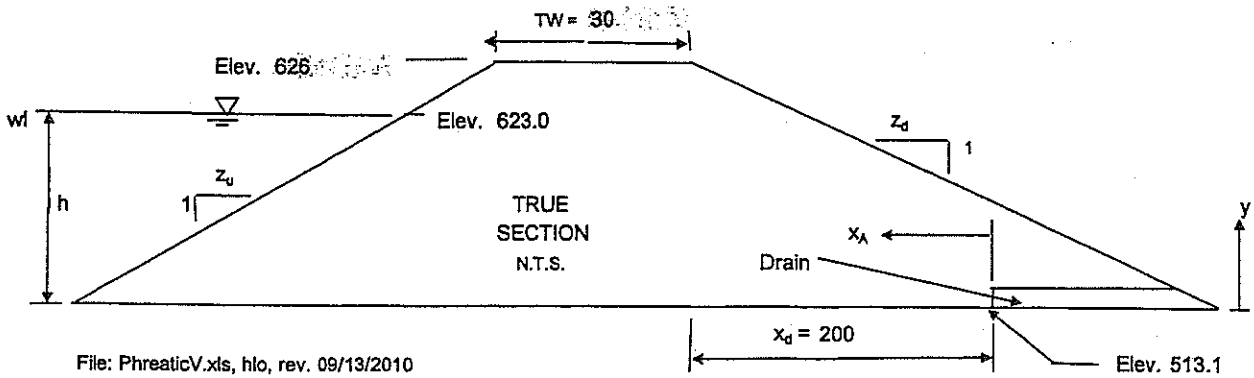
Phreatic Line Coordinates

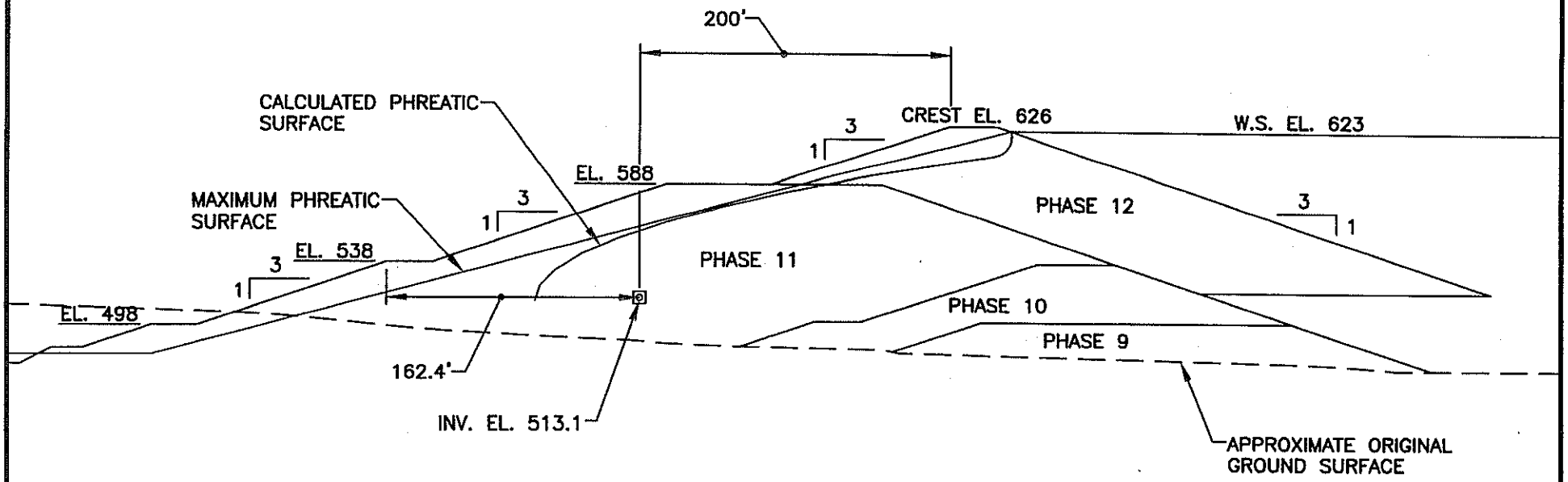
y (ft.)	x_T (ft.)	x_A (ft.)	Elev. (ft)
0.00	-22.37	-67.10	513.10
10.00	-21.25	-63.75	523.10
20.00	-17.90	-53.69	533.10
30.00	-12.31	-36.92	543.10
40.00	-4.48	-13.45	553.10
50.00	5.58	16.73	563.10
60.00	17.87	53.62	573.10
70.00	32.40	97.21	583.10
80.00	49.17	147.51	593.10
90.00	68.17	204.52	603.10
100.00	89.41	268.23	613.10
109.9	112.64	337.91	623.00

$k' = (k_v k_h)^{1/2}$ = 0.00060 cm/sec = 1.7008 ft/day
$q = k'y_o$ = 76.0803 ft^3/day/ft = **0.3952** *gpm/ft*

Note: $q = k'(h^2)/(2d)$ when $d < h$; $q = k'y_o$ when $d > h$ and $\alpha > 60°$, SM Note No. 7







PHASE 12 SECTION D–D

1"=100'

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

INTERNAL DRAIN DESIGN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
PREPARED FOR
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	RPC	03/10/12
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		
B12-271-A2		

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL DRAIN COLLECTION LINES PIPE SIZE AND CAPACITY

For Factor of Safety = 10, Q_{DRAIN} has been multiplied by 10 and the pipe sized according to this flow.

$Q_{PIPE} = \frac{1.486}{n}(AR^{2/3}S_D^{1/2})$ n = 0.015 (aged HDPE)

Ref. : Hydrology and Hydraulic Systems, Table 10.1 Geometric Elements for Circular Section

* Min. Diameter based on Q_{REQ} flowing full. Pipe I.D. based on DR-17 HDPE pipe

Collection lines shall be perforated according to the calculations in Appendix B, and detail drawings in this application.

COLLECTION LINES

Outlet	q (ft^3/d/ft)	Length of pipe/dam, L (ft)	Q_{DRAIN} (ft^3/d) (qxL)	Q_{REQ} (10xQ_{DRAIN})	Q_{REQ} (cfs)	Design Slope (ft/ft)	Pipe Dia.* (Inches)	Pipe O.D. (actual)	Pipe I.D. (actual)	Q_{FULL} (cfs)
1	84.2077	327.8	27,603.28	276,032.84	3.19	0.005	13.841	16	14.005	3.30
2	84.2077	327.8	27,603.28	276,032.84	3.19	0.005	13.841	16	14.005	3.30
3	84.2077	327.8	27,603.28	276,032.84	3.19	0.005	13.841	16	14.005	3.30
4	84.2077	327.8	27,603.28	276,032.84	3.19	0.005	13.841	16	14.005	3.30
5	146.4329	209.5	30,677.69	306,776.93	3.55	0.005	14.400	20	15.755	4.51
6	146.4329	209.5	30,677.69	306,776.93	3.55	0.005	14.400	20	15.755	4.51
7	146.4329	585.6	85,751.11	857,511.06	9.92	0.005	21.172	26	22.758	12.03
8	146.4329	585.6	85,751.11	857,511.06	9.92	0.005	21.172	26	22.758	12.03
9	146.4329	386.5	56,596.32	565,963.16	6.55	0.005	18.118	22	19.256	7.71
10	146.4329	386.5	56,596.32	565,963.16	6.55	0.005	18.118	22	19.256	7.71

Drain lines are to be non-perforated. Outlet drains will daylight on a bench or drainage structure to convey flow and minimize erosion of the embankment slopes.

OUTLET DRAIN LINES

Outlet	q (ft^3/d/ft)	Length of pipe/dam, L (ft)	Q_{DRAIN} (ft^3/d) (qxL)	Q_{REQ} (10xQ_{DRAIN})	Q_{REQ} (cfs)	Design Slope (ft/ft)	Pipe Dia.* (Inches)	Pipe O.D. (actual)	Pipe I.D. (actual)	Q_{FULL} (cfs)
1	84.2077	655.6	55,206.57	552,065.68	6.39	0.055	15.762	16	14.005	10.93
2	84.2077	655.6	55,206.57	552,065.68	6.39	0.055	15.762	16	14.005	10.93
3	84.2077	655.6	55,206.57	552,065.68	6.39	0.055	15.762	16	14.005	10.93
4	84.2077	655.6	55,206.57	552,065.68	6.39	0.055	15.762	16	14.005	10.93
5	146.4329	419.0	61,355.39	613,553.85	7.10	0.082	16.399	20	17.506	24.20
6	146.4329	419.0	61,355.39	613,553.85	7.10	0.082	16.399	20	17.506	24.20
7	146.4329	1,171.2	171,502.21	1,715,022.12	19.85	0.082	24.111	26	22.758	48.73
8	146.4329	1,171.2	171,502.21	1,715,022.12	19.85	0.082	24.111	26	22.758	48.73
9	146.4329	773.0	113,192.63	1,131,926.32	13.10	0.082	20.632	22	19.256	31.21
10	146.4329	773.0	113,192.63	1,131,926.32	13.10	0.082	20.632	22	19.256	31.21

Note: Outlet drain lines convey flow from two collection lines (L is doubled).

PE 3608/3408 IPS HDPE PIPE SIZES

Pressure Rating		DR 17 (100psi)			DR 19 (89psi)			DR 21 (80psi)			DR 26 (65psi)			DR 32.5 (50psi)		
Nominal Size	Actual O.D.	Min. wall	Average I.D.	Weight lb/ft	Min. wall	Average I.D.	Weight lb/ft	Min. wall	Average I.D.	Weight lb/ft	Min. wall	Average I.D.	Weight lb/ft	Min. wall	Average I.D.	Weight lb/ft
3/4"	1.050"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1"	1.315"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 1/4"	1.660"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 1/2"	1.900"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2"	2.375"	0.140"	2.079"	0.429	—	—	—	—	—	—	—	—	—	—	—	—
3"	3.500"	0.206"	3.064"	0.932	—	—	—	—	—	—	—	—	—	—	—	—
4"	4.500"	0.265"	3.939"	1.540	0.237"	3.998"	1.387	0.214"	4.046"	1.262	0.173"	4.133"	1.030	0.138"	4.206"	0.831
5"	5.375"	0.316"	4.705"	2.197	0.283"	4.775"	1.980	0.256"	4.832"	1.801	0.207"	4.937"	1.470	0.165"	5.024"	1.186
5"	5.563"	0.327"	4.869"	2.353	0.293"	4.942"	2.120	0.265"	5.001"	1.929	0.214"	5.109"	1.574	0.171"	5.200"	1.270
6"	6.625"	0.390"	5.799"	3.338	0.349"	5.886"	3.007	0.315"	5.956"	2.736	0.255"	6.085"	2.233	0.204"	6.193"	1.801
7"	7.125"	0.419"	6.236"	3.860	0.375"	6.330"	3.478	0.339"	6.406"	3.165	0.274"	6.544"	2.582	0.219"	6.660"	2.083
8"	8.625"	0.507"	7.549"	5.657	0.454"	7.663"	5.097	0.411"	7.754"	4.637	0.332"	7.922"	3.784	0.265"	8.062"	3.053
10"	10.750"	0.632"	9.409"	8.788	0.566"	9.551"	7.918	0.512"	9.665"	7.204	0.413"	9.873"	5.878	0.331"	10.049"	4.742
12"	12.750"	0.750"	11.160"	12.362	0.671"	11.327"	11.138	0.607"	11.463"	10.134	0.490"	11.710"	8.269	0.392"	11.918"	6.671
14"	14.000"	0.824"	12.254"	14.905	0.737"	12.438"	13.429	0.667"	12.587"	12.218	0.538"	12.858"	9.970	0.431"	13.087"	8.044
16"	16.00"	0.941"	14.005"	19.467	0.842"	14.215"	17.540	0.762"	14.385"	15.959	0.615"	14.695"	13.022	0.492"	14.956"	10.506
18"	18.00"	1.059"	15.755"	24.638	0.947"	15.992"	22.199	0.857"	16.183"	20.198	0.692"	16.532"	16.480	0.554"	16.826"	13.296
20"	20.00"	1.176"	17.506"	30.418	1.053"	17.768"	27.406	0.952"	17.981"	24.936	0.769"	18.369"	20.346	0.615"	18.695"	16.415
22"	22.00"	1.294"	19.256"	36.805	1.158"	19.545"	33.162	1.048"	19.779"	30.172	0.846"	20.206"	24.619	0.677"	20.565"	19.863
24"	24.00"	1.412"	21.007"	43.801	1.263"	21.322"	39.465	1.143"	21.577"	35.907	0.923"	22.043"	29.299	0.738"	22.434"	23.638
26"	26.00"	1.529"	22.758"	51.406	1.368"	23.099"	46.316	1.238"	23.375"	42.141	1.000"	23.880"	34.385	0.800"	24.304"	27.742
28"	28.00"	1.647"	24.508"	59.618	1.474"	24.876"	53.716	1.333"	25.173"	48.874	1.077"	25.717"	39.879	0.862"	26.174"	32.174
30"	30.00"	1.765"	26.259"	68.439	1.579"	26.653"	61.664	1.429"	26.971"	56.105	1.154"	27.554"	45.779	0.923"	28.043"	36.934
32"	32.00"	1.882"	28.009"	77.869	1.684"	28.429"	70.160	1.524"	28.770"	63.835	1.231"	29.391"	52.086	0.985"	29.913"	42.023
34"	34.00"	2.000"	29.760"	87.907	1.789"	30.206"	79.204	1.619"	30.568"	72.064	1.308"	31.228"	58.814	1.046"	31.782"	47.440
36"	36.00"	2.118"	31.511"	98.553	1.895"	31.983"	88.796	1.714"	32.366"	80.791	1.385"	33.065"	65.922	1.108"	33.652"	53.186
42"	42.00"	2.471"	36.762"	134.141	2.211"	37.314"	120.861	2.000"	37.760"	109.966	1.615"	38.575"	89.727	1.292"	39.260"	72.392
48"	48.00"	2.824"	42.014"	175.205	2.526"	42.644"	157.857	2.286"	43.154"	143.629	1.846"	44.086"	117.194	1.477"	44.869"	94.552
54"	54.00"	3.176"	47.266"	222.547	2.842"	47.975"	199.791	2.571"	48.549"	182.298	2.077"	49.597"	148.324	1.662"	50.478"	119.668
63"	62.99"	—	—	—	—	—	—	3.000"	56.631"	247.800	2.423"	57.854"	202.010	1.938"	58.861"	162.980

NOTE:

- Items highlighted in Blue indicates standard stocking items that are more readily available.
- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Service factors should be utilized to compensate for the effect of liquids other than water, and for other temperatures.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths: 40' for 2"-24" / 50' for 26" and larger / Coils available for 3/4"-6"(8" by special order)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL DRAIN COLLECTION LINE PERFORATION SPACING

Calculation to determine number of perforations required for internal drains.

Ref: Soil Mechanics Note No. 3, Soil Mechanics Considerations for Embankment Drains, SCS, USDA, 1971

Aggregate $C_U = D_{60} / D_{10} = 23$ mm / 13 mm = 1.8 <3.0 **OK**
Use 70% perforation flow area reduction

Previous design selected 3/8" dia. holes to prevent aggregate from entering pipe.
For 3/8-inch perforations:

$$A = \frac{\pi(0.03125\ ft)^2}{4} = 0.000767\ ft^2 / hole$$

Two spacings have been designed for the large difference in flowrates.

Design flowrate = Largest flowrate = q = 146.4329 $ft^3/d/ft$
For F.S. = 10, q = 1464.329 $ft^3/d/ft$ = 0.0169483 $ft^3/s/ft$
$q = CAe(2gh)^{1/2}$
$q = 0.6(0.3A)(2x32.2x2)^{1/2}$
$q = 2.0428A$
$A =$ 0.0082966 ft^2

Number of holes required:

$$\frac{0.0082966}{0.000767} = 10.82 \text{ Holes / ft}$$

or 12 Holes / ft

Design: Use 2 rows of 3/8" dia. holes with 6 holes/row at 2" C-C spacing.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL GRAVEL DRAIN CAPACITY

Calculation to check capacity of internal gravel drain.

Use same aggregate as previous underdrain stages.
Aggregate supplied by Freedom Materials, washed river gravel.

3/8" to 1-1/2"
66.7% is 3/8" to 1" 0% < 3/8"
33.3% is 1" to 1-1/2" 0% > 1-1/2"

Underdrain is on a 0.005 ft/ft slope
Aggregate underdrain area = 15.4 ft^2
Aggregate should have a permeability > Gradation No. 15 (See Figure No. 1 and Figure No. C-15)

For hydraulic gradient (i) =0.005

$q/A = 0.38 \times 10^3$ ft/d
$Q =$ 5852 ft^3/d

Check ability of aggregate to admit flow to perforated pipe

Smallest calculated head in Phase8, Section D-D
Calculated phreatic level above drain = 18.22 ft
To center of underdrain h = 17.72 ft
i = 17.72 / 2 = 8.86
For i = 8.86, $(q/A)x10^3 > 4.0$
A = 4 ft x 4(1 ft width) = 16 ft^2 / ft
$Q > (16)(4x10^3) = 64x10^3$ ft^3/d-ft

Max calculated groundflow = 146.43 ft^3/d-ft
$Q = 64x10^3$ ft^3/d-ft > 146.43 ft^3/d-ft

F.S. = $64x10^3$ / 146.43 = 437 > 10 **OK**

Form SCS 130
5-65

4

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

PROJECT and STATE: Project Study No. 101

DESIGNED AT | BY: SML | DATE

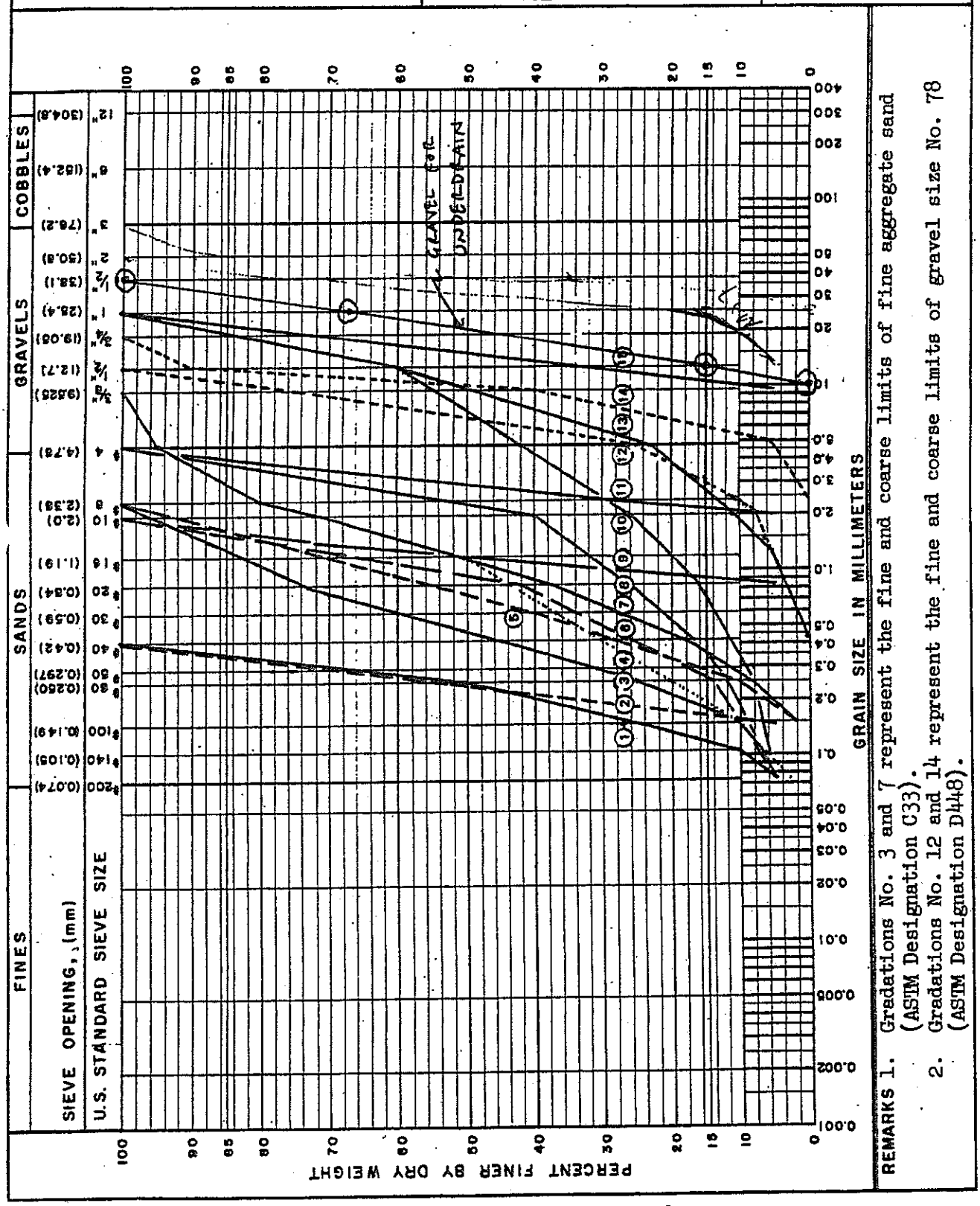
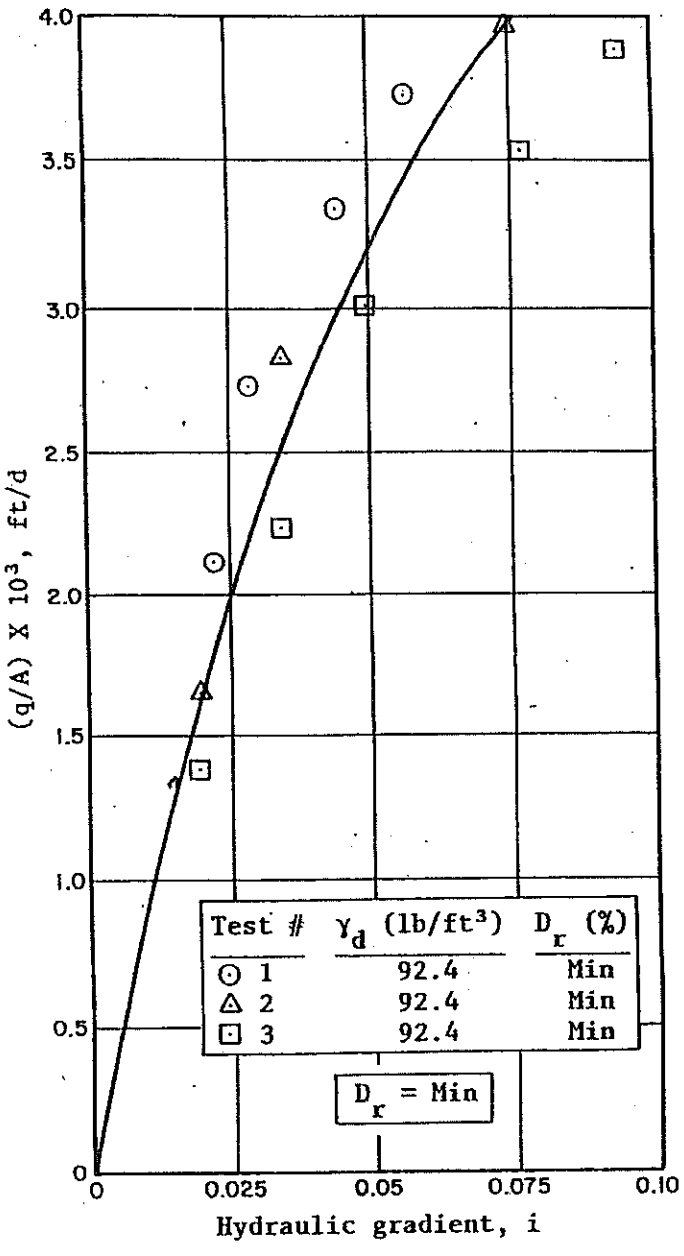
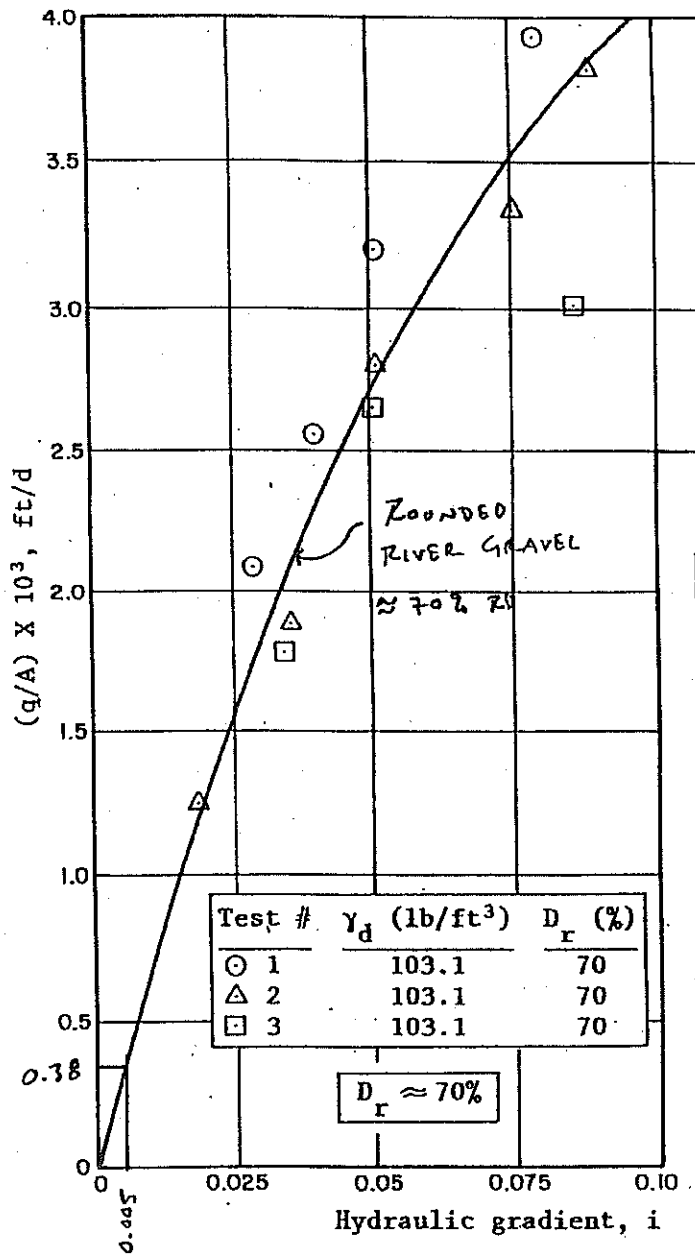


Figure 1. Gradations of sands and gravels tested





GRADATION #15
GP (rounded particles)
C_u = 1.7; C_z = 1.0

Sieve #	% Passing
1"	100
1/2"	34
3/8"	5

Relative Density, D_r
Min γ_d = 92.5 lb/ft³
Max γ_d = 108.7 lb/ft³

Figure C-15. Relationship between q/A and i for Gradation No. 15 (GP, rounded)

U.S. GOVERNMENT PRINTING OFFICE : 1984 0-420-551/SCS-5528

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: FILTER FABRIC PERMITTIVITY AND CLOGGING POTENTIAL

Check ability of fabric to admit flow into the underdrain.

Use GEOTEX 501 (See Manufacturers Data Sheet for Specs)

Required permittivity:

$q = KIA = K(\Delta h/t)A$
$t =$ Thickness of fabric
$\Delta h =$ 17.72 ft
$q =$ 31.0485 $ft^3/d\text{-}ft =$ 0.0003594 $ft^3/s\text{-}ft$
$K/t = \psi =$ Permittivity of fabric
$K/t = \psi = q/(\Delta hA)$

For F.S. = 10 use $10xq = 0.003097\ ft^3/s\text{-}ft$

Required $\psi = \frac{0.003594}{(17.72)(16)} = 0.00000127\ sec^{-1}$

ψ Fabric = $1.4\ sec^{-1} > 1.27x10^{-6}\ sec^{-1}$ OK

Check geotextile clogging potential.

From previous gradation tests on placed CCR:
Smallest d_{85} = 7 mm

Criteria - AOS ≤ d_{85} soil
EOS ≈ AOS = # 70 sieve = 0.210 mm < 7 mm OK

NRCS Criteria - For a nonwoven geotextile:
AOS ≤ # 40 sieve (# 70 Provided)
$\psi > 0.7\ sec^{-1}$ ($1.4\ sec^{-1}$ Provided)

Geotextile meets both criteria

GEOTEX®
BY PROPEX

Product Data
GEOTEX® 501

GEOTEX® 501 is a polypropylene, staple fiber, needlepunched nonwoven geotextile produced by Propex, and will meet the following Minimum Average Roll Values (MARV) when tested in accordance with the methods listed below. The fibers are needled to form a stable network that retains dimensional stability relative to each other. The geotextile is resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.

GEOTEX 501 conforms to the property values listed below[1]. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). This product is NTPEP approved for AASHTO standards.

		MARV[2]	
PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
MECHANICAL			
Tensile Strength (Grab)	ASTM D-4632	150 lbs	667 N
Elongation	ASTM D-4632	50%	50%
CBR Puncture	ASTM D-6241	360 lbs	1602 N
Trapezoidal Tear	ASTM D-4533	60 lbs	267 N
ENDURANCE			
UV Resistance % Retained at 500 hrs	ASTM D-4355	70%	70%
HYDRAULIC			
Apparent Opening Size (AOS)[3]	ASTM D-4751	70 US Std. Sieve	0.212 mm
Permittivity	ASTM D-4491	1.4 sec^{-1}	1.4 sec^{-1}
Water Flow Rate	ASTM D-4491	115 gpm/ft^2	4686 $l/min/m^2$
ROLL SIZES		15 ft x 360 ft	4.57 m x 109.8 m

NOTES:
1. The property values listed above are effective 04/2011 and are subject to change without notice.
2. Values shown are in weaker principal direction. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum average roll value.

Propex™ Geotextile Systems

TESTED. PROVEN. TRUSTED.
www.geotextile.com

Propex Operating Company, LLC · 6025 Lee Highway, Suite 425 · PO Box 22788 · Chattanooga, TN 37422

ph 423 899 0444 · ph 800 621 1273 · fax 423 899 7619

Geotex®, Landlok®, Pyramat®, X3®, SuperGro®, Petromat® and Petrotac® are registered trademarks of Propex Operating Company, LLC.

This publication should not be construed as engineering advice. While information contained in this publication is accurate to the best of our knowledge, Propex does not warrant its accuracy or completeness. The ultimate customer and user of the products should assume sole responsibility for the final determination of the suitability of the information and the products for the contemplated and actual use. The only warranty made by Propex for its products is set forth in our product data sheets for the product, or such other written warranty as might be agreed by Propex and individual customers. Propex specifically disclaims all other warranties, express or implied, including without limitation, warranties of merchantability or fitness for a particular purpose, or arising from provision of samples, a course of dealing or usage of trade.

© 2011 Propex Operating Company, LLC

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 2
DESCRIPTION: INTERNAL DRAIN AND DECANT PIPE STRUCTURAL DESIGN

Calculation to show the DR-17 HDPE Internal Drain Pipe and decant pipe is capable of sustaining the proposed cover loading.

Reference: Performance Pipe Design Manual, Ch. 7 - Buried Piped Design

Max proposed cover = 69 ft (Section H-H)

Unit Wt. of Material = 130 pcf

Pipe wall compressive stress:

$$S = \frac{P_T D_O}{288t}$$

Where:
S = Pipe wall compressive stress, lb/in^2
P_T = Vertical load applied to pipe, lb/ft^2
D_O = Pipe outside diameter, inches
t = Pipe wall thickness, inches

$P_T = 85 \times 130 =$ 8,970 psf = 62.29 psi

D_O	t	S
10	0.632	492.81
12	0.750	498.33
14	0.824	529.18
16	0.941	529.58
18	1.059	529.39
20	1.176	529.69
22	1.294	529.53
24	1.412	529.39
26	1.529	529.62

Highest compressive stress (S) = 529.69 psi, which is less than 800 psi (allowable according to manufacturer), therefore the DR-17 HDPE pipe will be resist the compressive stress of the backfill.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY:	RPC	DATE:	2/14/2012	CHKD. BY:	DATE:
PROJECT NAME:	MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN				
PROJECT NUMBER:	B12-495-1413	SHEET	2	OF	2
DESCRIPTION:	INTERNAL DRAIN AND DECANT PIPE STRUCTURAL DESIGN				

Calculation to check constrained pipe wall buckling for DR-17 HPDE.

$P_{wc} = 5.65[RB'E'(E/(12(DR-1)^3)]]^{1/2}$

Where:

- P_{wc} = Allowable constrained buckling pressure, psi
- R = Bouyancy reduction factor
- H' = groundwater height above pipe, ft
- H = Cover above pipe, ft
- B' = Elastic support factor
- E' = Soil reaction modulus, psi (Table 7-7)
- E = Elastic modulus, psi (Table 1, 50 yr @ 73°F)
- ΔX = Horizontal Deflection, inches
- D_1 = Inside Diameter, inches
- P_T = Vertical load applied to pipe, lb/ft²
- K = Bedding factor
- L = Deflection lag factor

$R = 1 - 0.33(H'/H)$

H' =	27.35	ft		
H =	69	ft		
R =	0.869			

$B' = 1 / (1 + 4e^{(-0.065xH)})$

B' =	0.957			
E' =	3,000	psi		
E =	28,200	psi		
P_T =	8,970	psf =	62.29	psi
DR =	17			

P_{wc} = 213.77 psi

$$\text{Factor of Safety} = \frac{P_{wc}}{P_T} = \frac{213.77}{62.29}$$

F.S. = 3.43

Calculation to check ring deflection.

$$\frac{\Delta X}{D_1} = \frac{P_T}{144} \cdot \frac{KL}{2E/3(1/DR-1)^3+0.061E'}$$

Where: K = 0.1, L = 1.5

$\frac{\Delta X}{D_1}$ = 5.0% ≤ 5% (Allowable)

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

www.performancepipe.com

The modulus is selected using the same criteria used for determining the stress in the pipe wall due to the thermal change. The applicability of Euler's equation for any specific pipeline calculation must be evaluated. For pipe installed on top of a surface (i.e. the ground, a pipe rack) pipe and fluid weight in the pipe and frictional forces increase the critical thrust force whereas in aerial applications weight and initial curvature due to deflection reduce the critical thrust force.

While the amount of length change experienced by polyethylene pipe during thermal changes is greater than many other materials, the amount of force required to restrain the movement is less because of its lower modulus of elasticity.

Table 1 Typical Elastic Modulus for DriscoPlex® PE 3608

Load Duration	*Elastic Modulus†, 1000 psi (MPa), at Temperature, °F (°C)*							
	-20 (-29)	*0 (-18)*	*40 (4)*	*60 (16)*	*73 (23)*	*100 (38)*	*120 (49)*	*140 (60)*
Short-Term	300.0 (2069)	260.0 (1793)	170.0 (1172)	130.0 (896)	110.0 (758)	100.0 (690)	65.0 (448)	50.0 (345)
10 h	140.8 (971)	122.0 (841)	79.8 (550)	61.0 (421)	57.5 (396)	46.9 (323)	30.5 (210)	23.5 (162)
100 h	125.4 (865)	108.7 (749)	71.0 (490)	54.3 (374)	51.2 (353)	41.8 (288)	27.2 (188)	20.9 (144)
1000 h	107.0 (738)	92.8 (640)	60.7 (419)	46.4 (320)	43.7 (301)	35.7 (246)	23.2 (160)	17.8 (123)
1 y	93.0 (641)	80.6 (556)	52.7 (363)	40.3 (278)	38.0 (262)	31.0 (214)	20.2 (139)	15.5 (107)
10 y	77.4 (534)	67.1 (463)	43.9 (303)	33.5 (231)	31.6 (218)	25.8 (178)	16.8 (116)	12.9 (89)
50 y	69.1 (476)	59.9 (413)	39.1 (270)	29.9 (206)	28.2 (194)	23.0 (159)	15.0 (103)	11.5 (79)

† Typical values based on ASTM D 638 testing of molded plaque material specimens.
Modulus values for PE4710 are under development.

Controlling Expansion and Contraction

Black polyethylene pipe on the surface or above grade and exposed to the sun can absorb solar energy. The resulting pipe temperatures can be greater than the air temperature. To help reduce temperature changes resulting solar heating of a piping system, the pipe may be shaded or placed in a location that receives less direct sunlight.

The effects of thermal expansion and contraction on a piping system can be controlled in several ways, including

- Lateral deflection expansion loops (snaking the pipe)
- Anchor and guide the pipe
- Conventional Expansion loops
- Expansion joints (non-pressures systems only)
- Burying pipes

March 2007 Supersedes all previous publications
© 2007 Chevron Phillips Chemical Company LP

Performance Pipe, a division of
Chevron Phillips Chemical Company LP
PO Box 269006
Plano, TX 75026-9066
Phone: 800-527-0662
Fax: 972-599-7348

Table 7-7 Bureau of Reclamation Average E' Values for Iowa Formula (Initial Deflection)

Soil type – pipe bedding material (Unified Classification)†	*E' for Degree of Bedding Compaction, lb/in²*			
	Dumped	*Slight (<85% Proctor <40% relative density)*	*Moderate (48%-95% Proctor 40%-70% relative density)*	*High (>95% Proctor >70% relative density)*
Fine-grained soils (LL>50)‡ Soils with medium to high plasticity CH, MH, CH-MH	No data available; consult a competent soils engineer; otherwise, use E' = 0.			
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with <25% coarse grained particles	50	200	400	1000
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with >25% coarse grained particles Coarse-grained soils with fines GM, GC, SM, SC◊ contains >12% fines	100	400	1000	2000
Coarse-grained soils with little or no fines GW, GP, SW, SP◊ contains <12% fines	200	1000	2000	3000
Crushed rock	1000	3000	3000	3000
Accuracy in terms of percentage deflection▼	±2%	±2%	±1%	±0.5%

† ASTM D 2487; USBR Designation E-3. ‡ LL = Liquid limit. ◊ Or any borderline soil beginning with one of these symbols, i.e., GM-GC, GC-SC. ▼ For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note – Values applicable only for fills less than 50 ft (15 m). No safety factor included in table values. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If bedding falls on the borderline between two compaction categories, select the lower E' value or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/ft^3 (598,000 J/m^2) (ASTM D 698, AASHTO T-99, USBR Designation E-11). 1 lb/in^2 = 6.895 kPa.

Table 7-8 Duncan-Hartley Soil Reaction Modulus

Type of Soil	Depth of Cover, ft	E' for Standard AASHTO Relative Compaction, lb.in²			
		85%	90%	95%	100%
Fine-grained soils with <25% sand content (CL, ML, CL-ML)	0-5	500	700	1000	1500
	5-10	600	1000	1400	2000
	10-15	700	1200	1600	2300
	15-20	800	1300	1800	2600
Coarse-grained soils with fines (SM, SC)	0-5	600	1000	1200	1900
	5-10	900	1400	1800	2700
	10-15	1000	1500	2100	3200
	15-20	1100	1600	1400	3700
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	0-5	700	1000	1600	2500
	5-10	1000	1500	2200	3300
	10-15	1050	1600	2400	3600
	15-20	1100	1700	2500	3800

©2003 Chevron Phillips Chemical Company LP

DRAINAGE SOLUTIONS, INC
SUPPLIER DISTRIBUTOR



(317) 346-4110

View Cart Checkout
Amount in Cart: $0.00

Search

Advanced Search

Categories

Animal Guards
Bar Guard Intake
Drains & Grates
Mitered Drains
Emitters
Grates - Brass
Grates - Chrome
Grates - Metal
Grates & Covers - Plastic
6" Catch Basins & Grates
9" Catch Basins & Grates
12" Catch Basins & Grates
18" Catch Basins & Grates
24" Catch Basins & Grates
Trench Drain
NDS Dura Slope Channel Drain 6"
NDS Micro Channel Drain 1 1/4"
NDS Mini Channel Drain 3"
NDS Spee-D Channel Drain 4"
NDS Pro Series Channel Drain 3"
NDS Pro Series Channel Drain 5"
NDS Pro Series Channel Drain 8"
NDS Pro Series Channel Drain 12"
Anti-Seep Collars
Biobarrier
Duckbill Earth Anchors
Fittings-Brass
Fittings-Corrugated-Singlewall
2" Singlewall
3" Singlewall
4" Singlewall
5" Singlewall
Singlewall
Singlewall
Fittings-Downspout Adapters
Fittings-Flexible

Search Results

Found **29** product(s) for **Animal Guards** (1-25 of 29)

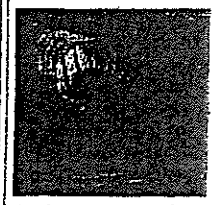
Animal Guards



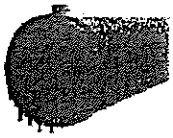
Animal Guard 4" (Polypropylene)
Price: **$5.88**
Add to Cart | Buy it Now!



Animal Guard 4" (Stainless Steel)
Price: **$10.93**
Add to Cart | Buy it Now!



Animal Guard 4" (Zinc Coated)
Price: **$7.79**
Add to Cart | Buy it Now!



Animal Guard 6" (Band Type)
Price: **$21.26**
Add to Cart | Buy it Now!



Animal Guard 6" (Polypropylene)
Price: **$6.83**
Add to Cart | Buy it Now!



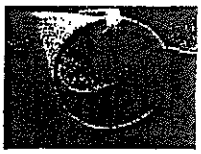
Animal Guard 6" (Stainless Steel)
Price: **$12.98**
Add to Cart | Buy it Now!



Animal Guard 6" (Zinc Coated)
Price: **$8.47**
Add to Cart | Buy it Now!



Animal Guard 8" (Band Type)
Price: **$27.15**
Add to Cart | Buy it Now!



Animal Guard 8" (Polypropylene)
Price: **$8.90**
Add to Cart | Buy it Now!

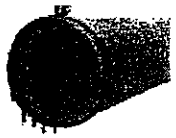
Fittings-Hickenbottom Intakes
Fittings-PVC DWV
1 1/2" DWV
2" DWV
2 1/2" DWV
3" DWV
4" DWV
6" DWV
8" DWV
10" DWV
12" DWV
Fittings-PVC Repair
1/2" S/40 Repair
3/4" S/40 Repair
1" S/40 Repair
1 1/4" S/40 Repair
1 1/2" S/40 Repair
2" S/40 Repair
2 1/2" S/40 Repair
3" S/40 Repair
4" S/40 Repair
6" S/40 Repair
8" S/40 Repair
Fittings-PVC Schedule 40
1/8"
1/4"
3/8"
1/2"
3/4"
1"
1 1/4"
1 1/2"
2"
2 1/2"
3"
4"
6"
8"
Fittings-PVC Schedule 80
1/4" Pressure
3/8" Pressure
1/2" Pressure
1" Pressure
1 1/4" Pressure
3/4" Pressure
1 1/2" Pressure
2" Pressure
2 1/2" Pressure
3" Pressure
4" Pressure
5" Pressure
6" Pressure
8" Pressure
Fittings-PVC SDR35
3" Solvent Weld
4" Solvent Weld
6" Solvent Weld
8" Solvent Weld
10" Solvent Weld
12" Solvent Weld
15" Solvent Weld
Fittings-Quick Connect
1/2" Cam & Groove
3/4" Cam & Groove
1" Cam & Groove
1/4" Cam & Groove
1/2" Cam & Groove
2" Cam & Groove
2 1/2" Cam & Groove
3" Cam & Groove



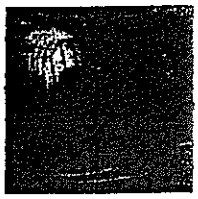
Animal Guard 8" (Stainless Steel)
Price: **$16.33**
Add to Cart | Buy it Now!



Animal Guard 8" (Zinc Coated)
Price: **$10.27**
Add to Cart | Buy it Now!



Animal Guard 10" (Band Type)
Price: **$30.47**
Add to Cart | Buy it Now!



Animal Guard 10" (Zinc Coated)
Price: **$13.51**
Add to Cart | Buy it Now!



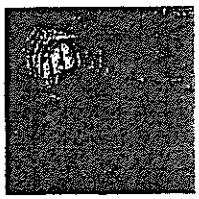
Animal Guard 10"(Stainless Steel)
Price: **$25.16**
Add to Cart | Buy it Now!



Animal Guard 12" (Band Type)
Price: **$37.74**
Add to Cart | Buy it Now!



Animal Guard 12" (Stainless Steel)
Price: **$38.83**
Add to Cart | Buy it Now!



Animal Guard 12" (Zinc Coated)
Price: **$20.28**
Add to Cart | Buy it Now!



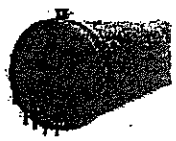
Animal Guard 15" (Band Type)
Price: **$53.27**
Add to Cart | Buy it Now!



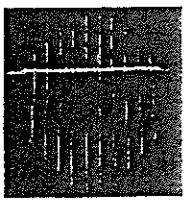
Animal Guard 15" (Stainless Steel)
Price: **$70.42**
Add to Cart | Buy it Now!

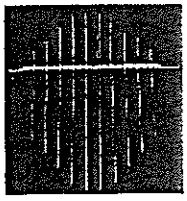


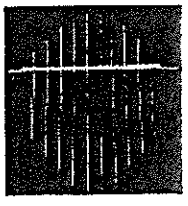
Animal Guard 15" (Zinc Coated)
Price: **$37.58**
Add to Cart | Buy it Now!



Animal Guard 18" (Band Type)
Price: **$84.60**
Add to Cart | Buy it Now!







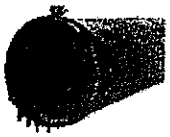
- 4" Cam & Groove
- 5" Cam & Groove
- 6" Cam & Groove
- 8" Cam & Groove
- 10" Cam & Groove
- 2" Cam & Groove
- ittings-QwikSeal
- Flo-Well
- Grass & Gravel Pavers
- Inlet Protection
  - Bags
  - Coir Mats
  - Dandy Products
  - Dewatering Bags
  - Drain Guards
  - Snout
- Landscape Supplies
  - Staples & Geopins
- New
- Septic & Sewer Accessories
  - Covers
  - Disconnects - Pump
  - Plugs
  - Valves
- Stealth Products
- Tools
  - Knives & Saws
  - Marking Products
  - Pipe Cutters
  - Ratchets
  - Shovels
  - Shrink Wrap
  - Staplers
  - Tapes
- Valve Box
  - Round 6"
  - ound 10"
  - ectangular 13" x 20"
  - Rectangular 13" x 24"
  - Rectangular 14" x 19"
- Valves- Lab
- Valves-Backwater
- Valves-Ball - Compact
- Valves-Ball Valves - Single Entry
- Valves-Ball Valves - True Union
- Valves-Flap Gates
- Valves-Septic
- Valves-Sewer
- Valves-Swing Check
- Valves-Valterra Gate

Items in your cart
Empty

Animal Guard 18" (Stainless Steel)
Price: **$90.24**
Add to Cart | Buy it Now!

Animal Guard 18" (Zinc Coated)
Price: **$69.75**
Add to Cart | Buy it Now!

Animal Guard 21" (Zinc Coated)
Price: **$73.61**
Add to Cart | Buy it Now!



Animal Guard 24" (Band Type)
Price: **$150.21**
Add to Cart | Buy it Now!

Pages: 1 2

ProStores

Copyright © 2011 THE DRAINAGE PRODUCTS STORE. All Rights Reserved.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 11/21/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: Hydrologic Design Parameters and Required Pump Capacity

Design Rainfall

The design rainfall is one PMF based on a 72-hour PMP of 41", to be stored and 90% evacuated in 10 days or less by pumps for all phases of construction until the decant pipes are installed and active.
The PMF volume and required pump capacity for each Phase is as follows:

72-hour PMF rainfall = 41"
Runoff Curve Number = 100

PMF Volume = (41")(1 ft/12in)(Drainage Area(Ac.))(43560sf/Ac.)

Phase	Drainage Area (Ac)	PMF Vol. (ft^3)	90% PMF Vol. (ft^3)	90% PMF Vol. (gal)	Req. Pump Rate (gpd)	Pump Rate (gpm)
7	80.29	11,949,561	10,754,604.63	80,444,442.63	8,044,444.26	5,586.42
5A	30.86	4,592,894	4,133,604.42	30,919,361.06	3,091,936.11	2,147.18
2A	40.80	6,072,264	5,465,037.60	40,878,481.25	4,087,848.12	2,838.78
8	105.45	15,694,124	14,124,711.15	105,652,839.40	10,565,283.94	7,337.00
9	118.15	17,584,265	15,825,838.05	118,377,268.61	11,837,726.86	8,220.64
10	123.78	18,422,177	16,579,959.66	124,018,098.26	12,401,809.83	8,612.37
11	157.90	23500257	21,150,231.300	158,203,730.12	15,820,373.01	10,986.37
12	126.50	18826995	16,944,295.500	126,743,330.34	12,674,333.03	8,801.62

Design Pumping Capability

The required pump capacity will be maintained onsite at all times. The critical pump rate occurs when Phase 10 is complete and the fines will be 55 feet below the completed Phase 10 crest , and Phases 2A, 5A, and 7 will still require individual pumping rates. To achieve the required pump rate after a design storm, the pumps will be lowered to 10 feet above the pool. The diesel powered pumps designed for storm evacuation requirements are:

The required pump capacity at the critical time for Phases 2A, 5A, and 7 is:

Model	Size (in)	Capacity (gpm)	Quantity
Godwin DPC300	12	4,012	2
Godwin CD150M	6	1,915	1
Godwin CD100M	4	716	1

Total Capacity (gpm)	10,655

10,655 gpm > 10,573 gpm required for Phases 2A, 5A, and 7.

The required pump capacity at the critical time for Facility No. 3 is:

Model	Size (in)	Capacity (gpm)	Quantity
Godwin DPC300	12	3,609	1
Godwin CD150M	6	1,800	3
Godwin CD100M	4	614	0

Total Capacity (gpm)	9,009

9,009 gpm > 8,612 gpm required for Phase 10.

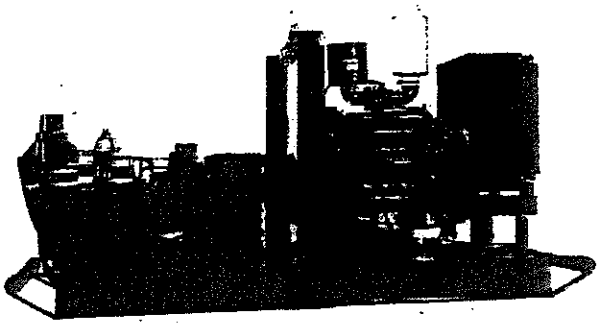
Note: Number of each type of pump is also based on existing onsite pump capacity. Mach may use any combination of these pumps to achieve the required pump rate.

DPC300 Dri-Prime Pump

The Godwin Dri-Prime DPC300 pump offers flow rates to 5,062 USGPM and discharge heads to 110' (34m). Also it has the capability of handling solids up to 4" (95mm) in diameter.

The DPC300 is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the DPC300 the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close-coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 4" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine John Deere 6068HF285. Also available with Caterpillar C6.6E.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 1976grbw 4 hardness to 200 hb brinell.

Specifications

Suction connection	12" 125# ANSI B16.1
Delivery connection	12" 125# ANSI B16.1
Max capacity	5062 USGPM
Max head	110' (34m)
Max solids handling	4" (95mm)
Max impeller diameter	17" (430mm)
Max operating temp	176°F (80°C)
Max working pressure	50.8 psi (3.5 bar)
Max suction pressure	29.0 psi (2.0 bar)
Max casing pressure	59.5 psi (4.1 bar)
Max operating speed	1200 rpm

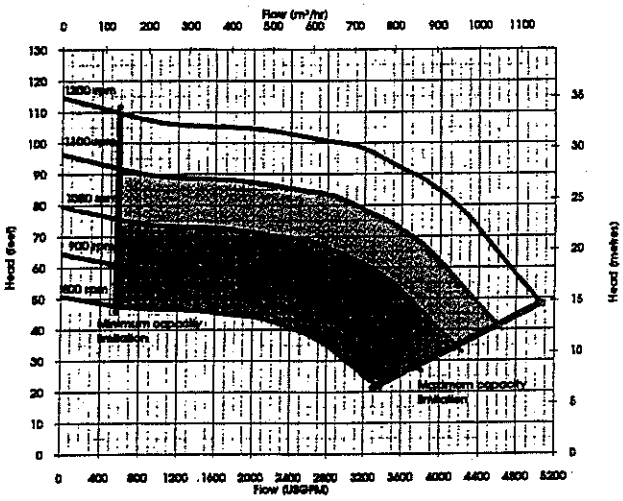
godwin
a xylem brand

Reference number : 95-1017-3000
Date of issue : August 25. 2011
Issue : 1

Please contact Godwin for further details.
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

DPC300

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS1452:1990 grade 220
Wearplates	Cast iron to BS1452 grade 220
Pump shaft	Carbon steel BS970-3:1991 080M40
Impeller	Cast steel BS3100 1976GRBW 4 hardness to 200 HB Brinell
Non-return valve body	Cast iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1 [redacted]

John Deere, 6068HF285, 155.4 HP @ 2200 rpm

Impeller diameter 17 " (430 mm)

Pump Speed 1100 rpm

Suction Lift Table

Total Suction Head (')	Total Delivery Head (') 24	36	47	59	70
	Output (USGPM)				
9.8	4606	4321	4012	3609	2849
15.1	4511	4178	3799	3229	950
20.0	4036	3561	2849	1899	712
24.9	2137	1899	1424	950	-

Fuel capacity (Full) 150 US Gal, (Usable) 150 US Gal

Fuel consumption @ 2200 rpm BEP 6.8 US Gal/hr

Weight: (Dry) 5,128 lbs, (Wet) 6,352 lbs

Dimensions: (L) 145" x (W) 53" x (H) 71"

Engine option 2 [redacted]

Caterpillar, C6.6E, 142.1 HP @ 2000 rpm

Impeller diameter 17 " (430 mm)

Pump Speed 1000 rpm

Suction Lift Table

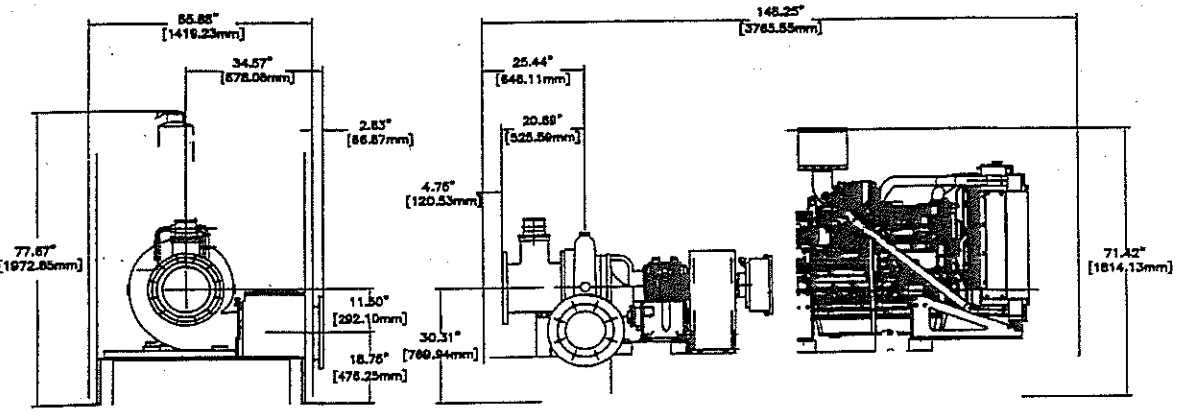
Total Suction Head (')	Total Delivery Head (') 9	19	28	38	47
	Output (USGPM)				
9.8	4187	3928	3647	3281	2590
15.1	4101	3799	3453	2935	863
20.0	3669	3237	2590	1727	647
24.9	1942	1727	1295	863	-

Fuel capacity (Full) 150 US Gal, (Usable) 150 US Gal

Fuel consumption @ 2000 rpm BEP 5.6 US Gal/hr

Weight: (Dry) 4,903 lbs, (Wet) 6,112 lbs

Dimensions: (L) 145" x (W) 53" x (H) 71"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1017-3000

Date of issue : August 25, 2011

Issue : 1

godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwinpumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

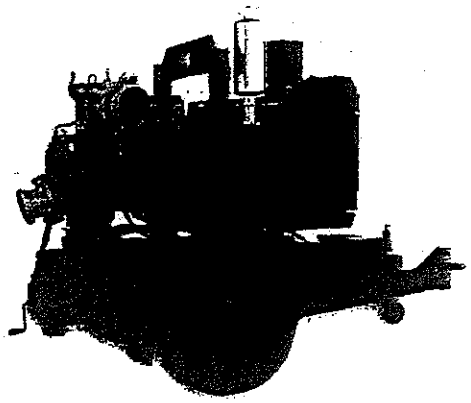
CD150M

CD150M Dri-Prime Pump

The Godwin Dri-Prime CD150M pump offers flow rates to 2,277 USGPM and discharge heads to 154' (47m). Also it has the capability of handling solids up to 3" (75mm) in diameter.

The CD150M is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the CD150M the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close-coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 3" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine John Deere 4045TF280. Also available with Caterpillar C4.4M-T.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 a5 hardness to 200 hb brinell.

Specifications

Suction connection	6" 125# ANSI B16.1
Delivery connection	6" 125# ANSI B16.1
Max capacity	2277 USGPM
Max head	154' (47m)
Max solids handling	3" (75mm)
Max impeller diameter	11" (280mm)
Max operating temp	176°F (80°C)
Max working pressure	69.6 psi (4.8 bar)
Max suction pressure	58.0 psi (4.0 bar)
Max casing pressure	104.4 psi (7.2 bar)
Max operating speed	2200 rpm

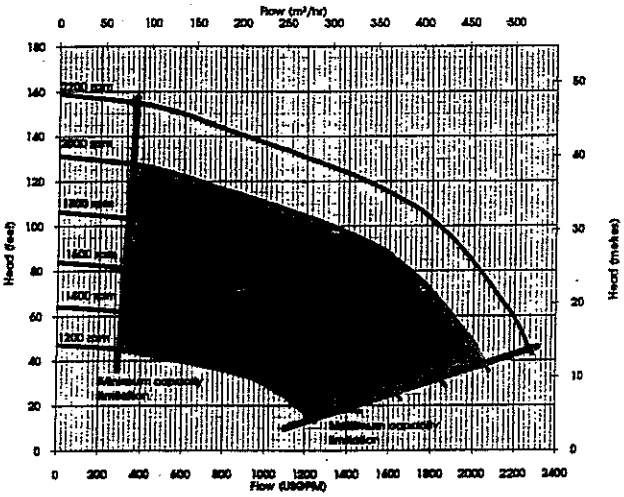
godwin
a xylem brand

Please contact Godwin for further details
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

Reference number : 95-1011-3000
Date of issue : August 25, 2011
Issue : 1

CD150M

Performance Curve



Materials

Pump casing & suction cover	Cast Iron BS1452:1990 grade 220
Wearplates	Cast Iron to BS1452 grade 220
Pump shaft	Carbon steel BS970 080M40
Impeller	Cast steel BS3100 A5 hardness to 200 HB Brinell
Non-return valve body	Cast Iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

John Deere, 4045TF280, 68.3 HP @ 2000 rpm

Impeller diameter 11 " (280 mm)

Suction Lift Table

Total Suction Head (')	Total Delivery Head (') 23	36	49	66	112
	Output (USGPM)				
9.8	2083	2008	1915	1739	550
15.1	2008	1964	1876	1655	440
20.0	1893	1849	1805	1611	374
24.9	1761	1717	1651	1567	-

Fuel capacity (Full) 60 US Gal, (Usable) 60 US Gal

Fuel consumption @ 2000 rpm BEP 3.4 US Gal/hr

Weight: (Dry) 2,840 lbs, (Wet) 3,340 lbs

Dimensions: (L) 118" x (W) 66" x (H) 72"

Engine option 2

Caterpillar, C4.4M-T, 69.7 HP @ 2000 rpm

Impeller diameter 11 " (280 mm)

Suction Lift Table

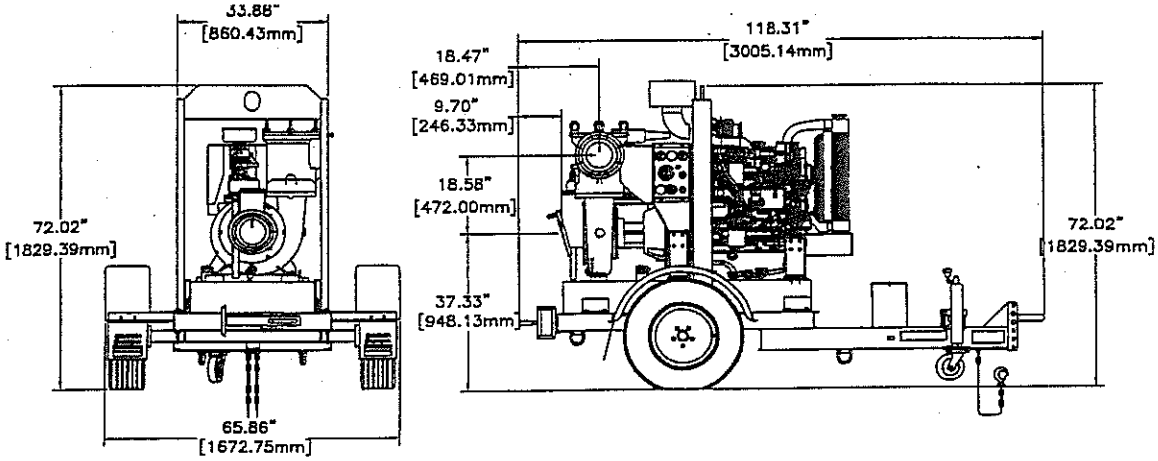
Total Suction Head (')	Total Delivery Head (') 23	36	49	66	112
	Output (USGPM)				
9.8	2083	2008	1915	1739	550
15.1	2008	1964	1876	1655	440
20.0	1893	1849	1805	1611	374
24.9	1761	1717	1651	1567	-

Fuel capacity (Full) 60 US Gal, (Usable) 60 US Gal

Fuel consumption @ 2000 rpm BEP 3.4 US Gal/hr

Weight: (Dry) 3,148 lbs, (Wet) 3,614 lbs

Dimensions: (L) 118" x (W) 66" x (H) 72"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1011-3000

Date of issue : August 25, 2011

Issue : 1

godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwinpumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

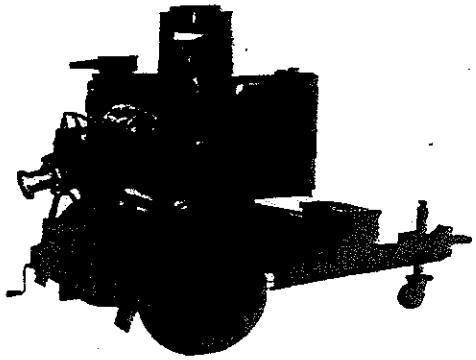
CD100M

CD100M Dri-Prime Pump

The Godwin Dri-Prime CD100M pump offers flow rates to 1,013 USGPM and discharge heads to 124' (38m). Also it has the capability of handling solids up to 2" (45mm) in diameter.

The CD100M is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the CD100M the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 2" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine Yanmar 3TNV88. Also available with Caterpillar C1.5T.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 a5 hardness to 200 hb brinell.

Specifications

Suction connection	4" 125# ANSI B16.1
Delivery connection	4" 125# ANSI B16.1
Max capacity	1013 USGPM
Max head	124' (38m)
Max solids handling	2" (45mm)
Max impeller diameter	9" (230mm)
Max operating temp	176°F (80°C)
Max working pressure	55.1 psi (3.8 bar)
Max suction pressure	39.9 psi (2.8 bar)
Max casing pressure	82.7 psi (5.7 bar)
Max operating speed	2200 rpm

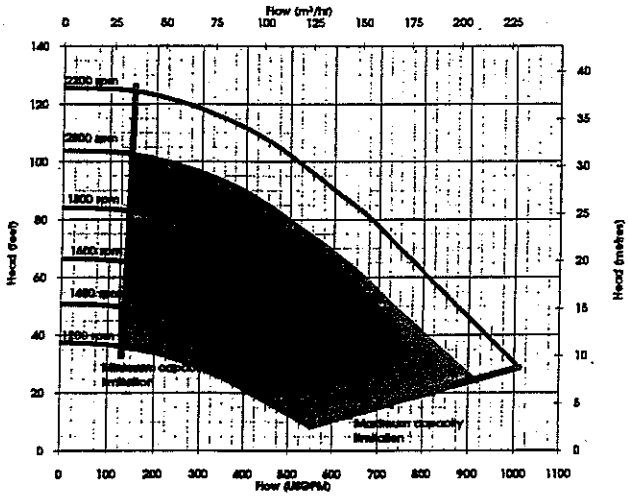
godwin
a xylem brand

Reference number : 95-1007-3000
Date of issue : August 25. 2011
Issue : 1

Please contact Godwin for further details.
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

CD100M

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS1452:1990 grade 220
Wearplates	Cast iron to BS1452 Gr220
Pump shaft	Carbon steel BS970 080M40
Impeller	Cast steel BS3100 A5 hardness to 200 HB Brinell
Non-return valve body	Cast iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

Yanmar, 3TNV88, 23.8 HP @ 2000 rpm

Impeller diameter 9 " (230 mm)

Suction Lift Table

Total Suction Head (')	Total Delivery Head (') 12	34	45	59	70
	Output (USGPM)				
9.8	921	793	716	614	496
15.1	869	742	665	563	409
20.0	639	604	563	486	358
24.9	409	384	358	307	205

Fuel capacity (Full) 30 US Gal, (Usable) 30 US Gal

Fuel consumption @ 2000 rpm BEP 1.1 US Gal/hr

Weight: (Dry) 1,936 lbs, (Wet) 2,189 lbs

Dimensions: (L) 102" x (W) 54" x (H) 70"

Engine option 2

Caterpillar, C1.5T, 26.8 HP @ 2000 rpm

Impeller diameter 9 " (230 mm)

Suction Lift Table

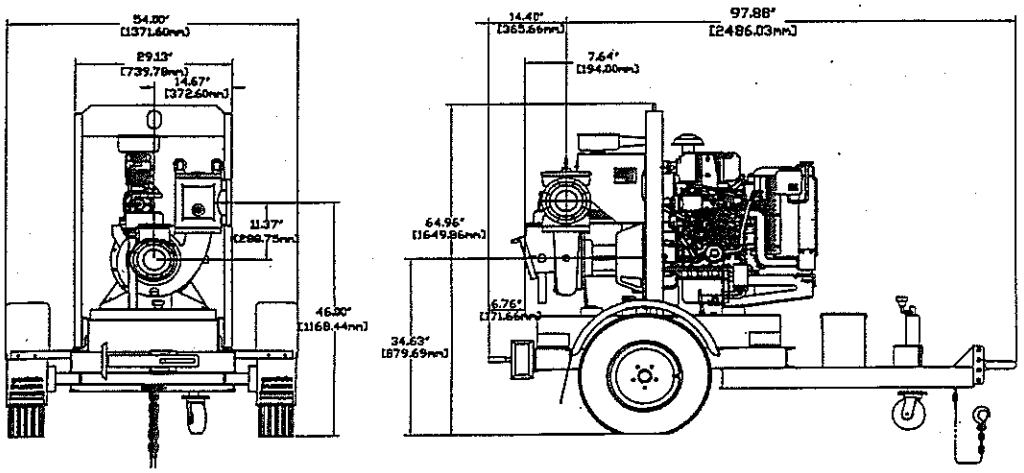
Total Suction Head (')	Total Delivery Head (') 12	34	45	59	70
	Output (USGPM)				
9.8	921	793	716	614	496
15.1	869	742	665	563	409
20.0	639	604	563	486	358
24.9	409	384	358	307	205

Fuel capacity (Full) 30 US Gal, (Usable) 30 US Gal

Fuel consumption @ 2000 rpm BEP 1.2 US Gal/hr

Weight: (Dry) 1,786 lbs, (Wet) 2,032 lbs

Dimensions: (L) 102" x (W) 54" x (H) 70"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1007-3000

Date of issue : August 25, 2011

Issue : 1

godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwinpumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

PROJECT NAME: MACH NO. 1 MINE, FACILITY NO. 2 EXPANSION PLAN
PROJECT NO.: B12-495-1413
DESCRIPTION: PHASE 12 DECANT- 28" DR-17 HDPE PIPE

CALC. BY: RPC 11-7-12
CHECKED BY: _____

WEIR FLOW $Q=C\pi DH^{1.5}$ REF. MSHA MANUAL, PAGE 6.136
$C=3.22+0.44(H/P)$

INLET DIAMETER(D)=	2.0423	FEET
WEIR HEIGHT(P)=	10	FEET
INLET EL.=	619.3	

ORIFICE FLOW $Q=CA(2gH)^{1/2}$ REF. HANDBOOK OF CONCRETE CULVERT PIPE HYDRAULICS, PORTLAND CEMENT ASSOCIATION, PAGE 70

DISCHARGE COEFFICIENT(C)=	0.8	
ORIFICE DIAMETER	2.0423	FEET
AREA(A)=	3.28	SQ. FT.
ORIFICE CONTROL ELEV.	619.30	

PRESSURE FLOW $Q=AV$
$V=(2GH/F(L/D)+K+1)^{1/2}$ REF. MSHA MANUAL, PAGE 6.154
$F=185(N^2/D^{0.33})$

MANNING'S N=	0.009	
PIPE LENGTH(L)=	153.8	FEET
ENERGY LOSSES(K)=	2.7	
OUTLET EL.=	604.9	
PIPE DIA. =	2.0423	FEET

ELEVATION	STORAGE, AC-FT	HEAD, FT.	Q.CFS		
			WEIR	ORIFICE	PRESSURE
619.3	4936.76	0	0.00	0.00	46.57
620	5018.34	0.7	12.22	17.60	47.68
620.5	5076.61	1.2	27.60	23.04	48.47
621	5134.88	1.7	46.86	27.42	49.24
621.5	5193.15	2.2	69.44	31.19	50.00
622	5251.42	2.7	95.04	34.56	50.74
622.5	5309.69	3.2	123.43	37.62	51.48
623	5367.96	3.7	154.47	40.45	52.21
623.5	5426.23	4.2	188.03	43.10	52.92
624	5484.51	4.7	224.03	45.59	53.63
624.5	5542.78	5.2	262.39	47.96	54.33
625	5601.05	5.7	303.05	50.21	55.02
625.5	5659.32	6.2	345.96	52.37	55.70
626	5717.59	6.7	391.09	54.44	56.37

WEIR FLOW CONTROLS

ORIFICE FLOW CONTROLS

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

PROJECT NAME: MACH - FACILITY NO. 2 EXPANSION PLAN
PROJECT NO.: B12-495-1413
DESCRIPTION: PHASE 12 HMS DECANT DRAWDOWN ANALYSIS

CALC. BY: RPC 1/26/12
CHECKED BY: _____

A decant drawdown analysis was performed for the 28" HDPE decant proposed for Phase 12 using HEC-HMS. The model distributes the 72 hour PMP design storm into a basin. The basin area was defined as the crest area of Phase 8 which is 105.45 acres, or 0.16 square miles. The outflow of the basin was directly input into a reservoir. The outflow of the reservoir was defined by paired data parameters of Elevation-Storage, Elevation-Outflow, and Storage-Outflow relationships. The outflow was calculated using a chart that will determine the appropriate flow regime as head increases.

From the results of the HMS model, setting the Phase 12 decant at Elevation 619.3 will create a peak design storm level of 622.4 which is below the required top of storm level while maintaining 3 feet of freeboard at Elevation 623.0.

Check capacity to dewater 90% design storm in 10 days or less:

Peak storage =	5303.9	Ac-ft (HMS analysis 2 Jan 12 22:00)
Initial storage =	4936.8	Ac-ft (East Stage 4 max fines storage at El. 619.3)

Total storm storage =	367.1	Ac-ft
90% storm volume =	330.4	Ac-ft

90% evacuated volume = (5303.9 - 330.4) = 4973.5 Ac-ft

From time series table: The reservoir volume will be drawn down to 4973.5 Ac-ft on 11 Jan 2012 at 14:30 which is less than 10 days from when the peak storage occurs.

Project: EastStage4
Simulation Run: Run 1 Reservoir: East Stage 4

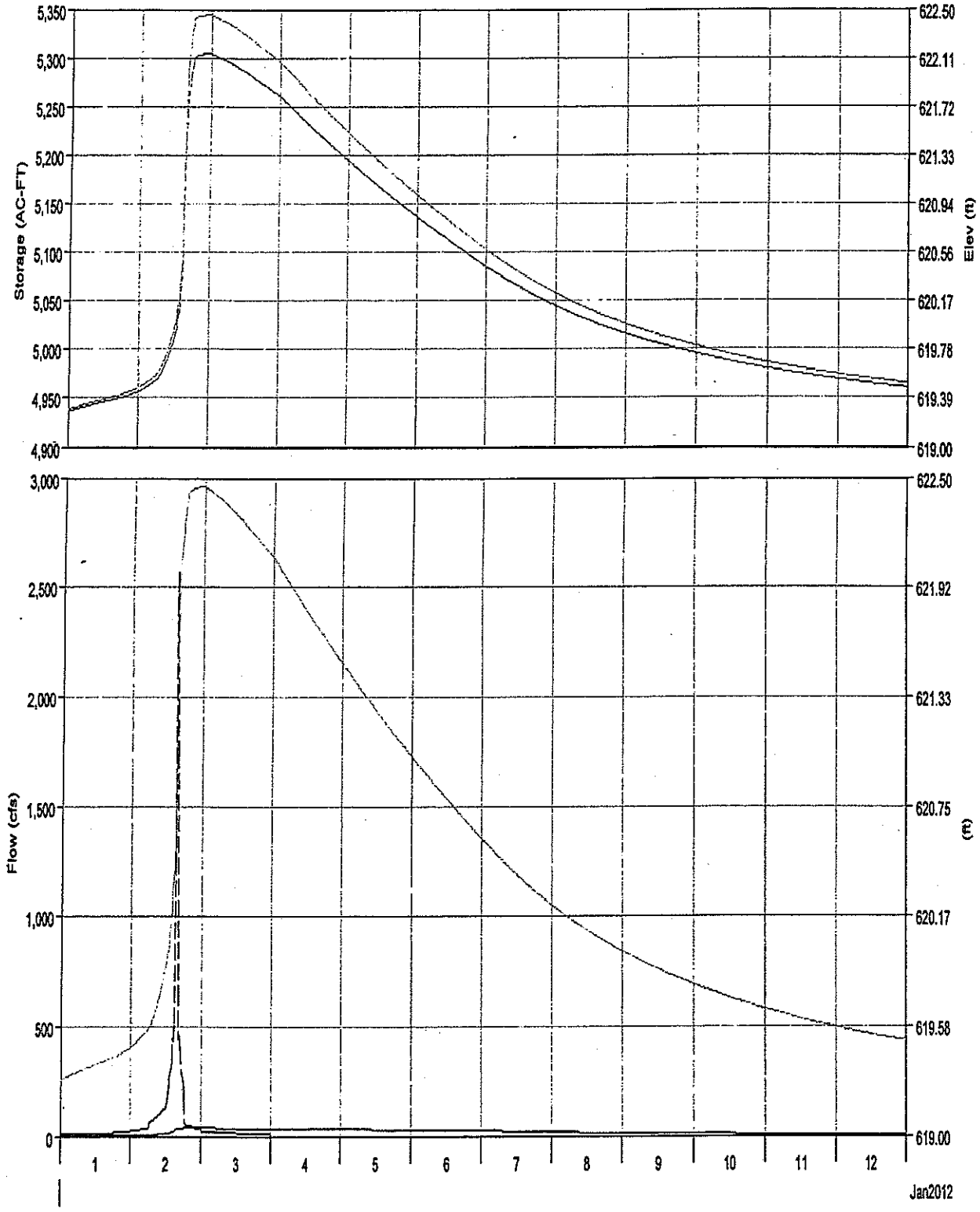
Start of Run:	01Jan2012, 00:00	Basin Model:	Basin 1
End of Run:	13Jan2012, 00:00	Meteorologic Model:	Met 1
Compute Time:	06Jun2013, 09:52:44	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	2565.8 (CFS)	Date/Time of Peak Inflow :	02Jan2012, 15:15
Peak Outflow :	37.3 (CFS)	Date/Time of Peak Outflow :	02Jan2012, 22:00
Total Inflow :	40.79 (IN)	Peak Storage :	5303.9 (AC-FT)
Total Outflow :	38.52 (IN)	Peak Elevation :	622.4 (FT)

Reservoir "East Stage 4" Results for Run "Run 1"



Run:Run 1 Element:EAST STAGE 4 Result:Storage

Run:Run 1 Element:EAST STAGE 4 Result:Pool Elevation

Run:Run 1 Element:EAST STAGE 4 Result:Outflow

Run:Run 1 Element:EAST STAGE 4 Result:Combined Flow

Run:Run 1 Element:EAST STAGE 4 Result:Stage

Project: EastStage4

Simulation Run: Run 1 Reservoir: East Stage 4

Start of Run: 01Jan2012, 00:00
End of Run: 13Jan2012, 00:00
Compute Time: 06Jun2013, 09:52:44

Basin Model: Basin 1
Meteorologic Model: Met 1
Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
1-Jan-12	0:00	0.0	4936.8	619.3	0.0	619.3
1-Jan-12	0:15	10.3	4936.9	619.3	0.0	619.3
1-Jan-12	0:30	10.3	4937.1	619.3	0.0	619.3
1-Jan-12	0:45	10.3	4937.3	619.3	0.1	619.3
1-Jan-12	1:00	10.3	4937.5	619.3	0.1	619.3
1-Jan-12	1:15	10.3	4937.7	619.3	0.1	619.3
1-Jan-12	1:30	10.3	4937.9	619.3	0.2	619.3
1-Jan-12	1:45	10.3	4938.1	619.3	0.2	619.3
1-Jan-12	2:00	10.3	4938.3	619.3	0.2	619.3
1-Jan-12	2:15	10.3	4938.5	619.3	0.3	619.3
1-Jan-12	2:30	10.3	4938.8	619.3	0.3	619.3
1-Jan-12	2:45	10.3	4939.0	619.3	0.3	619.3
1-Jan-12	3:00	10.3	4939.2	619.3	0.4	619.3
1-Jan-12	3:15	10.3	4939.4	619.3	0.4	619.3
1-Jan-12	3:30	10.3	4939.6	619.3	0.4	619.3
1-Jan-12	3:45	10.3	4939.8	619.3	0.5	619.3
1-Jan-12	4:00	10.3	4940.0	619.3	0.5	619.3
1-Jan-12	4:15	10.3	4940.2	619.3	0.5	619.3
1-Jan-12	4:30	10.3	4940.4	619.3	0.5	619.3
1-Jan-12	4:45	10.3	4940.6	619.3	0.6	619.3
1-Jan-12	5:00	10.3	4940.8	619.3	0.6	619.3
1-Jan-12	5:15	10.3	4941.0	619.3	0.6	619.3
1-Jan-12	5:30	10.3	4941.2	619.3	0.7	619.3
1-Jan-12	5:45	10.3	4941.4	619.3	0.7	619.3
1-Jan-12	6:00	10.3	4941.6	619.3	0.7	619.3
1-Jan-12	6:15	10.3	4941.8	619.3	0.8	619.3
1-Jan-12	6:30	10.3	4942.0	619.3	0.8	619.3
1-Jan-12	6:45	10.3	4942.2	619.3	0.8	619.3
1-Jan-12	7:00	10.3	4942.4	619.3	0.8	619.3
1-Jan-12	7:15	10.3	4942.6	619.3	0.9	619.3
1-Jan-12	7:30	10.3	4942.8	619.4	0.9	619.4
1-Jan-12	7:45	10.3	4943.0	619.4	0.9	619.4
1-Jan-12	8:00	10.3	4943.2	619.4	1.0	619.4
1-Jan-12	8:15	10.3	4943.4	619.4	1.0	619.4
1-Jan-12	8:30	10.3	4943.5	619.4	1.0	619.4
1-Jan-12	8:45	10.3	4943.7	619.4	1.0	619.4
1-Jan-12	9:00	10.3	4943.9	619.4	1.1	619.4
1-Jan-12	9:15	10.3	4944.1	619.4	1.1	619.4
1-Jan-12	9:30	10.3	4944.3	619.4	1.1	619.4
1-Jan-12	9:45	10.3	4944.5	619.4	1.2	619.4
1-Jan-12	10:00	10.3	4944.7	619.4	1.2	619.4
1-Jan-12	10:15	10.3	4944.9	619.4	1.2	619.4
1-Jan-12	10:30	10.3	4945.1	619.4	1.2	619.4
1-Jan-12	10:45	10.3	4945.3	619.4	1.3	619.4
1-Jan-12	11:00	10.3	4945.4	619.4	1.3	619.4
1-Jan-12	11:15	10.3	4945.6	619.4	1.3	619.4

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
1-Jan-12	11:30	10.3	4945.8	619.4	1.4	619.4
1-Jan-12	11:45	10.3	4946.0	619.4	1.4	619.4
1-Jan-12	12:00	10.3	4946.2	619.4	1.4	619.4
1-Jan-12	12:15	10.3	4946.4	619.4	1.4	619.4
1-Jan-12	12:30	10.3	4946.6	619.4	1.5	619.4
1-Jan-12	12:45	10.3	4946.7	619.4	1.5	619.4
1-Jan-12	13:00	10.3	4946.9	619.4	1.5	619.4
1-Jan-12	13:15	10.3	4947.1	619.4	1.5	619.4
1-Jan-12	13:30	10.3	4947.3	619.4	1.6	619.4
1-Jan-12	13:45	10.3	4947.5	619.4	1.6	619.4
1-Jan-12	14:00	10.3	4947.6	619.4	1.6	619.4
1-Jan-12	14:15	10.3	4947.8	619.4	1.7	619.4
1-Jan-12	14:30	10.3	4948.0	619.4	1.7	619.4
1-Jan-12	14:45	10.3	4948.2	619.4	1.7	619.4
1-Jan-12	15:00	10.3	4948.4	619.4	1.7	619.4
1-Jan-12	15:15	10.3	4948.5	619.4	1.8	619.4
1-Jan-12	15:30	10.3	4948.7	619.4	1.8	619.4
1-Jan-12	15:45	10.3	4948.9	619.4	1.8	619.4
1-Jan-12	16:00	10.3	4949.1	619.4	1.8	619.4
1-Jan-12	16:15	10.3	4949.2	619.4	1.9	619.4
1-Jan-12	16:30	10.3	4949.4	619.4	1.9	619.4
1-Jan-12	16:45	10.3	4949.6	619.4	1.9	619.4
1-Jan-12	17:00	10.3	4949.8	619.4	1.9	619.4
1-Jan-12	17:15	10.3	4949.9	619.4	2.0	619.4
1-Jan-12	17:30	10.3	4950.1	619.4	2.0	619.4
1-Jan-12	17:45	10.3	4950.3	619.4	2.0	619.4
1-Jan-12	18:00	10.3	4950.4	619.4	2.0	619.4
1-Jan-12	18:15	15.5	4950.7	619.4	2.1	619.4
1-Jan-12	18:30	15.5	4950.9	619.4	2.1	619.4
1-Jan-12	18:45	15.5	4951.2	619.4	2.2	619.4
1-Jan-12	19:00	15.5	4951.5	619.4	2.2	619.4
1-Jan-12	19:15	15.5	4951.8	619.4	2.2	619.4
1-Jan-12	19:30	15.5	4952.0	619.4	2.3	619.4
1-Jan-12	19:45	15.5	4952.3	619.4	2.3	619.4
1-Jan-12	20:00	15.5	4952.6	619.4	2.4	619.4
1-Jan-12	20:15	15.5	4952.9	619.4	2.4	619.4
1-Jan-12	20:30	15.5	4953.1	619.4	2.5	619.4
1-Jan-12	20:45	15.5	4953.4	619.4	2.5	619.4
1-Jan-12	21:00	15.5	4953.7	619.4	2.5	619.4
1-Jan-12	21:15	15.5	4953.9	619.4	2.6	619.4
1-Jan-12	21:30	15.5	4954.2	619.4	2.6	619.4
1-Jan-12	21:45	15.5	4954.5	619.5	2.7	619.5
1-Jan-12	22:00	15.5	4954.7	619.5	2.7	619.5
1-Jan-12	22:15	15.5	4955.0	619.5	2.7	619.5
1-Jan-12	22:30	15.5	4955.3	619.5	2.8	619.5
1-Jan-12	22:45	15.5	4955.5	619.5	2.8	619.5
1-Jan-12	23:00	15.5	4955.8	619.5	2.8	619.5
1-Jan-12	23:15	15.5	4956.0	619.5	2.9	619.5
1-Jan-12	23:30	15.5	4956.3	619.5	2.9	619.5
1-Jan-12	23:45	15.5	4956.6	619.5	3.0	619.5
2-Jan-12	0:00	15.5	4956.8	619.5	3.0	619.5
2-Jan-12	0:15	25.8	4957.2	619.5	3.1	619.5
2-Jan-12	0:30	25.8	4957.6	619.5	3.1	619.5

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
2-Jan-12	0:45	25.8	4958.1	619.5	3.2	619.5
2-Jan-12	1:00	25.8	4958.6	619.5	3.3	619.5
2-Jan-12	1:15	25.8	4959.0	619.5	3.3	619.5
2-Jan-12	1:30	25.8	4959.5	619.5	3.4	619.5
2-Jan-12	1:45	25.8	4960.0	619.5	3.5	619.5
2-Jan-12	2:00	25.8	4960.4	619.5	3.5	619.5
2-Jan-12	2:15	25.8	4960.9	619.5	3.6	619.5
2-Jan-12	2:30	25.8	4961.4	619.5	3.7	619.5
2-Jan-12	2:45	25.8	4961.8	619.5	3.8	619.5
2-Jan-12	3:00	25.8	4962.3	619.5	3.8	619.5
2-Jan-12	3:15	25.8	4962.7	619.5	3.9	619.5
2-Jan-12	3:30	31.0	4963.2	619.5	4.0	619.5
2-Jan-12	3:45	31.0	4963.8	619.5	4.0	619.5
2-Jan-12	4:00	31.0	4964.3	619.5	4.1	619.5
2-Jan-12	4:15	31.0	4964.9	619.5	4.2	619.5
2-Jan-12	4:30	31.0	4965.4	619.5	4.3	619.5
2-Jan-12	4:45	31.0	4966.0	619.6	4.4	619.6
2-Jan-12	5:00	31.0	4966.5	619.6	4.5	619.6
2-Jan-12	5:15	31.0	4967.1	619.6	4.5	619.6
2-Jan-12	5:30	31.0	4967.6	619.6	4.6	619.6
2-Jan-12	5:45	31.0	4968.2	619.6	4.7	619.6
2-Jan-12	6:00	36.1	4968.8	619.6	4.8	619.6
2-Jan-12	6:15	62.0	4969.7	619.6	4.9	619.6
2-Jan-12	6:30	62.0	4970.9	619.6	5.1	619.6
2-Jan-12	6:45	67.1	4972.1	619.6	5.3	619.6
2-Jan-12	7:00	67.1	4973.4	619.6	5.5	619.6
2-Jan-12	7:15	72.3	4974.7	619.6	5.7	619.6
2-Jan-12	7:30	72.3	4976.1	619.6	5.9	619.6
2-Jan-12	7:45	77.4	4977.5	619.6	6.1	619.6
2-Jan-12	8:00	77.4	4979.0	619.7	6.3	619.7
2-Jan-12	8:15	82.6	4980.5	619.7	6.5	619.7
2-Jan-12	8:30	82.6	4982.0	619.7	6.8	619.7
2-Jan-12	8:45	87.8	4983.7	619.7	7.0	619.7
2-Jan-12	9:00	92.9	4985.4	619.7	7.3	619.7
2-Jan-12	9:15	92.9	4987.1	619.7	7.5	619.7
2-Jan-12	9:30	98.1	4989.0	619.7	7.8	619.7
2-Jan-12	9:45	103.3	4990.9	619.8	8.1	619.8
2-Jan-12	10:00	103.3	4992.8	619.8	8.4	619.8
2-Jan-12	10:15	108.4	4994.9	619.8	8.7	619.8
2-Jan-12	10:30	113.6	4997.0	619.8	9.0	619.8
2-Jan-12	10:45	113.6	4999.1	619.8	9.3	619.8
2-Jan-12	11:00	118.7	5001.3	619.9	9.7	619.9
2-Jan-12	11:15	123.9	5003.6	619.9	10.0	619.9
2-Jan-12	11:30	123.9	5006.0	619.9	10.4	619.9
2-Jan-12	11:45	129.1	5008.4	619.9	10.7	619.9
2-Jan-12	12:00	134.2	5010.9	619.9	11.1	619.9
2-Jan-12	12:15	149.7	5013.6	620.0	11.5	620.0
2-Jan-12	12:30	196.2	5016.9	620.0	12.0	620.0
2-Jan-12	12:45	237.5	5021.1	620.0	12.7	620.0
2-Jan-12	13:00	268.5	5026.1	620.1	13.7	620.1
2-Jan-12	13:15	289.1	5031.5	620.1	14.7	620.1
2-Jan-12	13:30	304.6	5037.4	620.2	15.8	620.2
2-Jan-12	13:45	345.9	5043.7	620.2	16.9	620.2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
2-Jan-12	14:00	444.0	5051.5	620.3	18.4	620.3
2-Jan-12	14:15	433.7	5060.2	620.4	20.0	620.4
2-Jan-12	14:30	516.3	5069.6	620.4	21.7	620.4
2-Jan-12	14:45	1213.2	5087.0	620.6	23.8	620.6
2-Jan-12	15:00	2380.0	5123.6	620.9	26.6	620.9
2-Jan-12	15:15	2565.8	5174.1	621.3	30.0	621.3
2-Jan-12	15:30	1745.0	5218.0	621.7	32.6	621.7
2-Jan-12	15:45	666.0	5242.2	621.9	34.0	621.9
2-Jan-12	16:00	438.8	5252.9	622.0	34.6	622.0
2-Jan-12	16:15	459.5	5261.5	622.1	35.1	622.1
2-Jan-12	16:30	402.7	5269.6	622.2	35.5	622.2
2-Jan-12	16:45	309.8	5276.3	622.2	35.9	622.2
2-Jan-12	17:00	299.4	5281.8	622.3	36.2	622.3
2-Jan-12	17:15	278.8	5287.0	622.3	36.4	622.3
2-Jan-12	17:30	253.0	5291.8	622.3	36.7	622.3
2-Jan-12	17:45	216.8	5295.9	622.4	36.9	622.4
2-Jan-12	18:00	175.5	5299.2	622.4	37.1	622.4
2-Jan-12	18:15	56.8	5300.8	622.4	37.2	622.4
2-Jan-12	18:30	56.8	5301.2	622.4	37.2	622.4
2-Jan-12	18:45	56.8	5301.6	622.4	37.2	622.4
2-Jan-12	19:00	51.6	5302.0	622.4	37.2	622.4
2-Jan-12	19:15	51.6	5302.2	622.4	37.2	622.4
2-Jan-12	19:30	51.6	5302.5	622.4	37.2	622.4
2-Jan-12	19:45	46.5	5302.8	622.4	37.3	622.4
2-Jan-12	20:00	46.5	5303.0	622.4	37.3	622.4
2-Jan-12	20:15	46.5	5303.2	622.4	37.3	622.4
2-Jan-12	20:30	46.5	5303.4	622.4	37.3	622.4
2-Jan-12	20:45	41.3	5303.5	622.4	37.3	622.4
2-Jan-12	21:00	41.3	5303.6	622.4	37.3	622.4
2-Jan-12	21:15	41.3	5303.7	622.4	37.3	622.4
2-Jan-12	21:30	41.3	5303.7	622.4	37.3	622.4
2-Jan-12	21:45	41.3	5303.8	622.4	37.3	622.4
2-Jan-12	22:00	36.1	5303.9	622.4	37.3	622.4
2-Jan-12	22:15	36.1	5303.8	622.4	37.3	622.4
2-Jan-12	22:30	36.1	5303.8	622.4	37.3	622.4
2-Jan-12	22:45	36.1	5303.8	622.4	37.3	622.4
2-Jan-12	23:00	36.1	5303.8	622.4	37.3	622.4
2-Jan-12	23:15	36.1	5303.7	622.4	37.3	622.4
2-Jan-12	23:30	36.1	5303.7	622.4	37.3	622.4
2-Jan-12	23:45	36.1	5303.7	622.4	37.3	622.4
3-Jan-12	0:00	36.1	5303.7	622.4	37.3	622.4
3-Jan-12	0:15	20.7	5303.5	622.4	37.3	622.4
3-Jan-12	0:30	20.7	5303.1	622.4	37.3	622.4
3-Jan-12	0:45	20.7	5302.8	622.4	37.3	622.4
3-Jan-12	1:00	20.7	5302.4	622.4	37.2	622.4
3-Jan-12	1:15	20.7	5302.1	622.4	37.2	622.4
3-Jan-12	1:30	20.7	5301.8	622.4	37.2	622.4
3-Jan-12	1:45	20.7	5301.4	622.4	37.2	622.4
3-Jan-12	2:00	20.7	5301.1	622.4	37.2	622.4
3-Jan-12	2:15	20.7	5300.7	622.4	37.1	622.4
3-Jan-12	2:30	20.7	5300.4	622.4	37.1	622.4
3-Jan-12	2:45	20.7	5300.1	622.4	37.1	622.4
3-Jan-12	3:00	20.7	5299.7	622.4	37.1	622.4

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
3-Jan-12	3:15	20.7	5299.4	622.4	37.1	622.4
3-Jan-12	3:30	20.7	5299.0	622.4	37.1	622.4
3-Jan-12	3:45	20.7	5298.7	622.4	37.0	622.4
3-Jan-12	4:00	20.7	5298.4	622.4	37.0	622.4
3-Jan-12	4:15	20.7	5298.0	622.4	37.0	622.4
3-Jan-12	4:30	20.7	5297.7	622.4	37.0	622.4
3-Jan-12	4:45	20.7	5297.3	622.4	37.0	622.4
3-Jan-12	5:00	20.7	5297.0	622.4	37.0	622.4
3-Jan-12	5:15	20.7	5296.7	622.4	36.9	622.4
3-Jan-12	5:30	20.7	5296.3	622.4	36.9	622.4
3-Jan-12	5:45	20.7	5296.0	622.4	36.9	622.4
3-Jan-12	6:00	20.7	5295.7	622.4	36.9	622.4
3-Jan-12	6:15	15.5	5295.3	622.4	36.9	622.4
3-Jan-12	6:30	15.5	5294.8	622.4	36.8	622.4
3-Jan-12	6:45	15.5	5294.4	622.4	36.8	622.4
3-Jan-12	7:00	15.5	5294.0	622.4	36.8	622.4
3-Jan-12	7:15	15.5	5293.5	622.4	36.8	622.4
3-Jan-12	7:30	15.5	5293.1	622.4	36.7	622.4
3-Jan-12	7:45	15.5	5292.6	622.4	36.7	622.4
3-Jan-12	8:00	15.5	5292.2	622.3	36.7	622.3
3-Jan-12	8:15	15.5	5291.8	622.3	36.7	622.3
3-Jan-12	8:30	15.5	5291.3	622.3	36.7	622.3
3-Jan-12	8:45	15.5	5290.9	622.3	36.6	622.3
3-Jan-12	9:00	15.5	5290.4	622.3	36.6	622.3
3-Jan-12	9:15	15.5	5290.0	622.3	36.6	622.3
3-Jan-12	9:30	15.5	5289.6	622.3	36.6	622.3
3-Jan-12	9:45	15.5	5289.1	622.3	36.5	622.3
3-Jan-12	10:00	15.5	5288.7	622.3	36.5	622.3
3-Jan-12	10:15	15.5	5288.3	622.3	36.5	622.3
3-Jan-12	10:30	15.5	5287.8	622.3	36.5	622.3
3-Jan-12	10:45	15.5	5287.4	622.3	36.4	622.3
3-Jan-12	11:00	15.5	5287.0	622.3	36.4	622.3
3-Jan-12	11:15	15.5	5286.5	622.3	36.4	622.3
3-Jan-12	11:30	15.5	5286.1	622.3	36.4	622.3
3-Jan-12	11:45	15.5	5285.7	622.3	36.4	622.3
3-Jan-12	12:00	15.5	5285.2	622.3	36.3	622.3
3-Jan-12	12:15	10.3	5284.8	622.3	36.3	622.3
3-Jan-12	12:30	10.3	5284.2	622.3	36.3	622.3
3-Jan-12	12:45	10.3	5283.7	622.3	36.3	622.3
3-Jan-12	13:00	10.3	5283.2	622.3	36.2	622.3
3-Jan-12	13:15	10.3	5282.6	622.3	36.2	622.3
3-Jan-12	13:30	10.3	5282.1	622.3	36.2	622.3
3-Jan-12	13:45	10.3	5281.6	622.3	36.1	622.3
3-Jan-12	14:00	10.3	5281.0	622.3	36.1	622.3
3-Jan-12	14:15	10.3	5280.5	622.2	36.1	622.2
3-Jan-12	14:30	10.3	5280.0	622.2	36.1	622.2
3-Jan-12	14:45	10.3	5279.4	622.2	36.0	622.2
3-Jan-12	15:00	10.3	5278.9	622.2	36.0	622.2
3-Jan-12	15:15	10.3	5278.4	622.2	36.0	622.2
3-Jan-12	15:30	10.3	5277.8	622.2	35.9	622.2
3-Jan-12	15:45	10.3	5277.3	622.2	35.9	622.2
3-Jan-12	16:00	10.3	5276.8	622.2	35.9	622.2
3-Jan-12	16:15	10.3	5276.2	622.2	35.9	622.2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
3-Jan-12	16:30	10.3	5275.7	622.2	35.8	622.2
3-Jan-12	16:45	10.3	5275.2	622.2	35.8	622.2
3-Jan-12	17:00	10.3	5274.7	622.2	35.8	622.2
3-Jan-12	17:15	10.3	5274.1	622.2	35.8	622.2
3-Jan-12	17:30	10.3	5273.6	622.2	35.7	622.2
3-Jan-12	17:45	10.3	5273.1	622.2	35.7	622.2
3-Jan-12	18:00	10.3	5272.6	622.2	35.7	622.2
3-Jan-12	18:15	10.3	5272.0	622.2	35.6	622.2
3-Jan-12	18:30	10.3	5271.5	622.2	35.6	622.2
3-Jan-12	18:45	10.3	5271.0	622.2	35.6	622.2
3-Jan-12	19:00	10.3	5270.5	622.2	35.6	622.2
3-Jan-12	19:15	10.3	5270.0	622.2	35.5	622.2
3-Jan-12	19:30	10.3	5269.4	622.2	35.5	622.2
3-Jan-12	19:45	10.3	5268.9	622.2	35.5	622.2
3-Jan-12	20:00	10.3	5268.4	622.1	35.5	622.1
3-Jan-12	20:15	10.3	5267.9	622.1	35.4	622.1
3-Jan-12	20:30	10.3	5267.4	622.1	35.4	622.1
3-Jan-12	20:45	10.3	5266.8	622.1	35.4	622.1
3-Jan-12	21:00	10.3	5266.3	622.1	35.3	622.1
3-Jan-12	21:15	10.3	5265.8	622.1	35.3	622.1
3-Jan-12	21:30	10.3	5265.3	622.1	35.3	622.1
3-Jan-12	21:45	10.3	5264.8	622.1	35.3	622.1
3-Jan-12	22:00	10.3	5264.3	622.1	35.2	622.1
3-Jan-12	22:15	10.3	5263.7	622.1	35.2	622.1
3-Jan-12	22:30	10.3	5263.2	622.1	35.2	622.1
3-Jan-12	22:45	10.3	5262.7	622.1	35.2	622.1
3-Jan-12	23:00	10.3	5262.2	622.1	35.1	622.1
3-Jan-12	23:15	10.3	5261.7	622.1	35.1	622.1
3-Jan-12	23:30	10.3	5261.2	622.1	35.1	622.1
3-Jan-12	23:45	10.3	5260.7	622.1	35.0	622.1
4-Jan-12	0:00	10.3	5260.2	622.1	35.0	622.1
4-Jan-12	0:15	0.0	5259.5	622.1	35.0	622.1
4-Jan-12	0:30	0.0	5258.8	622.1	34.9	622.1
4-Jan-12	0:45	0.0	5258.1	622.1	34.9	622.1
4-Jan-12	1:00	0.0	5257.4	622.1	34.9	622.1
4-Jan-12	1:15	0.0	5256.7	622.0	34.8	622.0
4-Jan-12	1:30	0.0	5255.9	622.0	34.8	622.0
4-Jan-12	1:45	0.0	5255.2	622.0	34.8	622.0
4-Jan-12	2:00	0.0	5254.5	622.0	34.7	622.0
4-Jan-12	2:15	0.0	5253.8	622.0	34.7	622.0
4-Jan-12	2:30	0.0	5253.1	622.0	34.6	622.0
4-Jan-12	2:45	0.0	5252.4	622.0	34.6	622.0
4-Jan-12	3:00	0.0	5251.6	622.0	34.6	622.0
4-Jan-12	3:15	0.0	5250.9	622.0	34.5	622.0
4-Jan-12	3:30	0.0	5250.2	622.0	34.5	622.0
4-Jan-12	3:45	0.0	5249.5	622.0	34.4	622.0
4-Jan-12	4:00	0.0	5248.8	622.0	34.4	622.0
4-Jan-12	4:15	0.0	5248.1	622.0	34.4	622.0
4-Jan-12	4:30	0.0	5247.4	622.0	34.3	622.0
4-Jan-12	4:45	0.0	5246.7	622.0	34.3	622.0
4-Jan-12	5:00	0.0	5246.0	622.0	34.2	622.0
4-Jan-12	5:15	0.0	5245.2	621.9	34.2	621.9
4-Jan-12	5:30	0.0	5244.5	621.9	34.2	621.9

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
4-Jan-12	5:45	0.0	5243.8	621.9	34.1	621.9
4-Jan-12	6:00	0.0	5243.1	621.9	34.1	621.9
4-Jan-12	6:15	0.0	5242.4	621.9	34.0	621.9
4-Jan-12	6:30	0.0	5241.7	621.9	34.0	621.9
4-Jan-12	6:45	0.0	5241.0	621.9	34.0	621.9
4-Jan-12	7:00	0.0	5240.3	621.9	33.9	621.9
4-Jan-12	7:15	0.0	5239.6	621.9	33.9	621.9
4-Jan-12	7:30	0.0	5238.9	621.9	33.8	621.9
4-Jan-12	7:45	0.0	5238.2	621.9	33.8	621.9
4-Jan-12	8:00	0.0	5237.5	621.9	33.8	621.9
4-Jan-12	8:15	0.0	5236.8	621.9	33.7	621.9
4-Jan-12	8:30	0.0	5236.1	621.9	33.7	621.9
4-Jan-12	8:45	0.0	5235.4	621.9	33.6	621.9
4-Jan-12	9:00	0.0	5234.7	621.9	33.6	621.9
4-Jan-12	9:15	0.0	5234.0	621.9	33.6	621.9
4-Jan-12	9:30	0.0	5233.4	621.8	33.5	621.8
4-Jan-12	9:45	0.0	5232.7	621.8	33.5	621.8
4-Jan-12	10:00	0.0	5232.0	621.8	33.4	621.8
4-Jan-12	10:15	0.0	5231.3	621.8	33.4	621.8
4-Jan-12	10:30	0.0	5230.6	621.8	33.4	621.8
4-Jan-12	10:45	0.0	5229.9	621.8	33.3	621.8
4-Jan-12	11:00	0.0	5229.2	621.8	33.3	621.8
4-Jan-12	11:15	0.0	5228.5	621.8	33.2	621.8
4-Jan-12	11:30	0.0	5227.8	621.8	33.2	621.8
4-Jan-12	11:45	0.0	5227.2	621.8	33.2	621.8
4-Jan-12	12:00	0.0	5226.5	621.8	33.1	621.8
4-Jan-12	12:15	0.0	5225.8	621.8	33.1	621.8
4-Jan-12	12:30	0.0	5225.1	621.8	33.0	621.8
4-Jan-12	12:45	0.0	5224.4	621.8	33.0	621.8
4-Jan-12	13:00	0.0	5223.7	621.8	33.0	621.8
4-Jan-12	13:15	0.0	5223.1	621.8	32.9	621.8
4-Jan-12	13:30	0.0	5222.4	621.8	32.9	621.8
4-Jan-12	13:45	0.0	5221.7	621.7	32.8	621.7
4-Jan-12	14:00	0.0	5221.0	621.7	32.8	621.7
4-Jan-12	14:15	0.0	5220.3	621.7	32.8	621.7
4-Jan-12	14:30	0.0	5219.7	621.7	32.7	621.7
4-Jan-12	14:45	0.0	5219.0	621.7	32.7	621.7
4-Jan-12	15:00	0.0	5218.3	621.7	32.6	621.7
4-Jan-12	15:15	0.0	5217.6	621.7	32.6	621.7
4-Jan-12	15:30	0.0	5217.0	621.7	32.6	621.7
4-Jan-12	15:45	0.0	5216.3	621.7	32.5	621.7
4-Jan-12	16:00	0.0	5215.6	621.7	32.5	621.7
4-Jan-12	16:15	0.0	5215.0	621.7	32.5	621.7
4-Jan-12	16:30	0.0	5214.3	621.7	32.4	621.7
4-Jan-12	16:45	0.0	5213.6	621.7	32.4	621.7
4-Jan-12	17:00	0.0	5212.9	621.7	32.3	621.7
4-Jan-12	17:15	0.0	5212.3	621.7	32.3	621.7
4-Jan-12	17:30	0.0	5211.6	621.7	32.3	621.7
4-Jan-12	17:45	0.0	5210.9	621.7	32.2	621.7
4-Jan-12	18:00	0.0	5210.3	621.6	32.2	621.6
4-Jan-12	18:15	0.0	5209.6	621.6	32.1	621.6
4-Jan-12	18:30	0.0	5209.0	621.6	32.1	621.6
4-Jan-12	18:45	0.0	5208.3	621.6	32.1	621.6

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
4-Jan-12	19:00	0.0	5207.6	621.6	32.0	621.6
4-Jan-12	19:15	0.0	5207.0	621.6	32.0	621.6
4-Jan-12	19:30	0.0	5206.3	621.6	32.0	621.6
4-Jan-12	19:45	0.0	5205.6	621.6	31.9	621.6
4-Jan-12	20:00	0.0	5205.0	621.6	31.9	621.6
4-Jan-12	20:15	0.0	5204.3	621.6	31.8	621.6
4-Jan-12	20:30	0.0	5203.7	621.6	31.8	621.6
4-Jan-12	20:45	0.0	5203.0	621.6	31.8	621.6
4-Jan-12	21:00	0.0	5202.4	621.6	31.7	621.6
4-Jan-12	21:15	0.0	5201.7	621.6	31.7	621.6
4-Jan-12	21:30	0.0	5201.1	621.6	31.6	621.6
4-Jan-12	21:45	0.0	5200.4	621.6	31.6	621.6
4-Jan-12	22:00	0.0	5199.7	621.6	31.6	621.6
4-Jan-12	22:15	0.0	5199.1	621.6	31.5	621.6
4-Jan-12	22:30	0.0	5198.4	621.5	31.5	621.5
4-Jan-12	22:45	0.0	5197.8	621.5	31.5	621.5
4-Jan-12	23:00	0.0	5197.1	621.5	31.4	621.5
4-Jan-12	23:15	0.0	5196.5	621.5	31.4	621.5
4-Jan-12	23:30	0.0	5195.8	621.5	31.3	621.5
4-Jan-12	23:45	0.0	5195.2	621.5	31.3	621.5
5-Jan-12	0:00	0.0	5194.6	621.5	31.3	621.5
5-Jan-12	0:15	0.0	5193.9	621.5	31.2	621.5
5-Jan-12	0:30	0.0	5193.3	621.5	31.2	621.5
5-Jan-12	0:45	0.0	5192.6	621.5	31.2	621.5
5-Jan-12	1:00	0.0	5192.0	621.5	31.1	621.5
5-Jan-12	1:15	0.0	5191.3	621.5	31.1	621.5
5-Jan-12	1:30	0.0	5190.7	621.5	31.0	621.5
5-Jan-12	1:45	0.0	5190.0	621.5	31.0	621.5
5-Jan-12	2:00	0.0	5189.4	621.5	30.9	621.5
5-Jan-12	2:15	0.0	5188.8	621.5	30.9	621.5
5-Jan-12	2:30	0.0	5188.1	621.5	30.9	621.5
5-Jan-12	2:45	0.0	5187.5	621.5	30.8	621.5
5-Jan-12	3:00	0.0	5186.9	621.4	30.8	621.4
5-Jan-12	3:15	0.0	5186.2	621.4	30.7	621.4
5-Jan-12	3:30	0.0	5185.6	621.4	30.7	621.4
5-Jan-12	3:45	0.0	5185.0	621.4	30.7	621.4
5-Jan-12	4:00	0.0	5184.3	621.4	30.6	621.4
5-Jan-12	4:15	0.0	5183.7	621.4	30.6	621.4
5-Jan-12	4:30	0.0	5183.1	621.4	30.5	621.4
5-Jan-12	4:45	0.0	5182.4	621.4	30.5	621.4
5-Jan-12	5:00	0.0	5181.8	621.4	30.5	621.4
5-Jan-12	5:15	0.0	5181.2	621.4	30.4	621.4
5-Jan-12	5:30	0.0	5180.5	621.4	30.4	621.4
5-Jan-12	5:45	0.0	5179.9	621.4	30.3	621.4
5-Jan-12	6:00	0.0	5179.3	621.4	30.3	621.4
5-Jan-12	6:15	0.0	5178.7	621.4	30.3	621.4
5-Jan-12	6:30	0.0	5178.0	621.4	30.2	621.4
5-Jan-12	6:45	0.0	5177.4	621.4	30.2	621.4
5-Jan-12	7:00	0.0	5176.8	621.4	30.1	621.4
5-Jan-12	7:15	0.0	5176.2	621.4	30.1	621.4
5-Jan-12	7:30	0.0	5175.5	621.3	30.1	621.3
5-Jan-12	7:45	0.0	5174.9	621.3	30.0	621.3
5-Jan-12	8:00	0.0	5174.3	621.3	30.0	621.3

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
5-Jan-12	8:15	0.0	5173.7	621.3	29.9	621.3
5-Jan-12	8:30	0.0	5173.1	621.3	29.9	621.3
5-Jan-12	8:45	0.0	5172.5	621.3	29.9	621.3
5-Jan-12	9:00	0.0	5171.8	621.3	29.8	621.3
5-Jan-12	9:15	0.0	5171.2	621.3	29.8	621.3
5-Jan-12	9:30	0.0	5170.6	621.3	29.7	621.3
5-Jan-12	9:45	0.0	5170.0	621.3	29.7	621.3
5-Jan-12	10:00	0.0	5169.4	621.3	29.7	621.3
5-Jan-12	10:15	0.0	5168.8	621.3	29.6	621.3
5-Jan-12	10:30	0.0	5168.2	621.3	29.6	621.3
5-Jan-12	10:45	0.0	5167.5	621.3	29.5	621.3
5-Jan-12	11:00	0.0	5166.9	621.3	29.5	621.3
5-Jan-12	11:15	0.0	5166.3	621.3	29.5	621.3
5-Jan-12	11:30	0.0	5165.7	621.3	29.4	621.3
5-Jan-12	11:45	0.0	5165.1	621.3	29.4	621.3
5-Jan-12	12:00	0.0	5164.5	621.3	29.3	621.3
5-Jan-12	12:15	0.0	5163.9	621.2	29.3	621.2
5-Jan-12	12:30	0.0	5163.3	621.2	29.3	621.2
5-Jan-12	12:45	0.0	5162.7	621.2	29.2	621.2
5-Jan-12	13:00	0.0	5162.1	621.2	29.2	621.2
5-Jan-12	13:15	0.0	5161.5	621.2	29.1	621.2
5-Jan-12	13:30	0.0	5160.9	621.2	29.1	621.2
5-Jan-12	13:45	0.0	5160.3	621.2	29.1	621.2
5-Jan-12	14:00	0.0	5159.7	621.2	29.0	621.2
5-Jan-12	14:15	0.0	5159.1	621.2	29.0	621.2
5-Jan-12	14:30	0.0	5158.5	621.2	28.9	621.2
5-Jan-12	14:45	0.0	5157.9	621.2	28.9	621.2
5-Jan-12	15:00	0.0	5157.3	621.2	28.9	621.2
5-Jan-12	15:15	0.0	5156.7	621.2	28.8	621.2
5-Jan-12	15:30	0.0	5156.1	621.2	28.8	621.2
5-Jan-12	15:45	0.0	5155.5	621.2	28.8	621.2
5-Jan-12	16:00	0.0	5154.9	621.2	28.7	621.2
5-Jan-12	16:15	0.0	5154.3	621.2	28.7	621.2
5-Jan-12	16:30	0.0	5153.7	621.2	28.6	621.2
5-Jan-12	16:45	0.0	5153.1	621.2	28.6	621.2
5-Jan-12	17:00	0.0	5152.5	621.2	28.6	621.2
5-Jan-12	17:15	0.0	5152.0	621.1	28.5	621.1
5-Jan-12	17:30	0.0	5151.4	621.1	28.5	621.1
5-Jan-12	17:45	0.0	5150.8	621.1	28.4	621.1
5-Jan-12	18:00	0.0	5150.2	621.1	28.4	621.1
5-Jan-12	18:15	0.0	5149.6	621.1	28.4	621.1
5-Jan-12	18:30	0.0	5149.0	621.1	28.3	621.1
5-Jan-12	18:45	0.0	5148.4	621.1	28.3	621.1
5-Jan-12	19:00	0.0	5147.8	621.1	28.3	621.1
5-Jan-12	19:15	0.0	5147.3	621.1	28.2	621.1
5-Jan-12	19:30	0.0	5146.7	621.1	28.2	621.1
5-Jan-12	19:45	0.0	5146.1	621.1	28.1	621.1
5-Jan-12	20:00	0.0	5145.5	621.1	28.1	621.1
5-Jan-12	20:15	0.0	5144.9	621.1	28.1	621.1
5-Jan-12	20:30	0.0	5144.4	621.1	28.0	621.1
5-Jan-12	20:45	0.0	5143.8	621.1	28.0	621.1
5-Jan-12	21:00	0.0	5143.2	621.1	28.0	621.1
5-Jan-12	21:15	0.0	5142.6	621.1	27.9	621.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
5-Jan-12	21:30	0.0	5142.0	621.1	27.9	621.1
5-Jan-12	21:45	0.0	5141.5	621.1	27.8	621.1
5-Jan-12	22:00	0.0	5140.9	621.1	27.8	621.1
5-Jan-12	22:15	0.0	5140.3	621.0	27.8	621.0
5-Jan-12	22:30	0.0	5139.7	621.0	27.7	621.0
5-Jan-12	22:45	0.0	5139.2	621.0	27.7	621.0
5-Jan-12	23:00	0.0	5138.6	621.0	27.7	621.0
5-Jan-12	23:15	0.0	5138.0	621.0	27.6	621.0
5-Jan-12	23:30	0.0	5137.5	621.0	27.6	621.0
5-Jan-12	23:45	0.0	5136.9	621.0	27.6	621.0
6-Jan-12	0:00	0.0	5136.3	621.0	27.5	621.0
6-Jan-12	0:15	0.0	5135.8	621.0	27.5	621.0
6-Jan-12	0:30	0.0	5135.2	621.0	27.4	621.0
6-Jan-12	0:45	0.0	5134.6	621.0	27.4	621.0
6-Jan-12	1:00	0.0	5134.1	621.0	27.4	621.0
6-Jan-12	1:15	0.0	5133.5	621.0	27.3	621.0
6-Jan-12	1:30	0.0	5132.9	621.0	27.3	621.0
6-Jan-12	1:45	0.0	5132.4	621.0	27.2	621.0
6-Jan-12	2:00	0.0	5131.8	621.0	27.2	621.0
6-Jan-12	2:15	0.0	5131.2	621.0	27.1	621.0
6-Jan-12	2:30	0.0	5130.7	621.0	27.1	621.0
6-Jan-12	2:45	0.0	5130.1	621.0	27.1	621.0
6-Jan-12	3:00	0.0	5129.6	621.0	27.0	621.0
6-Jan-12	3:15	0.0	5129.0	620.9	27.0	620.9
6-Jan-12	3:30	0.0	5128.4	620.9	26.9	620.9
6-Jan-12	3:45	0.0	5127.9	620.9	26.9	620.9
6-Jan-12	4:00	0.0	5127.3	620.9	26.9	620.9
6-Jan-12	4:15	0.0	5126.8	620.9	26.8	620.9
6-Jan-12	4:30	0.0	5126.2	620.9	26.8	620.9
6-Jan-12	4:45	0.0	5125.7	620.9	26.7	620.9
6-Jan-12	5:00	0.0	5125.1	620.9	26.7	620.9
6-Jan-12	5:15	0.0	5124.6	620.9	26.6	620.9
6-Jan-12	5:30	0.0	5124.0	620.9	26.6	620.9
6-Jan-12	5:45	0.0	5123.5	620.9	26.6	620.9
6-Jan-12	6:00	0.0	5122.9	620.9	26.5	620.9
6-Jan-12	6:15	0.0	5122.4	620.9	26.5	620.9
6-Jan-12	6:30	0.0	5121.8	620.9	26.4	620.9
6-Jan-12	6:45	0.0	5121.3	620.9	26.4	620.9
6-Jan-12	7:00	0.0	5120.7	620.9	26.4	620.9
6-Jan-12	7:15	0.0	5120.2	620.9	26.3	620.9
6-Jan-12	7:30	0.0	5119.7	620.9	26.3	620.9
6-Jan-12	7:45	0.0	5119.1	620.9	26.2	620.9
6-Jan-12	8:00	0.0	5118.6	620.9	26.2	620.9
6-Jan-12	8:15	0.0	5118.0	620.9	26.2	620.9
6-Jan-12	8:30	0.0	5117.5	620.9	26.1	620.9
6-Jan-12	8:45	0.0	5116.9	620.8	26.1	620.8
6-Jan-12	9:00	0.0	5116.4	620.8	26.0	620.8
6-Jan-12	9:15	0.0	5115.9	620.8	26.0	620.8
6-Jan-12	9:30	0.0	5115.3	620.8	26.0	620.8
6-Jan-12	9:45	0.0	5114.8	620.8	25.9	620.8
6-Jan-12	10:00	0.0	5114.3	620.8	25.9	620.8
6-Jan-12	10:15	0.0	5113.7	620.8	25.8	620.8
6-Jan-12	10:30	0.0	5113.2	620.8	25.8	620.8

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
6-Jan-12	10:45	0.0	5112.7	620.8	25.8	620.8
6-Jan-12	11:00	0.0	5112.1	620.8	25.7	620.8
6-Jan-12	11:15	0.0	5111.6	620.8	25.7	620.8
6-Jan-12	11:30	0.0	5111.1	620.8	25.6	620.8
6-Jan-12	11:45	0.0	5110.5	620.8	25.6	620.8
6-Jan-12	12:00	0.0	5110.0	620.8	25.6	620.8
6-Jan-12	12:15	0.0	5109.5	620.8	25.5	620.8
6-Jan-12	12:30	0.0	5109.0	620.8	25.5	620.8
6-Jan-12	12:45	0.0	5108.4	620.8	25.4	620.8
6-Jan-12	13:00	0.0	5107.9	620.8	25.4	620.8
6-Jan-12	13:15	0.0	5107.4	620.8	25.4	620.8
6-Jan-12	13:30	0.0	5106.9	620.8	25.3	620.8
6-Jan-12	13:45	0.0	5106.3	620.8	25.3	620.8
6-Jan-12	14:00	0.0	5105.8	620.8	25.2	620.8
6-Jan-12	14:15	0.0	5105.3	620.7	25.2	620.7
6-Jan-12	14:30	0.0	5104.8	620.7	25.2	620.7
6-Jan-12	14:45	0.0	5104.3	620.7	25.1	620.7
6-Jan-12	15:00	0.0	5103.7	620.7	25.1	620.7
6-Jan-12	15:15	0.0	5103.2	620.7	25.0	620.7
6-Jan-12	15:30	0.0	5102.7	620.7	25.0	620.7
6-Jan-12	15:45	0.0	5102.2	620.7	25.0	620.7
6-Jan-12	16:00	0.0	5101.7	620.7	24.9	620.7
6-Jan-12	16:15	0.0	5101.2	620.7	24.9	620.7
6-Jan-12	16:30	0.0	5100.6	620.7	24.8	620.7
6-Jan-12	16:45	0.0	5100.1	620.7	24.8	620.7
6-Jan-12	17:00	0.0	5099.6	620.7	24.8	620.7
6-Jan-12	17:15	0.0	5099.1	620.7	24.7	620.7
6-Jan-12	17:30	0.0	5098.6	620.7	24.7	620.7
6-Jan-12	17:45	0.0	5098.1	620.7	24.7	620.7
6-Jan-12	18:00	0.0	5097.6	620.7	24.6	620.7
6-Jan-12	18:15	0.0	5097.1	620.7	24.6	620.7
6-Jan-12	18:30	0.0	5096.6	620.7	24.5	620.7
6-Jan-12	18:45	0.0	5096.1	620.7	24.5	620.7
6-Jan-12	19:00	0.0	5095.6	620.7	24.5	620.7
6-Jan-12	19:15	0.0	5095.0	620.7	24.4	620.7
6-Jan-12	19:30	0.0	5094.5	620.7	24.4	620.7
6-Jan-12	19:45	0.0	5094.0	620.6	24.4	620.6
6-Jan-12	20:00	0.0	5093.5	620.6	24.3	620.6
6-Jan-12	20:15	0.0	5093.0	620.6	24.3	620.6
6-Jan-12	20:30	0.0	5092.5	620.6	24.2	620.6
6-Jan-12	20:45	0.0	5092.0	620.6	24.2	620.6
6-Jan-12	21:00	0.0	5091.5	620.6	24.2	620.6
6-Jan-12	21:15	0.0	5091.0	620.6	24.1	620.6
6-Jan-12	21:30	0.0	5090.5	620.6	24.1	620.6
6-Jan-12	21:45	0.0	5090.0	620.6	24.0	620.6
6-Jan-12	22:00	0.0	5089.5	620.6	24.0	620.6
6-Jan-12	22:15	0.0	5089.0	620.6	24.0	620.6
6-Jan-12	22:30	0.0	5088.6	620.6	23.9	620.6
6-Jan-12	22:45	0.0	5088.1	620.6	23.9	620.6
6-Jan-12	23:00	0.0	5087.6	620.6	23.9	620.6
6-Jan-12	23:15	0.0	5087.1	620.6	23.8	620.6
6-Jan-12	23:30	0.0	5086.6	620.6	23.8	620.6
6-Jan-12	23:45	0.0	5086.1	620.6	23.8	620.6

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
7-Jan-12	0:00	0.0	5085.6	620.6	23.7	620.6
7-Jan-12	0:15	0.0	5085.1	620.6	23.7	620.6
7-Jan-12	0:30	0.0	5084.6	620.6	23.6	620.6
7-Jan-12	0:45	0.0	5084.1	620.6	23.6	620.6
7-Jan-12	1:00	0.0	5083.6	620.6	23.6	620.6
7-Jan-12	1:15	0.0	5083.2	620.6	23.5	620.6
7-Jan-12	1:30	0.0	5082.7	620.6	23.5	620.6
7-Jan-12	1:45	0.0	5082.2	620.5	23.5	620.5
7-Jan-12	2:00	0.0	5081.7	620.5	23.4	620.5
7-Jan-12	2:15	0.0	5081.2	620.5	23.4	620.5
7-Jan-12	2:30	0.0	5080.7	620.5	23.4	620.5
7-Jan-12	2:45	0.0	5080.3	620.5	23.3	620.5
7-Jan-12	3:00	0.0	5079.8	620.5	23.3	620.5
7-Jan-12	3:15	0.0	5079.3	620.5	23.2	620.5
7-Jan-12	3:30	0.0	5078.8	620.5	23.2	620.5
7-Jan-12	3:45	0.0	5078.3	620.5	23.2	620.5
7-Jan-12	4:00	0.0	5077.9	620.5	23.1	620.5
7-Jan-12	4:15	0.0	5077.4	620.5	23.1	620.5
7-Jan-12	4:30	0.0	5076.9	620.5	23.1	620.5
7-Jan-12	4:45	0.0	5076.4	620.5	23.0	620.5
7-Jan-12	5:00	0.0	5075.9	620.5	22.9	620.5
7-Jan-12	5:15	0.0	5075.5	620.5	22.8	620.5
7-Jan-12	5:30	0.0	5075.0	620.5	22.7	620.5
7-Jan-12	5:45	0.0	5074.5	620.5	22.7	620.5
7-Jan-12	6:00	0.0	5074.1	620.5	22.6	620.5
7-Jan-12	6:15	0.0	5073.6	620.5	22.5	620.5
7-Jan-12	6:30	0.0	5073.1	620.5	22.4	620.5
7-Jan-12	6:45	0.0	5072.7	620.5	22.3	620.5
7-Jan-12	7:00	0.0	5072.2	620.5	22.2	620.5
7-Jan-12	7:15	0.0	5071.8	620.5	22.1	620.5
7-Jan-12	7:30	0.0	5071.3	620.5	22.1	620.5
7-Jan-12	7:45	0.0	5070.8	620.5	22.0	620.5
7-Jan-12	8:00	0.0	5070.4	620.4	21.9	620.4
7-Jan-12	8:15	0.0	5069.9	620.4	21.8	620.4
7-Jan-12	8:30	0.0	5069.5	620.4	21.7	620.4
7-Jan-12	8:45	0.0	5069.0	620.4	21.6	620.4
7-Jan-12	9:00	0.0	5068.6	620.4	21.6	620.4
7-Jan-12	9:15	0.0	5068.2	620.4	21.5	620.4
7-Jan-12	9:30	0.0	5067.7	620.4	21.4	620.4
7-Jan-12	9:45	0.0	5067.3	620.4	21.3	620.4
7-Jan-12	10:00	0.0	5066.8	620.4	21.2	620.4
7-Jan-12	10:15	0.0	5066.4	620.4	21.1	620.4
7-Jan-12	10:30	0.0	5066.0	620.4	21.1	620.4
7-Jan-12	10:45	0.0	5065.5	620.4	21.0	620.4
7-Jan-12	11:00	0.0	5065.1	620.4	20.9	620.4
7-Jan-12	11:15	0.0	5064.7	620.4	20.8	620.4
7-Jan-12	11:30	0.0	5064.2	620.4	20.7	620.4
7-Jan-12	11:45	0.0	5063.8	620.4	20.7	620.4
7-Jan-12	12:00	0.0	5063.4	620.4	20.6	620.4
7-Jan-12	12:15	0.0	5063.0	620.4	20.5	620.4
7-Jan-12	12:30	0.0	5062.5	620.4	20.4	620.4
7-Jan-12	12:45	0.0	5062.1	620.4	20.3	620.4
7-Jan-12	13:00	0.0	5061.7	620.4	20.3	620.4

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
7-Jan-12	13:15	0.0	5061.3	620.4	20.2	620.4
7-Jan-12	13:30	0.0	5060.9	620.4	20.1	620.4
7-Jan-12	13:45	0.0	5060.4	620.4	20.0	620.4
7-Jan-12	14:00	0.0	5060.0	620.4	20.0	620.4
7-Jan-12	14:15	0.0	5059.6	620.4	19.9	620.4
7-Jan-12	14:30	0.0	5059.2	620.4	19.8	620.4
7-Jan-12	14:45	0.0	5058.8	620.3	19.7	620.3
7-Jan-12	15:00	0.0	5058.4	620.3	19.7	620.3
7-Jan-12	15:15	0.0	5058.0	620.3	19.6	620.3
7-Jan-12	15:30	0.0	5057.6	620.3	19.5	620.3
7-Jan-12	15:45	0.0	5057.2	620.3	19.4	620.3
7-Jan-12	16:00	0.0	5056.8	620.3	19.4	620.3
7-Jan-12	16:15	0.0	5056.4	620.3	19.3	620.3
7-Jan-12	16:30	0.0	5056.0	620.3	19.2	620.3
7-Jan-12	16:45	0.0	5055.6	620.3	19.1	620.3
7-Jan-12	17:00	0.0	5055.2	620.3	19.1	620.3
7-Jan-12	17:15	0.0	5054.8	620.3	19.0	620.3
7-Jan-12	17:30	0.0	5054.4	620.3	18.9	620.3
7-Jan-12	17:45	0.0	5054.0	620.3	18.8	620.3
7-Jan-12	18:00	0.0	5053.6	620.3	18.8	620.3
7-Jan-12	18:15	0.0	5053.2	620.3	18.7	620.3
7-Jan-12	18:30	0.0	5052.9	620.3	18.6	620.3
7-Jan-12	18:45	0.0	5052.5	620.3	18.6	620.3
7-Jan-12	19:00	0.0	5052.1	620.3	18.5	620.3
7-Jan-12	19:15	0.0	5051.7	620.3	18.4	620.3
7-Jan-12	19:30	0.0	5051.3	620.3	18.3	620.3
7-Jan-12	19:45	0.0	5050.9	620.3	18.3	620.3
7-Jan-12	20:00	0.0	5050.6	620.3	18.2	620.3
7-Jan-12	20:15	0.0	5050.2	620.3	18.1	620.3
7-Jan-12	20:30	0.0	5049.8	620.3	18.1	620.3
7-Jan-12	20:45	0.0	5049.4	620.3	18.0	620.3
7-Jan-12	21:00	0.0	5049.1	620.3	17.9	620.3
7-Jan-12	21:15	0.0	5048.7	620.3	17.9	620.3
7-Jan-12	21:30	0.0	5048.3	620.3	17.8	620.3
7-Jan-12	21:45	0.0	5048.0	620.3	17.7	620.3
7-Jan-12	22:00	0.0	5047.6	620.3	17.7	620.3
7-Jan-12	22:15	0.0	5047.2	620.2	17.6	620.2
7-Jan-12	22:30	0.0	5046.9	620.2	17.5	620.2
7-Jan-12	22:45	0.0	5046.5	620.2	17.5	620.2
7-Jan-12	23:00	0.0	5046.2	620.2	17.4	620.2
7-Jan-12	23:15	0.0	5045.8	620.2	17.3	620.2
7-Jan-12	23:30	0.0	5045.4	620.2	17.3	620.2
7-Jan-12	23:45	0.0	5045.1	620.2	17.2	620.2
8-Jan-12	0:00	0.0	5044.7	620.2	17.1	620.2
8-Jan-12	0:15	0.0	5044.4	620.2	17.1	620.2
8-Jan-12	0:30	0.0	5044.0	620.2	17.0	620.2
8-Jan-12	0:45	0.0	5043.7	620.2	16.9	620.2
8-Jan-12	1:00	0.0	5043.3	620.2	16.9	620.2
8-Jan-12	1:15	0.0	5043.0	620.2	16.8	620.2
8-Jan-12	1:30	0.0	5042.6	620.2	16.7	620.2
8-Jan-12	1:45	0.0	5042.3	620.2	16.7	620.2
8-Jan-12	2:00	0.0	5041.9	620.2	16.6	620.2
8-Jan-12	2:15	0.0	5041.6	620.2	16.5	620.2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
8-Jan-12	2:30	0.0	5041.3	620.2	16.5	620.2
8-Jan-12	2:45	0.0	5040.9	620.2	16.4	620.2
8-Jan-12	3:00	0.0	5040.6	620.2	16.4	620.2
8-Jan-12	3:15	0.0	5040.2	620.2	16.3	620.2
8-Jan-12	3:30	0.0	5039.9	620.2	16.2	620.2
8-Jan-12	3:45	0.0	5039.6	620.2	16.2	620.2
8-Jan-12	4:00	0.0	5039.2	620.2	16.1	620.2
8-Jan-12	4:15	0.0	5038.9	620.2	16.0	620.2
8-Jan-12	4:30	0.0	5038.6	620.2	16.0	620.2
8-Jan-12	4:45	0.0	5038.3	620.2	15.9	620.2
8-Jan-12	5:00	0.0	5037.9	620.2	15.9	620.2
8-Jan-12	5:15	0.0	5037.6	620.2	15.8	620.2
8-Jan-12	5:30	0.0	5037.3	620.2	15.7	620.2
8-Jan-12	5:45	0.0	5036.9	620.2	15.7	620.2
8-Jan-12	6:00	0.0	5036.6	620.2	15.6	620.2
8-Jan-12	6:15	0.0	5036.3	620.2	15.6	620.2
8-Jan-12	6:30	0.0	5036.0	620.2	15.5	620.2
8-Jan-12	6:45	0.0	5035.7	620.1	15.4	620.1
8-Jan-12	7:00	0.0	5035.3	620.1	15.4	620.1
8-Jan-12	7:15	0.0	5035.0	620.1	15.3	620.1
8-Jan-12	7:30	0.0	5034.7	620.1	15.3	620.1
8-Jan-12	7:45	0.0	5034.4	620.1	15.2	620.1
8-Jan-12	8:00	0.0	5034.1	620.1	15.1	620.1
8-Jan-12	8:15	0.0	5033.8	620.1	15.1	620.1
8-Jan-12	8:30	0.0	5033.5	620.1	15.0	620.1
8-Jan-12	8:45	0.0	5033.1	620.1	15.0	620.1
8-Jan-12	9:00	0.0	5032.8	620.1	14.9	620.1
8-Jan-12	9:15	0.0	5032.5	620.1	14.9	620.1
8-Jan-12	9:30	0.0	5032.2	620.1	14.8	620.1
8-Jan-12	9:45	0.0	5031.9	620.1	14.7	620.1
8-Jan-12	10:00	0.0	5031.6	620.1	14.7	620.1
8-Jan-12	10:15	0.0	5031.3	620.1	14.6	620.1
8-Jan-12	10:30	0.0	5031.0	620.1	14.6	620.1
8-Jan-12	10:45	0.0	5030.7	620.1	14.5	620.1
8-Jan-12	11:00	0.0	5030.4	620.1	14.5	620.1
8-Jan-12	11:15	0.0	5030.1	620.1	14.4	620.1
8-Jan-12	11:30	0.0	5029.8	620.1	14.4	620.1
8-Jan-12	11:45	0.0	5029.5	620.1	14.3	620.1
8-Jan-12	12:00	0.0	5029.2	620.1	14.2	620.1
8-Jan-12	12:15	0.0	5028.9	620.1	14.2	620.1
8-Jan-12	12:30	0.0	5028.6	620.1	14.1	620.1
8-Jan-12	12:45	0.0	5028.3	620.1	14.1	620.1
8-Jan-12	13:00	0.0	5028.1	620.1	14.0	620.1
8-Jan-12	13:15	0.0	5027.8	620.1	14.0	620.1
8-Jan-12	13:30	0.0	5027.5	620.1	13.9	620.1
8-Jan-12	13:45	0.0	5027.2	620.1	13.9	620.1
8-Jan-12	14:00	0.0	5026.9	620.1	13.8	620.1
8-Jan-12	14:15	0.0	5026.6	620.1	13.8	620.1
8-Jan-12	14:30	0.0	5026.3	620.1	13.7	620.1
8-Jan-12	14:45	0.0	5026.1	620.1	13.7	620.1
8-Jan-12	15:00	0.0	5025.8	620.1	13.6	620.1
8-Jan-12	15:15	0.0	5025.5	620.1	13.5	620.1
8-Jan-12	15:30	0.0	5025.2	620.1	13.5	620.1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
8-Jan-12	15:45	0.0	5024.9	620.1	13.4	620.1
8-Jan-12	16:00	0.0	5024.7	620.1	13.4	620.1
8-Jan-12	16:15	0.0	5024.4	620.1	13.3	620.1
8-Jan-12	16:30	0.0	5024.1	620.0	13.3	620.0
8-Jan-12	16:45	0.0	5023.8	620.0	13.2	620.0
8-Jan-12	17:00	0.0	5023.6	620.0	13.2	620.0
8-Jan-12	17:15	0.0	5023.3	620.0	13.1	620.0
8-Jan-12	17:30	0.0	5023.0	620.0	13.1	620.0
8-Jan-12	17:45	0.0	5022.7	620.0	13.0	620.0
8-Jan-12	18:00	0.0	5022.5	620.0	13.0	620.0
8-Jan-12	18:15	0.0	5022.2	620.0	12.9	620.0
8-Jan-12	18:30	0.0	5021.9	620.0	12.9	620.0
8-Jan-12	18:45	0.0	5021.7	620.0	12.8	620.0
8-Jan-12	19:00	0.0	5021.4	620.0	12.8	620.0
8-Jan-12	19:15	0.0	5021.2	620.0	12.7	620.0
8-Jan-12	19:30	0.0	5020.9	620.0	12.7	620.0
8-Jan-12	19:45	0.0	5020.6	620.0	12.6	620.0
8-Jan-12	20:00	0.0	5020.4	620.0	12.6	620.0
8-Jan-12	20:15	0.0	5020.1	620.0	12.5	620.0
8-Jan-12	20:30	0.0	5019.8	620.0	12.5	620.0
8-Jan-12	20:45	0.0	5019.6	620.0	12.5	620.0
8-Jan-12	21:00	0.0	5019.3	620.0	12.4	620.0
8-Jan-12	21:15	0.0	5019.1	620.0	12.4	620.0
8-Jan-12	21:30	0.0	5018.8	620.0	12.3	620.0
8-Jan-12	21:45	0.0	5018.6	620.0	12.3	620.0
8-Jan-12	22:00	0.0	5018.3	620.0	12.2	620.0
8-Jan-12	22:15	0.0	5018.1	620.0	12.2	620.0
8-Jan-12	22:30	0.0	5017.8	620.0	12.1	620.0
8-Jan-12	22:45	0.0	5017.6	620.0	12.1	620.0
8-Jan-12	23:00	0.0	5017.3	620.0	12.1	620.0
8-Jan-12	23:15	0.0	5017.1	620.0	12.0	620.0
8-Jan-12	23:30	0.0	5016.8	620.0	12.0	620.0
8-Jan-12	23:45	0.0	5016.6	620.0	12.0	620.0
9-Jan-12	0:00	0.0	5016.3	620.0	11.9	620.0
9-Jan-12	0:15	0.0	5016.1	620.0	11.9	620.0
9-Jan-12	0:30	0.0	5015.8	620.0	11.8	620.0
9-Jan-12	0:45	0.0	5015.6	620.0	11.8	620.0
9-Jan-12	1:00	0.0	5015.3	620.0	11.8	620.0
9-Jan-12	1:15	0.0	5015.1	620.0	11.7	620.0
9-Jan-12	1:30	0.0	5014.9	620.0	11.7	620.0
9-Jan-12	1:45	0.0	5014.6	620.0	11.7	620.0
9-Jan-12	2:00	0.0	5014.4	620.0	11.6	620.0
9-Jan-12	2:15	0.0	5014.1	620.0	11.6	620.0
9-Jan-12	2:30	0.0	5013.9	620.0	11.6	620.0
9-Jan-12	2:45	0.0	5013.7	620.0	11.5	620.0
9-Jan-12	3:00	0.0	5013.4	620.0	11.5	620.0
9-Jan-12	3:15	0.0	5013.2	620.0	11.4	620.0
9-Jan-12	3:30	0.0	5012.9	620.0	11.4	620.0
9-Jan-12	3:45	0.0	5012.7	620.0	11.4	620.0
9-Jan-12	4:00	0.0	5012.5	619.9	11.3	619.9
9-Jan-12	4:15	0.0	5012.2	619.9	11.3	619.9
9-Jan-12	4:30	0.0	5012.0	619.9	11.3	619.9
9-Jan-12	4:45	0.0	5011.8	619.9	11.2	619.9

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
9-Jan-12	5:00	0.0	5011.5	619.9	11.2	619.9
9-Jan-12	5:15	0.0	5011.3	619.9	11.2	619.9
9-Jan-12	5:30	0.0	5011.1	619.9	11.1	619.9
9-Jan-12	5:45	0.0	5010.9	619.9	11.1	619.9
9-Jan-12	6:00	0.0	5010.6	619.9	11.1	619.9
9-Jan-12	6:15	0.0	5010.4	619.9	11.0	619.9
9-Jan-12	6:30	0.0	5010.2	619.9	11.0	619.9
9-Jan-12	6:45	0.0	5009.9	619.9	11.0	619.9
9-Jan-12	7:00	0.0	5009.7	619.9	10.9	619.9
9-Jan-12	7:15	0.0	5009.5	619.9	10.9	619.9
9-Jan-12	7:30	0.0	5009.3	619.9	10.9	619.9
9-Jan-12	7:45	0.0	5009.0	619.9	10.8	619.9
9-Jan-12	8:00	0.0	5008.8	619.9	10.8	619.9
9-Jan-12	8:15	0.0	5008.6	619.9	10.8	619.9
9-Jan-12	8:30	0.0	5008.4	619.9	10.7	619.9
9-Jan-12	8:45	0.0	5008.2	619.9	10.7	619.9
9-Jan-12	9:00	0.0	5007.9	619.9	10.7	619.9
9-Jan-12	9:15	0.0	5007.7	619.9	10.6	619.9
9-Jan-12	9:30	0.0	5007.5	619.9	10.6	619.9
9-Jan-12	9:45	0.0	5007.3	619.9	10.6	619.9
9-Jan-12	10:00	0.0	5007.1	619.9	10.5	619.9
9-Jan-12	10:15	0.0	5006.8	619.9	10.5	619.9
9-Jan-12	10:30	0.0	5006.6	619.9	10.5	619.9
9-Jan-12	10:45	0.0	5006.4	619.9	10.4	619.9
9-Jan-12	11:00	0.0	5006.2	619.9	10.4	619.9
9-Jan-12	11:15	0.0	5006.0	619.9	10.4	619.9
9-Jan-12	11:30	0.0	5005.8	619.9	10.3	619.9
9-Jan-12	11:45	0.0	5005.6	619.9	10.3	619.9
9-Jan-12	12:00	0.0	5005.3	619.9	10.3	619.9
9-Jan-12	12:15	0.0	5005.1	619.9	10.2	619.9
9-Jan-12	12:30	0.0	5004.9	619.9	10.2	619.9
9-Jan-12	12:45	0.0	5004.7	619.9	10.2	619.9
9-Jan-12	13:00	0.0	5004.5	619.9	10.1	619.9
9-Jan-12	13:15	0.0	5004.3	619.9	10.1	619.9
9-Jan-12	13:30	0.0	5004.1	619.9	10.1	619.9
9-Jan-12	13:45	0.0	5003.9	619.9	10.1	619.9
9-Jan-12	14:00	0.0	5003.7	619.9	10.0	619.9
9-Jan-12	14:15	0.0	5003.5	619.9	10.0	619.9
9-Jan-12	14:30	0.0	5003.2	619.9	10.0	619.9
9-Jan-12	14:45	0.0	5003.0	619.9	9.9	619.9
9-Jan-12	15:00	0.0	5002.8	619.9	9.9	619.9
9-Jan-12	15:15	0.0	5002.6	619.9	9.9	619.9
9-Jan-12	15:30	0.0	5002.4	619.9	9.8	619.9
9-Jan-12	15:45	0.0	5002.2	619.9	9.8	619.9
9-Jan-12	16:00	0.0	5002.0	619.9	9.8	619.9
9-Jan-12	16:15	0.0	5001.8	619.9	9.7	619.9
9-Jan-12	16:30	0.0	5001.6	619.9	9.7	619.9
9-Jan-12	16:45	0.0	5001.4	619.9	9.7	619.9
9-Jan-12	17:00	0.0	5001.2	619.9	9.7	619.9
9-Jan-12	17:15	0.0	5001.0	619.9	9.6	619.9
9-Jan-12	17:30	0.0	5000.8	619.8	9.6	619.8
9-Jan-12	17:45	0.0	5000.6	619.8	9.6	619.8
9-Jan-12	18:00	0.0	5000.4	619.8	9.5	619.8

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
9-Jan-12	18:15	0.0	5000.2	619.8	9.5	619.8
9-Jan-12	18:30	0.0	5000.0	619.8	9.5	619.8
9-Jan-12	18:45	0.0	4999.8	619.8	9.4	619.8
9-Jan-12	19:00	0.0	4999.6	619.8	9.4	619.8
9-Jan-12	19:15	0.0	4999.5	619.8	9.4	619.8
9-Jan-12	19:30	0.0	4999.3	619.8	9.4	619.8
9-Jan-12	19:45	0.0	4999.1	619.8	9.3	619.8
9-Jan-12	20:00	0.0	4998.9	619.8	9.3	619.8
9-Jan-12	20:15	0.0	4998.7	619.8	9.3	619.8
9-Jan-12	20:30	0.0	4998.5	619.8	9.2	619.8
9-Jan-12	20:45	0.0	4998.3	619.8	9.2	619.8
9-Jan-12	21:00	0.0	4998.1	619.8	9.2	619.8
9-Jan-12	21:15	0.0	4997.9	619.8	9.2	619.8
9-Jan-12	21:30	0.0	4997.7	619.8	9.1	619.8
9-Jan-12	21:45	0.0	4997.5	619.8	9.1	619.8
9-Jan-12	22:00	0.0	4997.4	619.8	9.1	619.8
9-Jan-12	22:15	0.0	4997.2	619.8	9.0	619.8
9-Jan-12	22:30	0.0	4997.0	619.8	9.0	619.8
9-Jan-12	22:45	0.0	4996.8	619.8	9.0	619.8
9-Jan-12	23:00	0.0	4996.6	619.8	9.0	619.8
9-Jan-12	23:15	0.0	4996.4	619.8	8.9	619.8
9-Jan-12	23:30	0.0	4996.2	619.8	8.9	619.8
9-Jan-12	23:45	0.0	4996.1	619.8	8.9	619.8
10-Jan-12	0:00	0.0	4995.9	619.8	8.9	619.8
10-Jan-12	0:15	0.0	4995.7	619.8	8.8	619.8
10-Jan-12	0:30	0.0	4995.5	619.8	8.8	619.8
10-Jan-12	0:45	0.0	4995.3	619.8	8.8	619.8
10-Jan-12	1:00	0.0	4995.1	619.8	8.7	619.8
10-Jan-12	1:15	0.0	4995.0	619.8	8.7	619.8
10-Jan-12	1:30	0.0	4994.8	619.8	8.7	619.8
10-Jan-12	1:45	0.0	4994.6	619.8	8.7	619.8
10-Jan-12	2:00	0.0	4994.4	619.8	8.6	619.8
10-Jan-12	2:15	0.0	4994.2	619.8	8.6	619.8
10-Jan-12	2:30	0.0	4994.1	619.8	8.6	619.8
10-Jan-12	2:45	0.0	4993.9	619.8	8.6	619.8
10-Jan-12	3:00	0.0	4993.7	619.8	8.5	619.8
10-Jan-12	3:15	0.0	4993.5	619.8	8.5	619.8
10-Jan-12	3:30	0.0	4993.4	619.8	8.5	619.8
10-Jan-12	3:45	0.0	4993.2	619.8	8.5	619.8
10-Jan-12	4:00	0.0	4993.0	619.8	8.4	619.8
10-Jan-12	4:15	0.0	4992.8	619.8	8.4	619.8
10-Jan-12	4:30	0.0	4992.7	619.8	8.4	619.8
10-Jan-12	4:45	0.0	4992.5	619.8	8.3	619.8
10-Jan-12	5:00	0.0	4992.3	619.8	8.3	619.8
10-Jan-12	5:15	0.0	4992.2	619.8	8.3	619.8
10-Jan-12	5:30	0.0	4992.0	619.8	8.3	619.8
10-Jan-12	5:45	0.0	4991.8	619.8	8.2	619.8
10-Jan-12	6:00	0.0	4991.6	619.8	8.2	619.8
10-Jan-12	6:15	0.0	4991.5	619.8	8.2	619.8
10-Jan-12	6:30	0.0	4991.3	619.8	8.2	619.8
10-Jan-12	6:45	0.0	4991.1	619.8	8.1	619.8
10-Jan-12	7:00	0.0	4991.0	619.8	8.1	619.8
10-Jan-12	7:15	0.0	4990.8	619.8	8.1	619.8

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
10-Jan-12	7:30	0.0	4990.6	619.8	8.1	619.8
10-Jan-12	7:45	0.0	4990.5	619.8	8.0	619.8
10-Jan-12	8:00	0.0	4990.3	619.8	8.0	619.8
10-Jan-12	8:15	0.0	4990.1	619.8	8.0	619.8
10-Jan-12	8:30	0.0	4990.0	619.8	8.0	619.8
10-Jan-12	8:45	0.0	4989.8	619.8	7.9	619.8
10-Jan-12	9:00	0.0	4989.6	619.8	7.9	619.8
10-Jan-12	9:15	0.0	4989.5	619.8	7.9	619.8
10-Jan-12	9:30	0.0	4989.3	619.8	7.9	619.8
10-Jan-12	9:45	0.0	4989.1	619.7	7.8	619.7
10-Jan-12	10:00	0.0	4989.0	619.7	7.8	619.7
10-Jan-12	10:15	0.0	4988.8	619.7	7.8	619.7
10-Jan-12	10:30	0.0	4988.7	619.7	7.8	619.7
10-Jan-12	10:45	0.0	4988.5	619.7	7.8	619.7
10-Jan-12	11:00	0.0	4988.3	619.7	7.7	619.7
10-Jan-12	11:15	0.0	4988.2	619.7	7.7	619.7
10-Jan-12	11:30	0.0	4988.0	619.7	7.7	619.7
10-Jan-12	11:45	0.0	4987.9	619.7	7.7	619.7
10-Jan-12	12:00	0.0	4987.7	619.7	7.6	619.7
10-Jan-12	12:15	0.0	4987.6	619.7	7.6	619.7
10-Jan-12	12:30	0.0	4987.4	619.7	7.6	619.7
10-Jan-12	12:45	0.0	4987.2	619.7	7.6	619.7
10-Jan-12	13:00	0.0	4987.1	619.7	7.5	619.7
10-Jan-12	13:15	0.0	4986.9	619.7	7.5	619.7
10-Jan-12	13:30	0.0	4986.8	619.7	7.5	619.7
10-Jan-12	13:45	0.0	4986.6	619.7	7.5	619.7
10-Jan-12	14:00	0.0	4986.5	619.7	7.4	619.7
10-Jan-12	14:15	0.0	4986.3	619.7	7.4	619.7
10-Jan-12	14:30	0.0	4986.2	619.7	7.4	619.7
10-Jan-12	14:45	0.0	4986.0	619.7	7.4	619.7
10-Jan-12	15:00	0.0	4985.9	619.7	7.4	619.7
10-Jan-12	15:15	0.0	4985.7	619.7	7.3	619.7
10-Jan-12	15:30	0.0	4985.6	619.7	7.3	619.7
10-Jan-12	15:45	0.0	4985.4	619.7	7.3	619.7
10-Jan-12	16:00	0.0	4985.2	619.7	7.3	619.7
10-Jan-12	16:15	0.0	4985.1	619.7	7.2	619.7
10-Jan-12	16:30	0.0	4985.0	619.7	7.2	619.7
10-Jan-12	16:45	0.0	4984.8	619.7	7.2	619.7
10-Jan-12	17:00	0.0	4984.7	619.7	7.2	619.7
10-Jan-12	17:15	0.0	4984.5	619.7	7.2	619.7
10-Jan-12	17:30	0.0	4984.4	619.7	7.1	619.7
10-Jan-12	17:45	0.0	4984.2	619.7	7.1	619.7
10-Jan-12	18:00	0.0	4984.1	619.7	7.1	619.7
10-Jan-12	18:15	0.0	4983.9	619.7	7.1	619.7
10-Jan-12	18:30	0.0	4983.8	619.7	7.0	619.7
10-Jan-12	18:45	0.0	4983.6	619.7	7.0	619.7
10-Jan-12	19:00	0.0	4983.5	619.7	7.0	619.7
10-Jan-12	19:15	0.0	4983.3	619.7	7.0	619.7
10-Jan-12	19:30	0.0	4983.2	619.7	7.0	619.7
10-Jan-12	19:45	0.0	4983.0	619.7	6.9	619.7
10-Jan-12	20:00	0.0	4982.9	619.7	6.9	619.7
10-Jan-12	20:15	0.0	4982.8	619.7	6.9	619.7
10-Jan-12	20:30	0.0	4982.6	619.7	6.9	619.7

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
10-Jan-12	20:45	0.0	4982.5	619.7	6.8	619.7
10-Jan-12	21:00	0.0	4982.3	619.7	6.8	619.7
10-Jan-12	21:15	0.0	4982.2	619.7	6.8	619.7
10-Jan-12	21:30	0.0	4982.1	619.7	6.8	619.7
10-Jan-12	21:45	0.0	4981.9	619.7	6.8	619.7
10-Jan-12	22:00	0.0	4981.8	619.7	6.7	619.7
10-Jan-12	22:15	0.0	4981.6	619.7	6.7	619.7
10-Jan-12	22:30	0.0	4981.5	619.7	6.7	619.7
10-Jan-12	22:45	0.0	4981.4	619.7	6.7	619.7
10-Jan-12	23:00	0.0	4981.2	619.7	6.7	619.7
10-Jan-12	23:15	0.0	4981.1	619.7	6.6	619.7
10-Jan-12	23:30	0.0	4980.9	619.7	6.6	619.7
10-Jan-12	23:45	0.0	4980.8	619.7	6.6	619.7
11-Jan-12	0:00	0.0	4980.7	619.7	6.6	619.7
11-Jan-12	0:15	0.0	4980.5	619.7	6.6	619.7
11-Jan-12	0:30	0.0	4980.4	619.7	6.5	619.7
11-Jan-12	0:45	0.0	4980.3	619.7	6.5	619.7
11-Jan-12	1:00	0.0	4980.1	619.7	6.5	619.7
11-Jan-12	1:15	0.0	4980.0	619.7	6.5	619.7
11-Jan-12	1:30	0.0	4979.9	619.7	6.5	619.7
11-Jan-12	1:45	0.0	4979.7	619.7	6.4	619.7
11-Jan-12	2:00	0.0	4979.6	619.7	6.4	619.7
11-Jan-12	2:15	0.0	4979.5	619.7	6.4	619.7
11-Jan-12	2:30	0.0	4979.3	619.7	6.4	619.7
11-Jan-12	2:45	0.0	4979.2	619.7	6.4	619.7
11-Jan-12	3:00	0.0	4979.1	619.7	6.3	619.7
11-Jan-12	3:15	0.0	4978.9	619.7	6.3	619.7
11-Jan-12	3:30	0.0	4978.8	619.7	6.3	619.7
11-Jan-12	3:45	0.0	4978.7	619.7	6.3	619.7
11-Jan-12	4:00	0.0	4978.6	619.7	6.3	619.7
11-Jan-12	4:15	0.0	4978.4	619.7	6.2	619.7
11-Jan-12	4:30	0.0	4978.3	619.7	6.2	619.7
11-Jan-12	4:45	0.0	4978.2	619.7	6.2	619.7
11-Jan-12	5:00	0.0	4978.0	619.7	6.2	619.7
11-Jan-12	5:15	0.0	4977.9	619.7	6.2	619.7
11-Jan-12	5:30	0.0	4977.8	619.7	6.1	619.7
11-Jan-12	5:45	0.0	4977.7	619.7	6.1	619.7
11-Jan-12	6:00	0.0	4977.5	619.6	6.1	619.6
11-Jan-12	6:15	0.0	4977.4	619.6	6.1	619.6
11-Jan-12	6:30	0.0	4977.3	619.6	6.1	619.6
11-Jan-12	6:45	0.0	4977.2	619.6	6.1	619.6
11-Jan-12	7:00	0.0	4977.0	619.6	6.0	619.6
11-Jan-12	7:15	0.0	4976.9	619.6	6.0	619.6
11-Jan-12	7:30	0.0	4976.8	619.6	6.0	619.6
11-Jan-12	7:45	0.0	4976.7	619.6	6.0	619.6
11-Jan-12	8:00	0.0	4976.5	619.6	6.0	619.6
11-Jan-12	8:15	0.0	4976.4	619.6	5.9	619.6
11-Jan-12	8:30	0.0	4976.3	619.6	5.9	619.6
11-Jan-12	8:45	0.0	4976.2	619.6	5.9	619.6
11-Jan-12	9:00	0.0	4976.0	619.6	5.9	619.6
11-Jan-12	9:15	0.0	4975.9	619.6	5.9	619.6
11-Jan-12	9:30	0.0	4975.8	619.6	5.8	619.6
11-Jan-12	9:45	0.0	4975.7	619.6	5.8	619.6

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
11-Jan-12	10:00	0.0	4975.6	619.6	5.8	619.6
11-Jan-12	10:15	0.0	4975.4	619.6	5.8	619.6
11-Jan-12	10:30	0.0	4975.3	619.6	5.8	619.6
11-Jan-12	10:45	0.0	4975.2	619.6	5.8	619.6
11-Jan-12	11:00	0.0	4975.1	619.6	5.7	619.6
11-Jan-12	11:15	0.0	4975.0	619.6	5.7	619.6
11-Jan-12	11:30	0.0	4974.8	619.6	5.7	619.6
11-Jan-12	11:45	0.0	4974.7	619.6	5.7	619.6
11-Jan-12	12:00	0.0	4974.6	619.6	5.7	619.6
11-Jan-12	12:15	0.0	4974.5	619.6	5.7	619.6
11-Jan-12	12:30	0.0	4974.4	619.6	5.6	619.6
11-Jan-12	12:45	0.0	4974.3	619.6	5.6	619.6
11-Jan-12	13:00	0.0	4974.1	619.6	5.6	619.6
11-Jan-12	13:15	0.0	4974.0	619.6	5.6	619.6
11-Jan-12	13:30	0.0	4973.9	619.6	5.6	619.6
11-Jan-12	13:45	0.0	4973.8	619.6	5.5	619.6
11-Jan-12	14:00	0.0	4973.7	619.6	5.5	619.6
11-Jan-12	14:15	0.0	4973.6	619.6	5.5	619.6
11-Jan-12	14:30	0.0	4973.5	619.6	5.5	619.6
11-Jan-12	14:45	0.0	4973.3	619.6	5.5	619.6
11-Jan-12	15:00	0.0	4973.2	619.6	5.5	619.6
11-Jan-12	15:15	0.0	4973.1	619.6	5.4	619.6
11-Jan-12	15:30	0.0	4973.0	619.6	5.4	619.6
11-Jan-12	15:45	0.0	4972.9	619.6	5.4	619.6
11-Jan-12	16:00	0.0	4972.8	619.6	5.4	619.6
11-Jan-12	16:15	0.0	4972.7	619.6	5.4	619.6
11-Jan-12	16:30	0.0	4972.6	619.6	5.4	619.6
11-Jan-12	16:45	0.0	4972.5	619.6	5.3	619.6
11-Jan-12	17:00	0.0	4972.3	619.6	5.3	619.6
11-Jan-12	17:15	0.0	4972.2	619.6	5.3	619.6
11-Jan-12	17:30	0.0	4972.1	619.6	5.3	619.6
11-Jan-12	17:45	0.0	4972.0	619.6	5.3	619.6
11-Jan-12	18:00	0.0	4971.9	619.6	5.3	619.6
11-Jan-12	18:15	0.0	4971.8	619.6	5.2	619.6
11-Jan-12	18:30	0.0	4971.7	619.6	5.2	619.6
11-Jan-12	18:45	0.0	4971.6	619.6	5.2	619.6
11-Jan-12	19:00	0.0	4971.5	619.6	5.2	619.6
11-Jan-12	19:15	0.0	4971.4	619.6	5.2	619.6
11-Jan-12	19:30	0.0	4971.3	619.6	5.2	619.6
11-Jan-12	19:45	0.0	4971.2	619.6	5.2	619.6
11-Jan-12	20:00	0.0	4971.0	619.6	5.1	619.6
11-Jan-12	20:15	0.0	4970.9	619.6	5.1	619.6
11-Jan-12	20:30	0.0	4970.8	619.6	5.1	619.6
11-Jan-12	20:45	0.0	4970.7	619.6	5.1	619.6
11-Jan-12	21:00	0.0	4970.6	619.6	5.1	619.6
11-Jan-12	21:15	0.0	4970.5	619.6	5.1	619.6
11-Jan-12	21:30	0.0	4970.4	619.6	5.0	619.6
11-Jan-12	21:45	0.0	4970.3	619.6	5.0	619.6
11-Jan-12	22:00	0.0	4970.2	619.6	5.0	619.6
11-Jan-12	22:15	0.0	4970.1	619.6	5.0	619.6
11-Jan-12	22:30	0.0	4970.0	619.6	5.0	619.6
11-Jan-12	22:45	0.0	4969.9	619.6	5.0	619.6
11-Jan-12	23:00	0.0	4969.8	619.6	4.9	619.6

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
11-Jan-12	23:15	0.0	4969.7	619.6	4.9	619.6
11-Jan-12	23:30	0.0	4969.6	619.6	4.9	619.6
11-Jan-12	23:45	0.0	4969.5	619.6	4.9	619.6
12-Jan-12	0:00	0.0	4969.4	619.6	4.9	619.6
12-Jan-12	0:15	0.0	4969.3	619.6	4.9	619.6
12-Jan-12	0:30	0.0	4969.2	619.6	4.9	619.6
12-Jan-12	0:45	0.0	4969.1	619.6	4.8	619.6
12-Jan-12	1:00	0.0	4969.0	619.6	4.8	619.6
12-Jan-12	1:15	0.0	4968.9	619.6	4.8	619.6
12-Jan-12	1:30	0.0	4968.8	619.6	4.8	619.6
12-Jan-12	1:45	0.0	4968.7	619.6	4.8	619.6
12-Jan-12	2:00	0.0	4968.6	619.6	4.8	619.6
12-Jan-12	2:15	0.0	4968.5	619.6	4.8	619.6
12-Jan-12	2:30	0.0	4968.4	619.6	4.7	619.6
12-Jan-12	2:45	0.0	4968.3	619.6	4.7	619.6
12-Jan-12	3:00	0.0	4968.2	619.6	4.7	619.6
12-Jan-12	3:15	0.0	4968.1	619.6	4.7	619.6
12-Jan-12	3:30	0.0	4968.0	619.6	4.7	619.6
12-Jan-12	3:45	0.0	4967.9	619.6	4.7	619.6
12-Jan-12	4:00	0.0	4967.8	619.6	4.7	619.6
12-Jan-12	4:15	0.0	4967.7	619.6	4.6	619.6
12-Jan-12	4:30	0.0	4967.6	619.6	4.6	619.6
12-Jan-12	4:45	0.0	4967.5	619.6	4.6	619.6
12-Jan-12	5:00	0.0	4967.4	619.6	4.6	619.6
12-Jan-12	5:15	0.0	4967.3	619.6	4.6	619.6
12-Jan-12	5:30	0.0	4967.2	619.6	4.6	619.6
12-Jan-12	5:45	0.0	4967.1	619.6	4.6	619.6
12-Jan-12	6:00	0.0	4967.1	619.6	4.5	619.6
12-Jan-12	6:15	0.0	4967.0	619.6	4.5	619.6
12-Jan-12	6:30	0.0	4966.9	619.6	4.5	619.6
12-Jan-12	6:45	0.0	4966.8	619.6	4.5	619.6
12-Jan-12	7:00	0.0	4966.7	619.6	4.5	619.6
12-Jan-12	7:15	0.0	4966.6	619.6	4.5	619.6
12-Jan-12	7:30	0.0	4966.5	619.6	4.5	619.6
12-Jan-12	7:45	0.0	4966.4	619.6	4.4	619.6
12-Jan-12	8:00	0.0	4966.3	619.6	4.4	619.6
12-Jan-12	8:15	0.0	4966.2	619.6	4.4	619.6
12-Jan-12	8:30	0.0	4966.1	619.6	4.4	619.6
12-Jan-12	8:45	0.0	4966.0	619.6	4.4	619.6
12-Jan-12	9:00	0.0	4965.9	619.6	4.4	619.6
12-Jan-12	9:15	0.0	4965.9	619.5	4.4	619.5
12-Jan-12	9:30	0.0	4965.8	619.5	4.3	619.5
12-Jan-12	9:45	0.0	4965.7	619.5	4.3	619.5
12-Jan-12	10:00	0.0	4965.6	619.5	4.3	619.5
12-Jan-12	10:15	0.0	4965.5	619.5	4.3	619.5
12-Jan-12	10:30	0.0	4965.4	619.5	4.3	619.5
12-Jan-12	10:45	0.0	4965.3	619.5	4.3	619.5
12-Jan-12	11:00	0.0	4965.2	619.5	4.3	619.5
12-Jan-12	11:15	0.0	4965.1	619.5	4.3	619.5
12-Jan-12	11:30	0.0	4965.1	619.5	4.2	619.5
12-Jan-12	11:45	0.0	4965.0	619.5	4.2	619.5
12-Jan-12	12:00	0.0	4964.9	619.5	4.2	619.5
12-Jan-12	12:15	0.0	4964.8	619.5	4.2	619.5

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)	Stage (FT)
12-Jan-12	12:30	0.0	4964.7	619.5	4.2	619.5
12-Jan-12	12:45	0.0	4964.6	619.5	4.2	619.5
12-Jan-12	13:00	0.0	4964.5	619.5	4.2	619.5
12-Jan-12	13:15	0.0	4964.5	619.5	4.1	619.5
12-Jan-12	13:30	0.0	4964.4	619.5	4.1	619.5
12-Jan-12	13:45	0.0	4964.3	619.5	4.1	619.5
12-Jan-12	14:00	0.0	4964.2	619.5	4.1	619.5
12-Jan-12	14:15	0.0	4964.1	619.5	4.1	619.5
12-Jan-12	14:30	0.0	4964.0	619.5	4.1	619.5
12-Jan-12	14:45	0.0	4963.9	619.5	4.1	619.5
12-Jan-12	15:00	0.0	4963.9	619.5	4.1	619.5
12-Jan-12	15:15	0.0	4963.8	619.5	4.0	619.5
12-Jan-12	15:30	0.0	4963.7	619.5	4.0	619.5
12-Jan-12	15:45	0.0	4963.6	619.5	4.0	619.5
12-Jan-12	16:00	0.0	4963.5	619.5	4.0	619.5
12-Jan-12	16:15	0.0	4963.4	619.5	4.0	619.5
12-Jan-12	16:30	0.0	4963.4	619.5	4.0	619.5
12-Jan-12	16:45	0.0	4963.3	619.5	4.0	619.5
12-Jan-12	17:00	0.0	4963.2	619.5	4.0	619.5
12-Jan-12	17:15	0.0	4963.1	619.5	3.9	619.5
12-Jan-12	17:30	0.0	4963.0	619.5	3.9	619.5
12-Jan-12	17:45	0.0	4963.0	619.5	3.9	619.5
12-Jan-12	18:00	0.0	4962.9	619.5	3.9	619.5
12-Jan-12	18:15	0.0	4962.8	619.5	3.9	619.5
12-Jan-12	18:30	0.0	4962.7	619.5	3.9	619.5
12-Jan-12	18:45	0.0	4962.6	619.5	3.9	619.5
12-Jan-12	19:00	0.0	4962.5	619.5	3.9	619.5
12-Jan-12	19:15	0.0	4962.5	619.5	3.9	619.5
12-Jan-12	19:30	0.0	4962.4	619.5	3.8	619.5
12-Jan-12	19:45	0.0	4962.3	619.5	3.8	619.5
12-Jan-12	20:00	0.0	4962.2	619.5	3.8	619.5
12-Jan-12	20:15	0.0	4962.2	619.5	3.8	619.5
12-Jan-12	20:30	0.0	4962.1	619.5	3.8	619.5
12-Jan-12	20:45	0.0	4962.0	619.5	3.8	619.5
12-Jan-12	21:00	0.0	4961.9	619.5	3.8	619.5
12-Jan-12	21:15	0.0	4961.8	619.5	3.8	619.5
12-Jan-12	21:30	0.0	4961.8	619.5	3.7	619.5
12-Jan-12	21:45	0.0	4961.7	619.5	3.7	619.5
12-Jan-12	22:00	0.0	4961.6	619.5	3.7	619.5
12-Jan-12	22:15	0.0	4961.5	619.5	3.7	619.5
12-Jan-12	22:30	0.0	4961.5	619.5	3.7	619.5
12-Jan-12	22:45	0.0	4961.4	619.5	3.7	619.5
12-Jan-12	23:00	0.0	4961.3	619.5	3.7	619.5
12-Jan-12	23:15	0.0	4961.2	619.5	3.7	619.5
12-Jan-12	23:30	0.0	4961.2	619.5	3.7	619.5
12-Jan-12	23:45	0.0	4961.1	619.5	3.6	619.5
13-Jan-12	0:00	0.0	4961.0	619.5	3.6	619.5

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 11/26/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: FACILITY NO. 2 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 1
DESCRIPTION: PHASE 12 DECANT TRASH RACK

Calculation to size trash rack for Phase 12 decant.

From HEC-HMS analysis - Q = 37.3 cfs

For Velocity (V) through trash rack < 2 ft/s :
Q = VA, set V = 2 ft/s
A_n = 37.3 / 2
A_n = 18.65 ft^2

Try 4' x 4' x 12" rack.
Area top = (4 x 4) = 16 ft^2
Area sides = (4)(1 x 4) = 16 ft^2
Area (gross) = A_g = 32 ft^2

With #4 bars at 6" spacing
Bars on top = (2)(4 / (6/12) - 1) = 14
Bars on sides (horizontal)= (4)[(1 / (6/12) - 1)] = 4
Bars on sides (vertical)= (4)[(4 / (6/12) - 1)] = 28

Area of bar (top and long side) = A_b = [(0.5/12) x 4] = 0.1667 ft^2/bar
Area of bar (short side) = [(.5/12) x 1] = 0.0417 ft^2/bar

Total area of bars A_b = (14 + 4)(0.1667) + 28(0.0417) = 4.167 ft^2

$A_n = A_g - A_b$ = 27.833 ft^2 > 18.8 ft^2 **OK**

Check Flow
V = Q /A
V = 37.3 / 27.83 = 1.340 ft/s < 2 ft/s **OK**

Use 4' x 4' x 12" trash rack with #4 bars at 6" spacing.

28" DR-17 DECANT PIPE
DESIGN Q = 37.3 cfs (REF HEC-HMS ANALYSIS)
OUTLET SECTION ON 2% SLOPE

DETERMINE EXIT VELOCITY:

$$Q = \frac{1.48}{n} A R^{2/3} S_o^{1/2} \rightarrow A R^{2/3} = \frac{Q n}{1.48 S_o^{1/2}} = \frac{(37.3)(0.015)}{(1.48)(0.02)^{1/2}} = 2.673$$

FROM TABLE 10.1 GEOMETRIC ELEMENTS FOR CIRCULAR SECTION ("HYDROLOGY & HYDRAULIC SYSTEMS", GUPTA)

$$\frac{A R^{2/3}}{d_o^{8/3}} = \frac{2.673}{(28/12)^{8/3}} = 0.279 \rightarrow \text{PIPE IS FLOWING 74\% DEPTH} \cdot \frac{y}{d_o} = 0.74$$

AT 74% DEPTH, $A/d_o^2 = 0.6229 \Rightarrow$ FLOW AREA $= A = (0.6229)(28/12)^2 = 3.391\ ft^2$

$Q = VA \Rightarrow V = \frac{37.3}{3.391} = 11\ ft/s < 50\ ft/s \Rightarrow$ USBR TYPE VI IMPACT BASIN OK

BASIN DESIGN (REF. HEC 14)
EQUIVALENT DEPTH $y_c = (A/2)^{1/2} = (3.391/2)^{1/2} = 1.302\ ft$

$$F_r = \frac{V_c}{(g y_c)^{1/2}} = \frac{11}{[(32.2)(1.302)]^{1/2}} = 1.7$$

$$H_o = y_c + \frac{V_1^2}{2g} = 1.302 + \frac{11^2}{2(32.2)} = 3.181$$

$H_o/W_b = 0.45$ (REF FIG. 9.14) $\Rightarrow W_b = H_o/0.45 = 3.181/0.45 = 7.07 \Rightarrow$ USE 8 ft WIDE BASIN

DIMENSIONS OF BASIN OBTAINED FROM TABLE 9.2

CHECK EXIT VELOCITY TO DETERMINE IF EROSION PROTECTION IS REQUIRED

$$H_B = \frac{Q}{W_B V_B} + \frac{V_B^2}{2g} = H_o(1 - H_L/H_o) \qquad H_L/H_1 = 0.375 \text{ (FROM FIG. 9.15)}$$

$$= \frac{37.3}{8 V_B} + \frac{V_B^2}{2(32.2)} = 3.181(1 - 0.375)$$

$$= \frac{4.66}{V_B} + \frac{V_B^2}{64.4} = 1.99$$

USING EXCEL GOAL SEEK

$V_B = 2.46\ ft/s \rightarrow$ NO ADDITIONAL EROSION PROTECTION REQUIRED

9.4 USBR TYPE VI IMPACT BASIN

The U.S. Bureau of Reclamation (USBR) Type VI impact basin was developed at the USBR Laboratory (ASCE, 1957). The dissipator is contained in a relatively small box-like structure that requires no tailwater for successful performance. Although the emphasis in this manual is on its use at culvert outlets, the structure may also be used in open channels.

The shape of the basin has evolved from extensive tests, but these were limited in range by the practical size of field structures required. With the many combinations of discharge, velocity, and depth possible for the incoming flow, it became apparent that some device was needed which would be equally effective over the entire range. The vertical hanging baffle, shown in Figure 9.13, proved to be this device. Energy dissipation is initiated by flow striking the vertical hanging baffle and being deflected upstream by the horizontal portion of the baffle and by the floor, creating horizontal eddies.

Notches in the baffle are provided to aid in cleaning the basin after prolonged periods of low or no flow. If the basin is full of sediment, the notches provide concentrated jets of water for cleaning. The basin is designed to carry the full discharge over the top of the baffle if the space beneath the baffle becomes completely clogged. Although this performance is not good, it is acceptable for short periods of time.

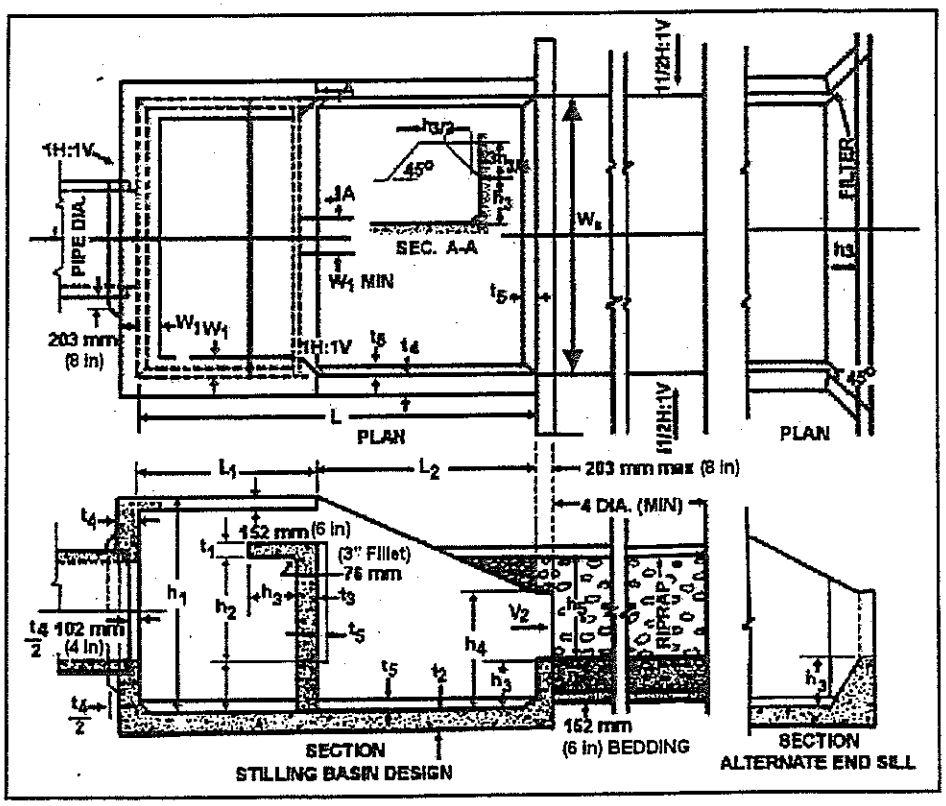


Figure 9.13. USBR Type VI Impact Basin

The design information is presented as a dimensionless curve in Figure 9.14. This curve incorporates the original information contained in ASCE (1957) and the results of additional experimentation performed by the Department of Public Works, City of Los Angeles. The curve

shows the relationship of the Froude number to the ratio of the energy entering the dissipator to the width of dissipator required. The Los Angeles tests indicate that limited extrapolation of this curve is permissible.

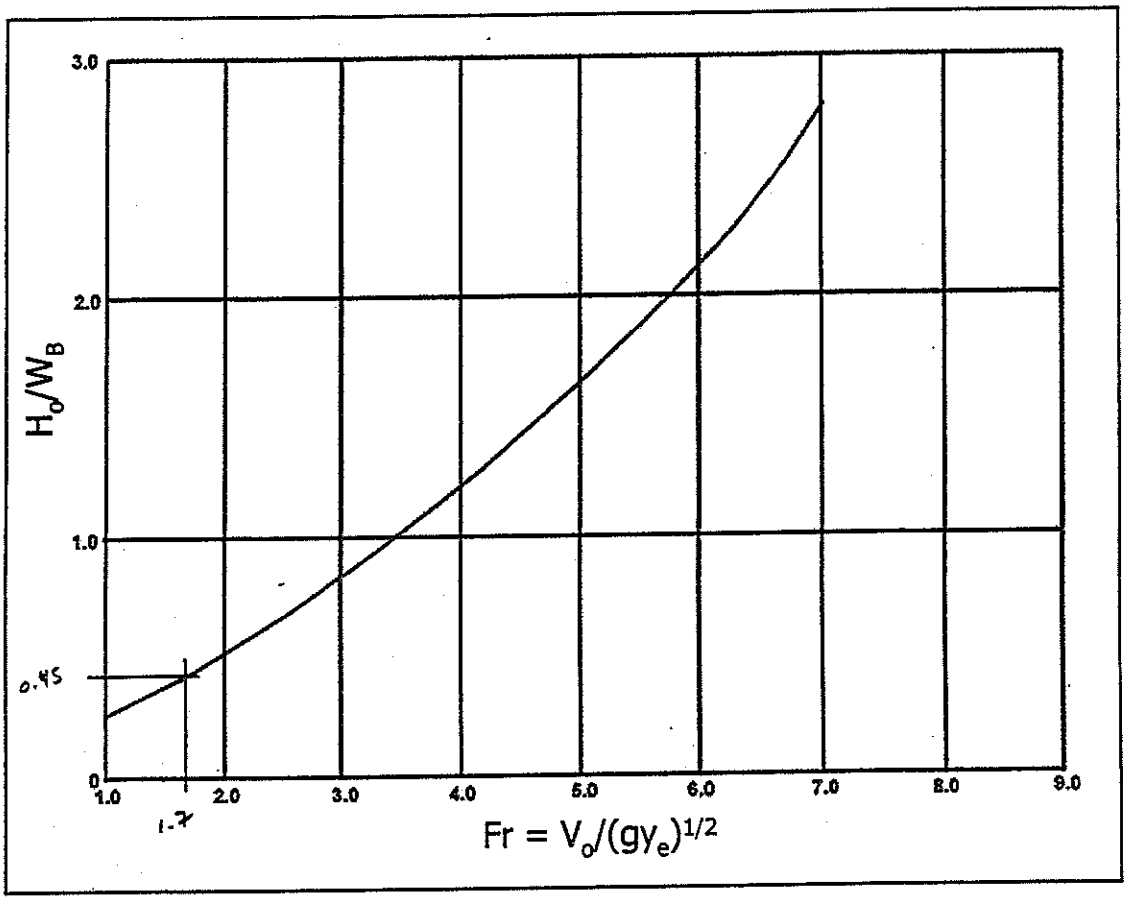


Figure 9.14. Design Curve for USBR Type VI Impact Basin

Once the basin width, W_B, has been determined, many of the other dimensions shown in Figure 9.13 follow according to Table 9.2. To use Table 9.2, round the value of W_B to the nearest entry in the table to determine the other dimensions. Interpolation is not necessary.

In calculating the energy and the Froude number, the equivalent depth of flow, $y_e = (A/2)^{1/2}$, entering the dissipator from a pipe or irregular-shaped conduit must be computed. In other words, the cross section flow area in the pipe is converted into an equivalent rectangular cross section in which the width is twice the depth of flow. The conduit preceding the dissipator can be open, closed, or of any cross section.

The effectiveness of the basin is best illustrated by comparing the energy losses within the structure to those in a natural hydraulic jump, Figure 9.15. The energy loss was computed based on depth and velocity measurements made in the approach pipe and also in the downstream channel with no tailwater. Compared with the natural hydraulic jump, the USBR Type VI impact basin shows a greater capacity for dissipating energy.

Although tailwater is not necessary for successful operation, a moderate depth of tailwater will improve the performance. For best performance set the basin so that maximum tailwater does not exceed $h_3 + (h_2/2)$ which is half of the baffle.

The basin floor should be constructed horizontally and will operate effectively with entrance conduits on slopes up to 15° (27%). For entrance conduits with slopes greater than 15°, a horizontal conduit section of at least four conduit widths long should be provided immediately upstream of the dissipator. Experience has shown that, even for conduits with slopes less than 15 degrees, it is more efficient when the horizontal section of pipe recommended for steeper slopes is used. In every case, the proper position of the entrance invert, as shown in Figure 9.13, should be maintained.

If a horizontal section of pipe is provided before the dissipator, the conduit should be analyzed to determine if a hydraulic jump would form in the conduit. When a hydraulic jump is expected and the pipe outlet is flowing full, a vent about one-sixth the pipe diameter should be installed at a convenient location upstream from the jump.

To provide structural support to the hanging baffle, a short support should be placed under the center of the baffle wall. This support will also provide an additional energy dissipating barrier to the flow.

Table 9.2 (SI). USBR Type VI Impact Basin Dimensions (m) (AASHTO, 1999)

W_B	h_1	h_2	h_3	H_4	L	L_1	L_2
1.0	0.79	0.38	0.17	0.43	1.40	0.59	0.79
1.5	1.16	0.57	0.25	0.62	2.00	0.88	1.16
2.0	1.54	0.75	0.33	0.83	2.68	1.14	1.54
2.5	1.93	0.94	0.42	1.04	3.33	1.43	1.93
3.0	2.30	1.12	0.50	1.25	4.02	1.72	2.30
3.5	2.68	1.32	0.58	1.46	4.65	2.00	2.68
4.0	3.12	1.51	0.67	1.67	5.33	2.28	3.08
4.5	3.46	1.68	0.75	1.88	6.00	2.56	3.46
5.0	3.82	1.87	0.83	2.08	6.52	2.84	3.82
5.5	4.19	2.03	0.91	2.29	7.29	3.12	4.19
6.0	4.60	2.25	1.00	2.50	7.98	3.42	4.60

W_B	W_1	W_2	t_1	t_2	t_3	t_4	t_5
1.0	0.08	0.26	0.15	0.15	0.15	0.15	0.08
1.5	0.13	0.42	0.15	0.15	0.15	0.15	0.08
2.0	0.15	0.55	0.15	0.15	0.15	0.15	0.08
2.5	0.18	0.68	0.16	0.18	0.18	0.16	0.08
3.0	0.22	0.83	0.20	0.20	0.22	0.20	0.08
3.5	0.26	0.91	0.20	0.23	0.23	0.21	0.10
4.0	0.30	0.91	0.20	0.28	0.25	0.25	0.10
4.5	0.36	0.91	0.20	0.30	0.30	0.30	0.13
5.0	0.39	0.91	0.22	0.31	0.30	0.30	0.15
5.5	0.41	0.91	0.22	0.33	0.33	0.33	0.18
6.0	0.45	0.91	0.25	0.36	0.35	0.35	0.19

Table 9.2 (CU). USBR Type VI Impact Basin Dimensions (ft) (AASHTO, 2005)

W_B	h_1	h_2	h_3	h_4	L	L_1	L_2
4.	3.08	1.50	0.67	1.67	5.42	2.33	3.08
5.	3.83	1.92	0.83	2.08	6.67	2.92	3.83
6.	4.58	2.25	1.00	2.50	8.00	3.42	4.58
7.	5.42	2.58	1.17	2.92	9.42	4.00	5.42
8.	6.17	3.00	1.33	3.33	10.67	4.58	6.17
9.	6.92	3.42	1.50	3.75	12.00	5.17	6.92
10.	7.58	3.75	1.67	4.17	13.42	5.75	7.67
11.	8.42	4.17	1.83	4.58	14.58	6.33	8.42
12.	9.17	4.50	2.00	5.00	16.00	6.83	9.17
13.	10.17	4.92	2.17	5.42	17.33	7.42	10.00
14.	10.75	5.25	2.33	5.83	18.67	8.00	10.75
15.	11.50	5.58	2.50	6.25	20.00	8.50	11.50
16.	12.25	6.00	2.67	6.67	21.33	9.08	12.25
17.	13.00	6.33	2.83	7.08	21.50	9.67	13.00
18.	13.75	6.67	3.00	7.50	23.92	10.25	13.75
19.	14.58	7.08	3.17	7.92	25.33	10.83	14.58
20.	15.33	7.50	3.33	8.33	26.58	11.42	15.33

W_B	W_1	W_2	t_1	t_2	t_3	t_4	t_5
4.	0.33	1.08	0.50	0.50	0.50	0.50	0.25
5.	0.42	1.42	0.50	0.50	0.50	0.50	0.25
6.	0.50	1.67	0.50	0.50	0.50	0.50	0.25
7.	0.50	1.92	0.50	0.50	0.50	0.50	0.25
8.	0.58	2.17	0.50	0.58	0.58	0.50	0.25
9.	0.67	2.50	0.58	0.58	0.67	0.58	0.25
10.	0.75	2.75	0.67	0.67	0.75	0.67	0.25
11.	0.83	3.00	0.67	0.75	0.75	0.67	0.33
12.	0.92	3.00	0.67	0.83	0.83	0.75	0.33
13.	1.00	3.00	0.67	0.92	0.83	0.83	0.33
14.	1.08	3.00	0.67	1.00	0.92	0.92	0.42
15.	1.17	3.00	0.67	1.00	1.00	1.00	0.42
16.	1.25	3.00	0.75	1.00	1.00	1.00	0.50
17.	1.33	3.00	0.75	1.08	1.00	1.00	0.50
18.	1.33	3.00	0.75	1.08	1.08	1.08	0.58
19.	1.42	3.00	0.83	1.17	1.08	1.08	0.58
20.	1.50	3.00	0.83	1.17	1.17	1.17	0.67

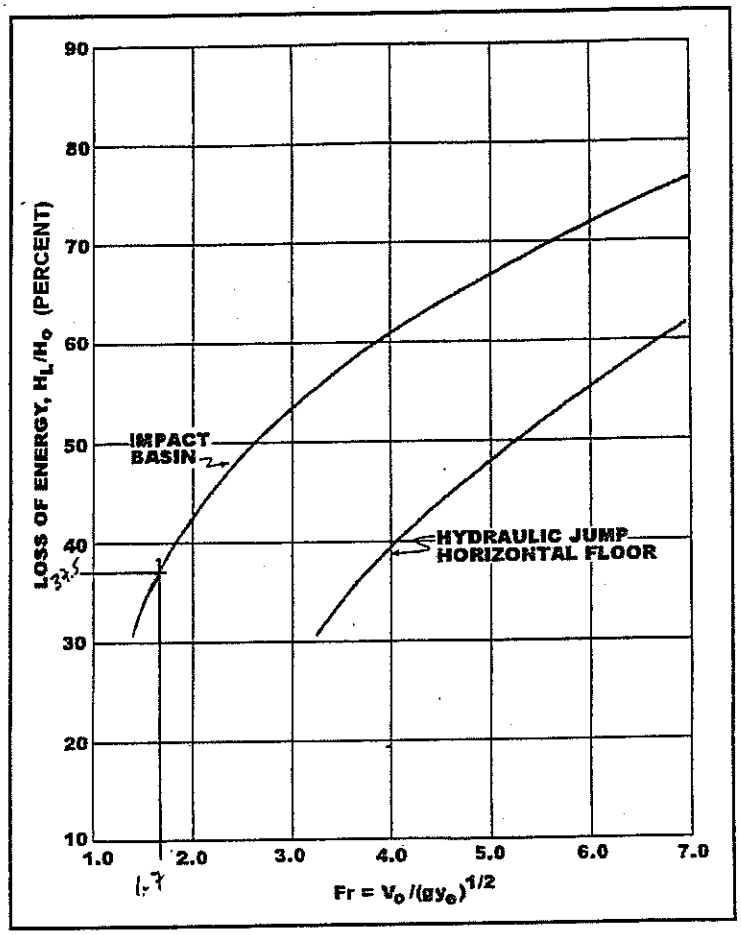


Figure 9.15. Energy Loss of USBR Type VI Impact Basin versus Hydraulic Jump

For erosion reduction and better basin operation, use the alternative end sill and 45° wingwall design as shown in Figure 9.13. The sill should be set as low as possible to prevent degradation downstream. For best performance, the downstream channel should be at the same elevation as the top of the sill. A slot should be placed in the end sill to provide for drainage during periods of low flow. Although the basin is depressed, the slot allows water to drain into the surrounding soil.

For protection against undermining, a cutoff wall should be added at the end of the basin. Its depth will depend on the type of soil present. Riprap should be placed downstream of the basin for a length of at least four conduit widths. For riprap size recommendations see Chapter 10.

The Los Angeles experiments simulated discharges up to 11.3 m^3/s (400 ft^3/s) and entrance velocities as high as 15.2 m/s (50 ft/s). Therefore, use of the basin is limited to installations within these parameters. Velocities up to 15.2 m/s (50 ft/s) can be used without subjecting the structure to damage from cavitation forces. Some structures already constructed have exceeded these thresholds suggesting there may be some design flexibility. For larger installations where discharge is separable, two or more structures may be placed side by side. The USBR Type VI is not recommended where debris or ice buildup may cause substantial clogging.

The recommended design procedure for the USBR Type VI impact basin is as follows:

Step 1. Determine the maximum discharge, Q, and velocity, V_o and check against design limits. Compute the flow area at the end of the approach pipe, A. Compute equivalent depth, $y_e = (A/2)^{1/2}$.

Step 2. Compute the Froude number, Fr, and the energy at the end of the pipe, H_o.

Step 3. Determine H_o/W_B from Figure 9.14. Calculate the required width of basin, W_B.

$W_B = H_o / (H_o/ W_B)$

Step 4. Obtain the remaining dimensions of the USBR Type VI impact basin from Table 9.2 using W_B obtained from step 3.

Step 5. Determine exit velocity, $V_B = V_2$, by trial and error using an energy balance between the culvert exit and the basin exit. Determine if this velocity is acceptable and whether or not riprap protection is needed downstream (see Chapter 10.)

$H_B = Q/(W_B V_B) + V_B^2/(2g) = H_o(1 - H_L/H_o)$

This equation is a cubic equation yielding 3 solutions, two positive and one negative. The negative solution is discarded. The two positive roots yield a subcritical and supercritical solution. Where low or no tailwater exists, the supercritical solution is taken. Where sufficient tailwater exists, the subcritical solution is taken.

Design Example: USBR Type VI Impact Basin (SI)

Determine the USBR Type VI impact basin dimensions for use at the outlet of a concrete pipe. Compare the design with a dissipator at the end of a rectangular concrete channel. Given:

D = 1.219 m (pipe diameter and rectangular channel width)
S_o = 0.15 m/m
Q = 8.5 m^3/s (pipe)
Q = 10.6 m^3/s (channel)
n = 0.015
V_o = 12.192 m/s
y_o = 0.701 m (for both pipe and channel)

Solution

First design dissipator for the pipe conduit.

Step 1. Determine the maximum discharge, Q, and velocity, V_o. Compute the flow area at the end of the approach pipe, A. Compute equivalent depth, $y_e = (A/2)^{1/2}$.

Since Q is less than 11.3 m^3/s and V_o less than 15.2 m/s, the dissipator can be tried at this site.

$A = Q/V_o = 8.5/12.192 = 0.697\ m^2$

$y_o = (A/2)^{1/2} = (0.697/2)^{1/2} = 0.590$ m

Step 2. Compute the Froude number, Fr, and the energy at the end of the pipe, H_o.

$Fr = V_o /(gy_e)^{1/2} = 12.192/ [9.81(0.590)]^{1/2} = 5.07$

$H_o = y_e + V_o^2/(2g) = 0.590 + (12.192)^2/19.62 = 8.166$ m

Step 3. Determine H_o/W_B from Figure 9.14. Calculate the required width of basin, W_B.

$W_B = H_o/(H_o/W_B) = 8.166/1.68 = 4.86$ m

Step 4. Obtain the remaining dimensions of the USBR Type VI impact basin from Table 9.2 using $W_B = 5.0$ m obtained from step 3. (The basin width is taken to the nearest 0.5 m.) Results are summarized in the following table.

Step 5. Determine exit velocity, $V_B = V_2$, by trial and error using an energy balance between the culvert exit and the basin exit. Determine if this velocity is acceptable and whether or not riprap protection is needed downstream (see Chapter 10.)

$H_B = Q/(W_B V_B) + V_B^2/(2g) = H_o(1 - H_L/H_o)$

$H_B = 8.5/(5.0V_B) + V_B^2/19.62 = 8.166(1 - 0.67)$

$H_B = 1.7/V_B + V_B^2/19.62 = 2.695$

No tailwater exists so the supercritical solution is chosen. By trial and error, $V_B = 6.9$ m/s, therefore velocity has been reduced from 12.2 m/s to 6.9 m/s.

Compare the design for the circular pipe with a second USBR Type VI impact basin at the end of a long rectangular concrete channel. The computations and comparison with the pipe are tabulated below. $W_B = 5.5$ m for this case.

Approach Channel	Circular Pipe	Rectangular Channel
Depth of flow y_o (m)	0.701	0.701
Area of flow, A (m^2)	0.697	0.855
Velocity, V_o (m/s)	12.192	12.419
Equivalent depth, y_e (m)	0.590	0.701
Velocity Head, $V_o^2/(2g)$ (m)	7.576	7.861
$H_o = y_e + V_o^2/2g$ (m)	8.166	8.562
$Fr = V_o/(gy_e)^{0.5}$	5.07	4.74
H_o/W_B from Figure 9.14	1.68	1.55
Width of basin, W_B (m)	5.0	5.5
H_L/H_o from Figure 9.15	67%	65%

Design Example: USBR Type VI Impact Basin (CU)

Determine the USBR Type VI impact basin dimensions for use at the outlet of a concrete pipe. Compare the design with a dissipator at the end of a rectangular concrete channel. Given:

D = 4 ft (pipe diameter and rectangular channel width)
S_o = 0.15 ft/ft
Q = 300 ft^3/s (pipe)
Q = 375 ft^3/s (channel)

n = 0.015
V_o = 40 ft/s
y_o = 2.3 ft (for both pipe and channel)

Solution

First design dissipator for the pipe conduit.

Step 1. Determine the maximum discharge, Q, and velocity, V_o. Compute the flow area at the end of the approach pipe, A. Compute equivalent depth, $y_e = (A/2)^{1/2}$.

Since Q is less than 400 ft^3/s and V_o less than 50 ft/s, the dissipator can be tried at this site.

$A = Q/V_o = 300/40 = 7.5\ ft^2$

$y_e = (A/2)^{1/2} = (7.5/2)^{1/2} = 1.94$ ft

Step 2. Compute the Froude number, Fr, and the energy at the end of the pipe, H_o.

$Fr = V_o / (gy_e)^{1/2} = 40/ [32.2(1.94)]^{1/2} = 5.06$

$H_o = y_e + V_o^2 /(2g) = 1.94 + (40)^2 /64.4 = 26.8$ ft

Step 3. Determine H_o/ W_B from Figure 9.14. Calculate the required width of basin, W_B.

$W_B = H_o / (H_o/ W_B) = 26.8 /1.68 = 16$ ft

Step 4. Obtain the remaining dimensions of the USBR Type VI impact basin from Table 9.2 using W_B = 16 ft obtained from step 3. (The basin width is taken to the nearest 1 ft.) Results are summarized in the following table.

Step 5. Determine exit velocity, $V_B = V_2$, by trial and error using an energy balance between the culvert exit and the basin exit. Determine if this velocity is acceptable and whether or not riprap protection is needed downstream (see Chapter 10.)

$H_B = Q/(W_B V_B) + V_B^2/(2g) = H_o(1- H_L/H_o)$

$H_B = 300/(16V_B) + V_B^2/64.4 = 26.8(1 -0.67)$

$H_B = 18.75/V_B + V_B^2/64.4 = 8.84$

No tailwater exists so the supercritical solution is chosen. By trial and error, V_B = 22.7 ft/s, therefore velocity has been reduced from 40 ft/s to 22.7 ft/s.

Compare the design for the circular pipe with a second USBR Type VI impact basin at the end of a long rectangular concrete channel. The computations and comparison with the pipe are tabulated below. W_B = 18 ft for this case.

Approach Channel	Circular Pipe	Rectangular Channel
Depth of flow y_o (ft)	2.3	2.3
Area of flow, A (ft^2)	7.5	9.2
Velocity, V_o (ft/s)	40	40.9
Equivalent depth, y_e (ft)	1.9	2.3
Velocity Head, $V_o^2/(2g)$ (ft)	24.9	26
$H_o = y_e + V_o^2/2g$ (ft)	26.8	28.3
$Fr = V_o/(gy_e)^{0.5}$	5.06	4.75
H_o/ W_B from Figure 9.14	1.68	1.55
Width of basin, W_B (ft)	16	18
H_L/H_o from Figure 9.15	67%	65%

TABLE 10.1 GEOMETRIC ELEMENTS FOR CIRCULAR SECTION

$\frac{y}{d_0}$	$\frac{A}{d_0^2}$	$\frac{P}{d_0}$	$\frac{R}{d_0}$	$\frac{T}{d_0}$	$\frac{D}{d_0}$	$\frac{A\sqrt{D}}{d_0^{5/2}}$	$\frac{AR^{2/3}}{d_0^{8/3}}$
0.01	0.0013	0.2003	0.0066	0.1990	0.0066	0.0001	0.0000
0.05	0.0147	0.4510	0.0326	0.4359	0.0336	0.0027	0.0015
0.10	0.0409	0.6435	0.0635	0.6000	0.0682	0.0107	0.0065
0.15	0.0739	0.7954	0.0929	0.7141	0.1034	0.0238	0.0152
0.20	0.1118	0.9273	0.1206	0.8000	0.1398	0.0418	0.0273
0.25	0.1535	1.0472	0.1466	0.8660	0.1774	0.0646	0.0427
0.30	0.1982	1.1593	0.1709	0.9165	0.2162	0.0921	0.0610
0.35	0.2450	1.2661	0.1935	0.9539	0.2568	0.1241	0.0820
0.40	0.2934	1.3694	0.2142	0.9798	0.2994	0.1603	0.1050
0.45	0.3428	1.4706	0.2331	0.9950	0.3446	0.2011	0.1298
0.50	0.3927	1.5708	0.2500	1.0000	0.3928	0.2459	0.1558
0.55	0.4426	1.6710	0.2649	0.9950	0.4448	0.2949	0.1825
0.60	0.4920	1.7722	0.2776	0.9798	0.5022	0.3438	0.2092
0.65	0.5404	1.8755	0.2881	0.9539	0.5666	0.4066	0.2358
0.70	0.5872	1.9823	0.2962	0.9165	0.6408	0.4694	0.2608
0.75	0.6318	2.0944	0.3017	0.8660	0.7296	0.5392	0.2840
0.80	0.6736	2.2143	0.3042	0.8000	0.8420	0.6177	0.3045
0.85	0.7115	2.3462	0.3033	0.7141	0.9964	0.7098	0.3212
0.90	0.7445	2.4981	0.2980	0.6000	1.2408	0.8285	0.3324
0.94[a]	0.7662	2.6467	0.2896	0.4750	1.6130	0.9725	0.3353
0.95	0.7707	2.6906	0.2864	0.4359	1.7682	1.0242	0.3349
1.00	0.7854	3.1416	0.2500	0.0000	∞	∞	0.3117

[a]Maximum flow occurs at 0.94 full depth.

From Table 10.1:

$$\frac{A}{d_0^2} = 0.492, \quad A = 0.492(5)^2 = 12.3 \text{ ft}^2$$

$$\frac{P}{d_0} = 1.7722, \quad P = 1.7722(5) = 8.861 \text{ ft}$$

$$\frac{R}{d_0} = 0.2776, \quad R = 0.2776(5) = 1.39 \text{ ft}$$

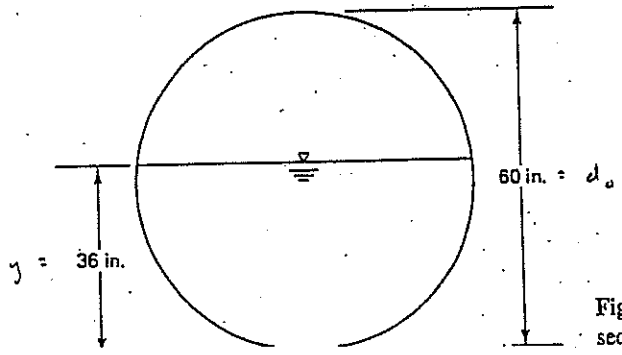
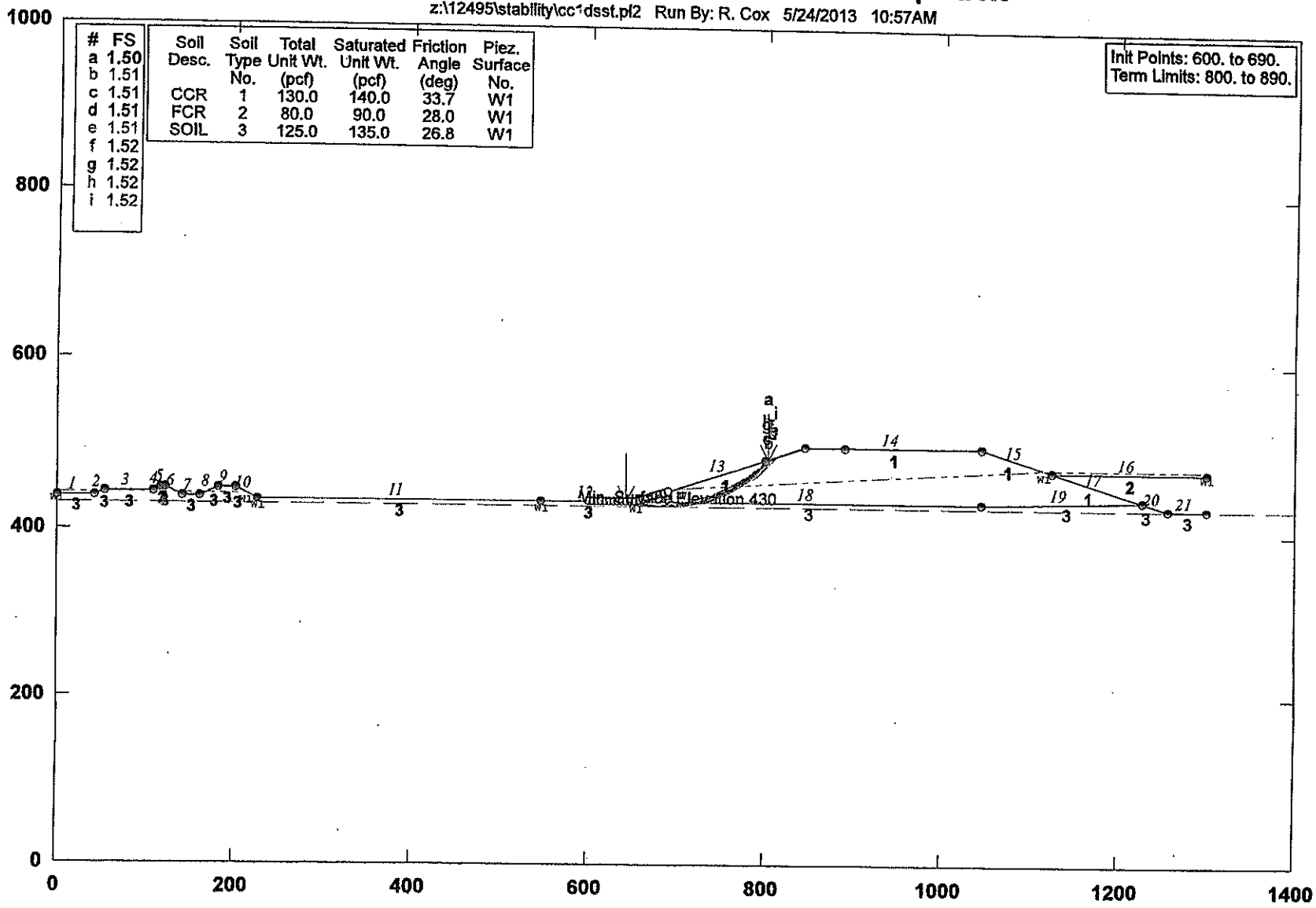


Figure 10.2 Partial full circular channel section of Example 10.1.

FROM "HYDROLOGY AND HYDRAULIC SYSTEMS"
BY RAM S. GUPTA

Section C-C Phase 9 Downstream Static Deep Circle

z:\12495\stability\cc1dsst.pl2 Run By: R. Cox 5/24/2013 10:57AM



PCSTABL5M/si FSmin=1.50

Safety Factors Are Calculated By The Modified Bishop Method

STED

R10160

3001-15
part 13

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 10:57AM
Run By: R. Cox
Input Data Filename: Z:cc1dsst.
Output Filename: Z:cc1dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc1dsst.PLT
PROBLEM DESCRIPTION Section C-C Phase 9
Downstream Static Deep Circle

BOUNDARY COORDINATES
16 Top Boundaries
21 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	438.00	41.63	438.00	3
2	41.63	438.00	53.63	444.00	3
3	53.63	444.00	108.40	444.00	3
4	108.40	444.00	116.28	448.00	3
5	116.28	448.00	121.28	448.00	3
6	121.28	448.00	141.28	438.00	3
7	141.28	438.00	161.28	438.00	3
8	161.28	438.00	181.28	448.00	3
9	181.28	448.00	201.28	448.00	3
10	201.28	448.00	225.34	436.00	3
11	225.34	436.00	545.47	436.00	3
12	545.47	436.00	653.54	435.98	3
13	653.54	435.98	845.61	500.00	1
14	845.61	500.00	1045.61	500.00	1
15	1045.61	500.00	1124.16	473.80	1
16	1124.16	473.80	1300.00	473.80	2
17	1124.16	473.80	1226.55	439.64	1
18	653.54	435.98	1044.41	436.00	3
19	1044.41	436.00	1226.55	439.64	3
20	1226.55	439.64	1255.44	430.00	3
21	1255.44	430.00	1300.00	430.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 9 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	442.00
2	213.16	442.00
3	225.16	436.00
4	545.47	436.00
5	653.54	435.98
6	689.72	448.03
7	709.99	450.98
8	1114.57	477.00
9	1300.00	477.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 600.00 ft.
and X = 690.00 ft.

Each Surface Terminates Between X = 800.00 ft.
and X = 890.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	642.63	435.98
2	652.33	433.53
3	662.16	431.72
4	672.09	430.56
5	682.08	430.05
6	692.08	430.20
7	702.05	431.00
8	711.94	432.46
9	721.72	434.57
10	731.33	437.31
11	740.75	440.68
12	749.92	444.65
13	758.82	449.23
14	767.39	454.37
15	775.61	460.07
16	783.43	466.30
17	790.84	473.02
18	797.78	480.22
19	802.30	485.56

Circle Center At X = 684.8 ; Y = 582.3 and Radius, 152.2
*** 1.501 ***
Individual data on the 23 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	1604.1	0.0	764.8	0.0	0.0	0.0	0.0	0.0
2	1.2	419.9	0.0	197.4	0.0	0.0	0.0	0.0	0.0
3	8.6	5749.6	0.0	2548.6	0.0	0.0	0.0	0.0	0.0
4	9.9	12744.8	0.0	5554.2	0.0	0.0	0.0	0.0	0.0
5	10.0	18561.0	0.0	8015.4	0.0	0.0	0.0	0.0	0.0
6	7.6	17530.8	0.0	7542.9	0.0	0.0	0.0	0.0	0.0
7	2.4	5950.1	0.0	2625.7	0.0	0.0	0.0	0.0	0.0
8	10.0	27324.1	0.0	11422.9	0.0	0.0	0.0	0.0	0.0
9	7.9	23901.2	0.0	9327.9	0.0	0.0	0.0	0.0	0.0
10	1.9	6108.1	0.0	2297.9	0.0	0.0	0.0	0.0	0.0
11	9.8	31568.6	0.0	11149.9	0.0	0.0	0.0	0.0	0.0
12	5.0	16478.4	0.0	5348.0	0.0	0.0	0.0	0.0	0.0
13	4.6	15515.3	0.0	4681.2	0.0	0.0	0.0	0.0	0.0
14	9.4	31256.9	0.0	8508.1	0.0	0.0	0.0	0.0	0.0
15	9.2	29489.0	0.0	6593.3	0.0	0.0	0.0	0.0	0.0
16	8.9	26796.6	0.0	4292.9	0.0	0.0	0.0	0.0	0.0
17	8.6	23295.4	0.0	1616.8	0.0	0.0	0.0	0.0	0.0
18	0.5	1204.5	0.0	5.4	0.0	0.0	0.0	0.0	0.0
19	7.7	18107.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	7.8	15046.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	7.4	10439.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	6.9	5668.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	4.5	1127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	647.37	435.98
2	657.05	433.46
3	666.88	431.62
4	676.81	430.47
5	686.80	430.01
6	696.80	430.24

7	706.75	431.16
8	716.62	432.77
9	726.36	435.06
10	735.91	438.02
11	745.23	441.63
12	754.28	445.88
13	763.02	450.75
14	771.39	456.22
15	779.37	462.25
16	786.91	468.82
17	793.98	475.89
18	800.54	483.44
19	802.09	485.49

Circle Center At X = 688.5 ; Y = 574.2 and Radius, 144.2

*** 1.507 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	637.90	435.98
2	647.65	433.78
3	657.52	432.17
4	667.47	431.16
5	677.46	430.76
6	687.46	430.96
7	697.42	431.77
8	707.32	433.18
9	717.12	435.20
10	726.78	437.80
11	736.26	440.98
12	745.53	444.73
13	754.55	449.03
14	763.30	453.88
15	771.74	459.25
16	779.83	465.12
17	787.56	471.46
18	794.89	478.27
19	801.63	485.34

Circle Center At X = 679.1 ; Y = 595.6 and Radius, 164.8

*** 1.509 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	637.90	435.98
2	647.62	433.65
3	657.46	431.90
4	667.40	430.74
5	677.38	430.18
6	687.38	430.21
7	697.36	430.85
8	707.28	432.08
9	717.12	433.90
10	726.82	436.31
11	736.37	439.30
12	745.72	442.85
13	754.83	446.95
14	763.69	451.59
15	772.26	456.76
16	780.49	462.42
17	788.38	468.57
18	795.88	475.18
19	802.98	482.23
20	807.50	487.30

Circle Center At X = 681.8 ; Y = 596.9 and Radius, 166.8

*** 1.513 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	637.90	435.98
2	647.61	433.61
3	657.45	431.82

4	667.38	430.63
5	677.36	430.02
6	687.36	430.02
7	697.34	430.61
8	707.27	431.80
9	717.11	433.59
10	726.83	435.95
11	736.38	438.89
12	745.75	442.40
13	754.89	446.46
14	763.77	451.06
15	772.35	456.18
16	780.62	461.81
17	788.54	467.92
18	796.07	474.49
19	803.20	481.51
20	808.83	487.74

Circle Center At X = 682.4 ; Y = 597.1 and Radius, 167.1

*** 1.514 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	628.42	435.98
2	638.16	433.70
3	648.00	431.95
4	657.93	430.76
5	667.91	430.11
6	677.91	430.02
7	687.90	430.48
8	697.85	431.50
9	707.72	433.06
10	717.50	435.17
11	727.14	437.82
12	736.63	440.99
13	745.92	444.69
14	754.99	448.90
15	763.82	453.60
16	772.37	458.78
17	780.62	464.43
18	788.55	470.52
19	796.12	477.05
20	803.33	483.99
21	805.91	486.77

Circle Center At X = 674.6 ; Y = 610.5 and Radius, 180.5

*** 1.516 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	652.11	435.98
2	661.77	433.42
3	671.60	431.57
4	681.54	430.46
5	691.53	430.08
6	701.52	430.44
7	711.46	431.53
8	721.30	433.35
9	730.97	435.89
10	740.43	439.13
11	749.62	443.06
12	758.50	447.66
13	767.02	452.90
14	775.13	458.75
15	782.79	465.18
16	789.95	472.16
17	796.58	479.65
18	800.67	485.02

Circle Center At X = 691.7 ; Y = 565.6 and Radius, 135.5

*** 1.517 ***

Failure Surface Specified By 20 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	628.42	435.98
2	638.20	433.91
3	648.08	432.37
4	658.04	431.38
5	668.03	430.93
6	678.02	431.04
7	688.00	431.69
8	697.93	432.89
9	707.78	434.63
10	717.52	436.91
11	727.11	439.71
12	736.54	443.05
13	745.77	446.89
14	754.78	451.23
15	763.54	456.06
16	772.01	461.37
17	780.19	467.13
18	788.03	473.33
19	795.52	479.95
20	800.65	485.02

Circle Center At X = 671.1 ; Y = 612.9 and Radius, 182.0

*** 1.520 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	637.90	435.98
2	647.62	433.63
3	657.46	431.86
4	667.39	430.67
5	677.37	430.05
6	687.37	430.03
7	697.35	430.59
8	707.29	431.73
9	717.14	433.45
10	726.87	435.75
11	736.45	438.61
12	745.85	442.03
13	755.03	445.99
14	763.96	450.49
15	772.62	455.50
16	780.96	461.01
17	788.97	466.99
18	796.62	473.44
19	803.87	480.32
20	810.71	487.62
21	811.58	488.66

Circle Center At X = 682.8 ; Y = 600.7 and Radius, 170.7

*** 1.521 ***

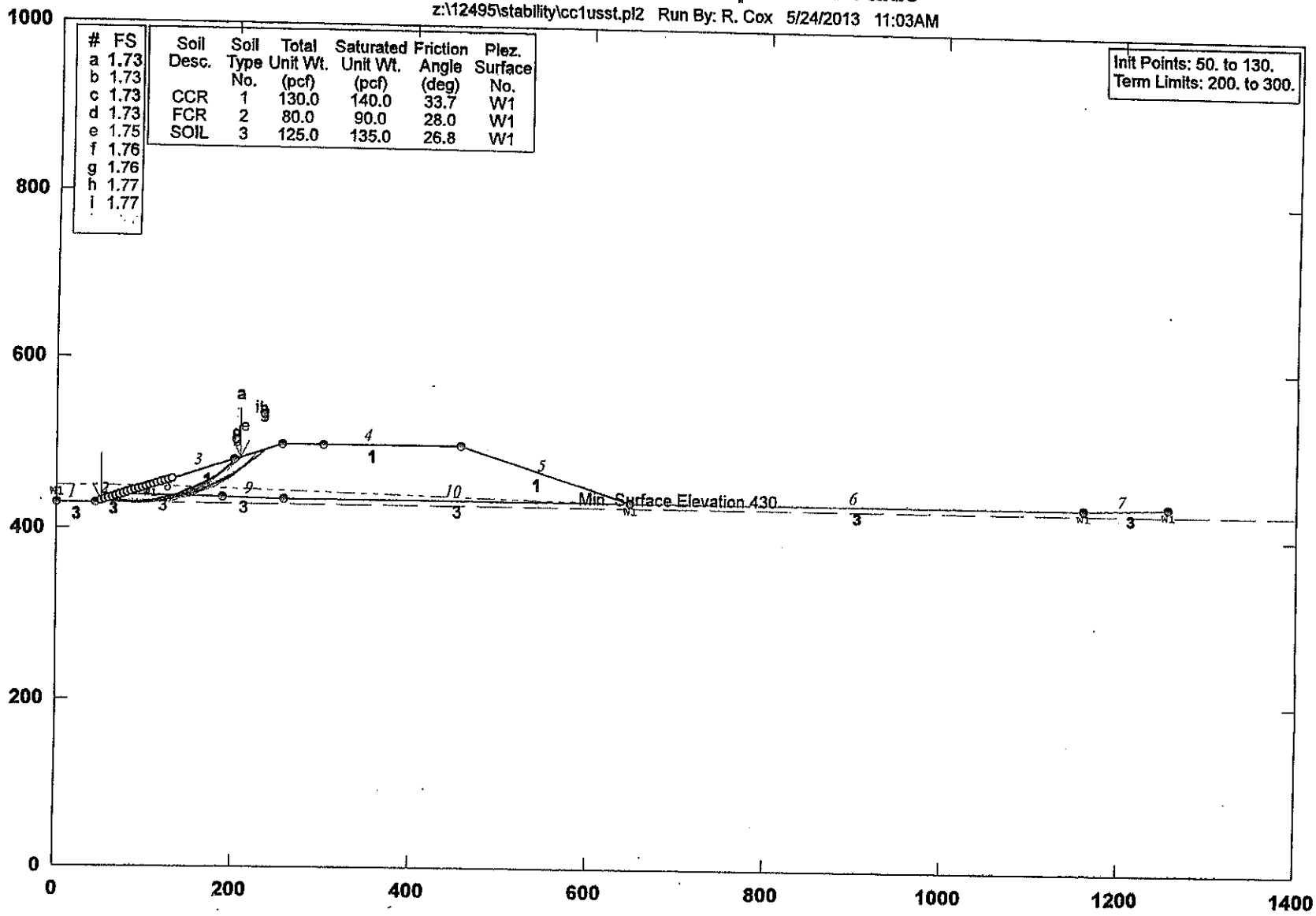
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	652.11	435.98
2	661.80	433.53
3	671.65	431.79
4	681.59	430.76
5	691.59	430.45
6	701.58	430.87
7	711.52	432.01
8	721.34	433.86
9	731.01	436.42
10	740.47	439.67
11	749.67	443.59
12	758.56	448.17
13	767.09	453.37
14	775.23	459.18
15	782.93	465.57
16	790.15	472.49
17	796.84	479.92
18	800.87	485.09

Circle Center At X = 690.8 ; Y = 568.6 and Radius, 138.1
*** 1.521 ***

Section C-C Phase 9 Upstream Static

z:\12495\stability\cc1usst.pl2 Run By: R. Cox 5/24/2013 11:03AM



PCSTABL5M/si FSmin=1.73

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:03AM
Run By: R. Cox
Input Data Filename: Z:cclusst.in
Output Filename: Z:cclusst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cclusst.PLT
PROBLEM DESCRIPTION Section C-C Phase 9 Upstream Static
BOUNDARY COORDINATES
7 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	430.00	44.60	430.00	3
2	44.60	430.00	73.40	439.60	3
3	73.40	439.60	254.40	500.00	1
4	254.40	500.00	454.40	500.00	1
5	454.40	500.00	646.50	436.00	1
6	646.50	436.00	1159.70	436.00	3
7	1159.70	436.00	1254.70	439.80	3
8	73.40	439.60	186.30	438.00	3
9	186.30	438.00	255.60	436.00	3
10	255.60	436.00	646.50	436.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	450.00
2	104.50	450.00
3	646.50	436.00
4	1159.70	436.00
5	1254.70	439.80

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 50.00 ft.
and X = 130.00 ft.
Each Surface Terminates Between X = 200.00 ft.
and X = 300.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.00	431.80
2	59.95	430.75
3	69.93	430.23
4	79.93	430.23
5	89.92	430.76

6	99.86	431.81
7	109.74	433.39
8	119.52	435.48
9	129.17	438.08
10	138.68	441.19
11	148.00	444.80
12	157.13	448.89
13	166.02	453.45
14	174.67	458.48
15	183.04	463.96
16	191.11	469.86
17	198.85	476.19
18	206.25	482.91
19	207.77	484.44

Circle Center At X = 74.9 ; Y = 620.1 and Radius, 190.0

*** 1.728 ***

Individual data on the 22 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	2929.3	10820.8	11683.9	0.0	0.0	0.0	0.0	0.0
2	10.0	8480.1	8683.9	12174.6	0.0	0.0	0.0	0.0	0.0
3	3.5	4117.7	2504.5	4279.3	0.0	0.0	0.0	0.0	0.0
4	6.5	9261.2	4000.3	8058.2	0.0	0.0	0.0	0.0	0.0
5	10.0	17660.9	4305.5	12171.8	0.0	0.0	0.0	0.0	0.0
6	9.9	21162.1	2112.2	11678.3	0.0	0.0	0.0	0.0	0.0
7	4.6	10890.7	242.8	5222.1	0.0	0.0	0.0	0.0	0.0
8	5.2	12902.3	0.0	5611.8	0.0	0.0	0.0	0.0	0.0
9	9.8	25329.0	0.0	9547.4	0.0	0.0	0.0	0.0	0.0
10	9.7	25999.7	0.0	7925.8	0.0	0.0	0.0	0.0	0.0
11	2.1	5795.0	0.0	1522.1	0.0	0.0	0.0	0.0	0.0
12	7.4	20020.7	0.0	4467.4	0.0	0.0	0.0	0.0	0.0
13	9.3	24743.3	0.0	3743.8	0.0	0.0	0.0	0.0	0.0
14	8.6	21653.4	0.0	1199.4	0.0	0.0	0.0	0.0	0.0
15	0.5	1268.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	8.9	20650.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	8.6	17963.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	8.4	14764.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	8.1	11141.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	7.7	7195.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	7.4	3030.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.5	100.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.21	433.20
2	64.11	431.82
3	74.08	431.04
4	84.08	430.86
5	94.07	431.30
6	104.02	432.33
7	113.88	433.97
8	123.63	436.20
9	133.23	439.02
10	142.63	442.41
11	151.82	446.37
12	160.74	450.88
13	169.38	455.92
14	177.69	461.48
15	185.66	467.53
16	193.24	474.05
17	200.41	481.01
18	201.69	482.41

Circle Center At X = 82.0 ; Y = 595.6 and Radius, 164.7

*** 1.728 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	58.42	434.61

2	68.17	432.39
3	78.06	430.89
4	88.03	430.13
5	98.03	430.10
6	108.01	430.80
7	117.90	432.24
8	127.67	434.40
9	137.24	437.27
10	146.58	440.84
11	155.64	445.09
12	164.35	449.99
13	172.69	455.52
14	180.59	461.65
15	188.02	468.34
16	194.94	475.56
17	200.19	481.91

Circle Center At X = 93.4 ; Y = 565.9 and Radius, 135.9

*** 1.728 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.21	433.20
2	64.13	431.93
3	74.11	431.24
4	84.10	431.14
5	94.09	431.62
6	104.04	432.70
7	113.90	434.36
8	123.64	436.60
9	133.24	439.40
10	142.66	442.77
11	151.86	446.68
12	160.81	451.13
13	169.49	456.10
14	177.86	461.58
15	185.90	467.53
16	193.56	473.95
17	200.84	480.81
18	202.66	482.73

Circle Center At X = 80.8 ; Y = 600.6 and Radius, 169.5

*** 1.734 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.21	433.20
2	64.15	432.11
3	74.13	431.54
4	84.13	431.51
5	94.12	432.01
6	104.07	433.05
7	113.95	434.61
8	123.73	436.70
9	133.38	439.30
10	142.88	442.42
11	152.20	446.04
12	161.32	450.15
13	170.20	454.74
14	178.83	459.80
15	187.17	465.31
16	195.21	471.26
17	202.92	477.63
18	210.28	484.40
19	211.55	485.70

Circle Center At X = 79.7 ; Y = 618.9 and Radius, 187.5

*** 1.751 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.00	431.80
2	59.95	430.80

3	69.93	430.24
4	79.93	430.12
5	89.93	430.45
6	99.90	431.22
7	109.83	432.43
8	119.69	434.07
9	129.47	436.15
10	139.15	438.66
11	148.71	441.60
12	158.13	444.96
13	167.39	448.73
14	176.48	452.90
15	185.37	457.48
16	194.05	462.44
17	202.51	467.78
18	210.71	473.49
19	218.66	479.56
20	226.33	485.97
21	233.72	492.72
22	234.28	493.29

Circle Center At X = 77.6 ; Y = 656.0 and Radius, 225.9

*** 1.757 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.21	433.20
2	64.11	431.78
3	74.07	430.84
4	84.06	430.41
5	94.06	430.47
6	104.04	431.02
7	113.98	432.07
8	123.87	433.61
9	133.66	435.64
10	143.34	438.16
11	152.88	441.15
12	162.26	444.61
13	171.46	448.53
14	180.45	452.91
15	189.21	457.72
16	197.73	462.97
17	205.97	468.63
18	213.93	474.69
19	221.57	481.14
20	228.88	487.96
21	233.94	493.17

Circle Center At X = 87.9 ; Y = 631.8 and Radius, 201.4

*** 1.758 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	58.42	434.61
2	68.26	432.80
3	78.18	431.54
4	88.15	430.83
5	98.15	430.67
6	108.14	431.06
7	118.10	432.00
8	127.99	433.49
9	137.78	435.52
10	147.44	438.09
11	156.95	441.19
12	166.27	444.80
13	175.38	448.93
14	184.25	453.55
15	192.85	458.66
16	201.15	464.23
17	209.14	470.25
18	216.78	476.70
19	224.05	483.56

20	230.93	490.82
21	232.54	492.70

Circle Center At X = 96.1 ; Y = 611.9 and Radius, 181.2

*** 1.765 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.63	436.01
2	72.35	433.64
3	82.20	431.91
4	92.14	430.83
5	102.13	430.41
6	112.13	430.64
7	122.09	431.53
8	131.97	433.07
9	141.73	435.26
10	151.32	438.07
11	160.71	441.52
12	169.85	445.57
13	178.71	450.21
14	187.24	455.42
15	195.42	461.18
16	203.19	467.47
17	210.54	474.25
18	217.43	481.50
19	223.83	489.19
20	224.42	489.99

Circle Center At X = 103.6 ; Y = 582.7 and Radius, 152.3

*** 1.767 ***

Failure Surface Specified By 17 Coordinate Points

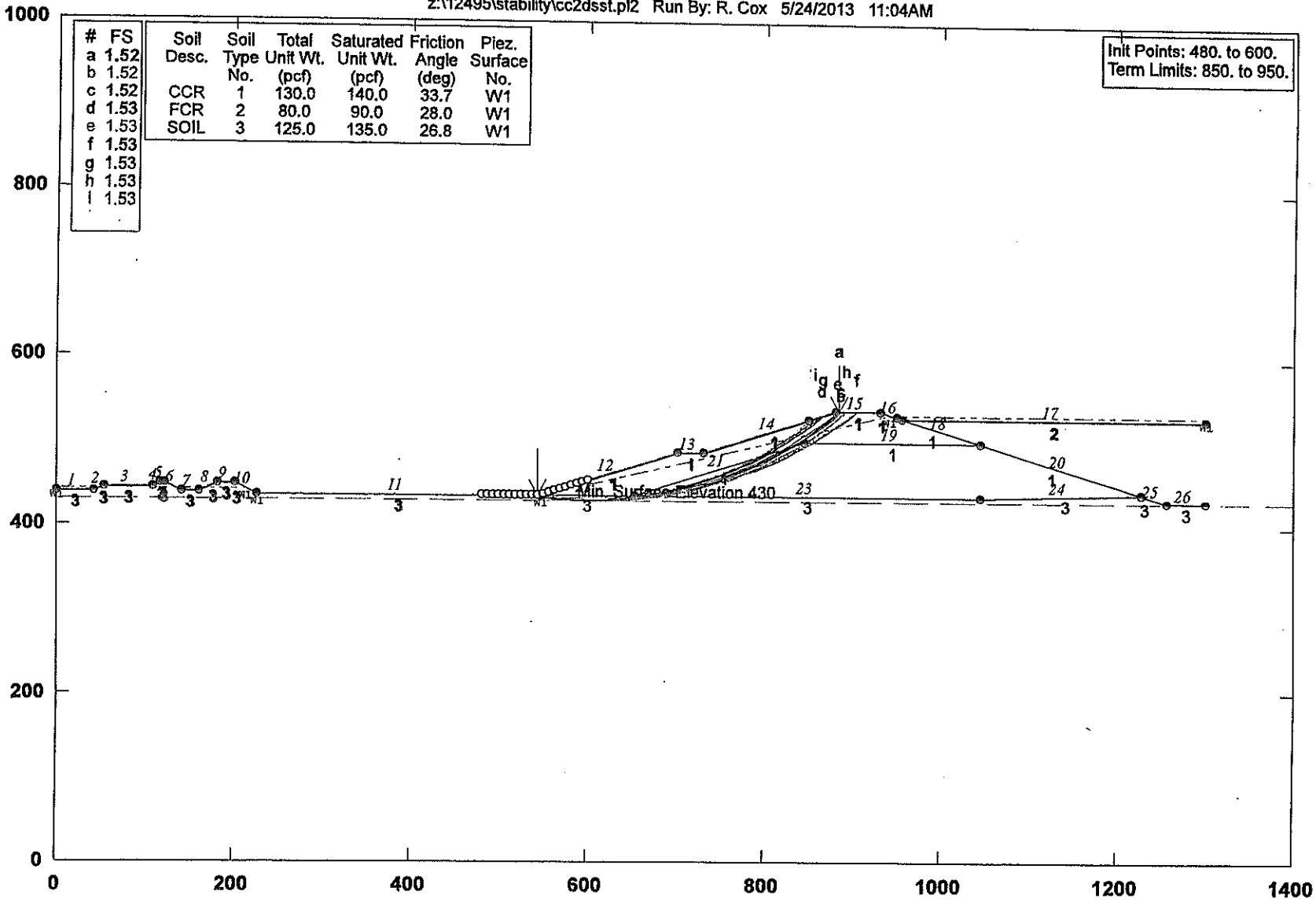
Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.63	436.01
2	72.48	434.26
3	82.42	433.18
4	92.41	432.78
5	102.41	433.05
6	112.36	434.00
7	122.23	435.62
8	131.97	437.90
9	141.53	440.84
10	150.86	444.41
11	159.94	448.61
12	168.71	453.42
13	177.14	458.80
14	185.18	464.74
15	192.80	471.22
16	199.97	478.19
17	204.64	483.39

Circle Center At X = 93.4 ; Y = 580.6 and Radius, 147.8

*** 1.768 ***

Section C-C Phase 10 Downstream Static Deep Circle

z:\12495\stability\cc2dsst.pl2 Run By: R. Cox 5/24/2013 11:04AM



PCSTABL5M/si FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:04AM
Run By: R. Cox
Input Data Filename: Z:cc2dsst.
Output Filename: Z:cc2dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc2dsst.PLT
PROBLEM DESCRIPTION Section C-C Phase 10
Downstream Static Deep Circle

BOUNDARY COORDINATES
17 Top Boundaries
26 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	438.00	41.63	438.00	3
2	41.63	438.00	53.63	444.00	3
3	53.63	444.00	108.40	444.00	3
4	108.40	444.00	116.28	448.00	3
5	116.28	448.00	121.28	448.00	3
6	121.28	448.00	141.28	438.00	3
7	141.28	438.00	161.28	438.00	3
8	161.28	438.00	181.28	448.00	3
9	181.28	448.00	201.28	448.00	3
10	201.28	448.00	225.34	436.00	3
11	225.34	436.00	545.47	436.00	3
12	545.47	436.00	701.47	488.00	1
13	701.47	488.00	731.47	488.00	1
14	731.47	488.00	881.47	538.00	1
15	881.47	538.00	931.57	538.00	1
16	931.57	538.00	956.09	529.80	1
17	956.09	529.80	1300.00	529.80	2
18	956.09	529.80	1045.61	500.00	1
19	845.61	500.00	1045.61	500.00	1
20	1045.61	500.00	1226.55	439.64	1
21	653.54	435.98	845.61	500.00	1
22	545.47	436.00	653.54	435.98	3
23	653.54	435.98	1044.41	436.00	3
24	1044.41	436.00	1226.55	439.64	3
25	1226.55	439.64	1255.44	430.00	3
26	1255.44	430.00	1300.00	430.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	442.00
2	213.16	442.00
3	225.16	436.00
4	545.47	436.00
5	940.47	535.00
6	1300.00	535.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 480.00 ft.

and X = 600.00 ft.
Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	543.16	436.00
2	553.03	434.39
3	562.94	433.03
4	572.87	431.92
5	582.84	431.07
6	592.82	430.46
7	602.81	430.11
8	612.81	430.01
9	622.81	430.16
10	632.80	430.57
11	642.78	431.22
12	652.74	432.13
13	662.67	433.29
14	672.57	434.70
15	682.43	436.36
16	692.25	438.27
17	702.01	440.43
18	711.72	442.83
19	721.36	445.48
20	730.94	448.37
21	740.44	451.50
22	749.85	454.87
23	759.18	458.47
24	768.41	462.31
25	777.54	466.39
26	786.57	470.69
27	795.49	475.22
28	804.29	479.97
29	812.96	484.94
30	821.51	490.13
31	829.92	495.53
32	838.20	501.15
33	846.33	506.97
34	854.31	513.00
35	862.14	519.22
36	869.80	525.65
37	877.30	532.26
38	883.49	538.00

Circle Center At X = 611.8 ; Y = 825.8 and Radius, 395.8
*** 1.516 ***
Individual data on the 45 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.3	58.8	0.0	27.5	0.0	0.0	0.0	0.0	0.0
2	7.6	2318.0	0.0	899.6	0.0	0.0	0.0	0.0	0.0
3	9.9	8726.7	0.0	3284.6	0.0	0.0	0.0	0.0	0.0
4	9.9	14919.1	0.0	5537.6	0.0	0.0	0.0	0.0	0.0
5	10.0	20812.3	0.0	7642.8	0.0	0.0	0.0	0.0	0.0
6	10.0	26389.4	0.0	9599.0	0.0	0.0	0.0	0.0	0.0
7	10.0	31634.1	0.0	11404.8	0.0	0.0	0.0	0.0	0.0
8	10.0	36532.1	0.0	13059.2	0.0	0.0	0.0	0.0	0.0
9	10.0	41070.1	0.0	14560.9	0.0	0.0	0.0	0.0	0.0
10	10.0	45237.0	0.0	15909.2	0.0	0.0	0.0	0.0	0.0
11	10.0	49022.3	0.0	17103.0	0.0	0.0	0.0	0.0	0.0
12	10.0	52418.0	0.0	18141.8	0.0	0.0	0.0	0.0	0.0

13	0.8	4355.4	0.0	1503.1	0.0	0.0	0.0	0.0	0.0
14	9.1	51061.3	0.0	17521.6	0.0	0.0	0.0	0.0	0.0
15	9.9	58014.0	0.0	19751.2	0.0	0.0	0.0	0.0	0.0
16	7.6	46110.1	0.0	15586.8	0.0	0.0	0.0	0.0	0.0
17	2.3	14094.0	0.0	4734.1	0.0	0.0	0.0	0.0	0.0
18	9.8	61925.4	0.0	20733.5	0.0	0.0	0.0	0.0	0.0
19	9.2	59644.6	0.0	19814.4	0.0	0.0	0.0	0.0	0.0
20	0.5	3553.0	0.0	1174.2	0.0	0.0	0.0	0.0	0.0
21	9.7	61795.3	0.0	21086.1	0.0	0.0	0.0	0.0	0.0
22	9.6	58215.3	0.0	21025.9	0.0	0.0	0.0	0.0	0.0
23	9.6	54314.8	0.0	20808.0	0.0	0.0	0.0	0.0	0.0
24	0.5	2909.5	0.0	1156.0	0.0	0.0	0.0	0.0	0.0
25	9.0	48942.6	0.0	19276.7	0.0	0.0	0.0	0.0	0.0
26	9.4	51198.2	0.0	19900.1	0.0	0.0	0.0	0.0	0.0
27	9.3	50174.9	0.0	19210.5	0.0	0.0	0.0	0.0	0.0
28	9.2	48788.1	0.0	18364.5	0.0	0.0	0.0	0.0	0.0
29	9.1	47050.6	0.0	17362.5	0.0	0.0	0.0	0.0	0.0
30	9.0	44976.9	0.0	16205.3	0.0	0.0	0.0	0.0	0.0
31	8.9	42582.9	0.0	14893.5	0.0	0.0	0.0	0.0	0.0
32	8.8	39885.9	0.0	13427.9	0.0	0.0	0.0	0.0	0.0
33	8.7	36905.0	0.0	11809.6	0.0	0.0	0.0	0.0	0.0
34	8.5	33659.8	0.0	10039.5	0.0	0.0	0.0	0.0	0.0
35	5.9	21643.9	0.0	5944.1	0.0	0.0	0.0	0.0	0.0
36	2.5	8527.7	0.0	2174.6	0.0	0.0	0.0	0.0	0.0
37	8.3	26463.0	0.0	6048.6	0.0	0.0	0.0	0.0	0.0
38	8.1	22557.4	0.0	3830.4	0.0	0.0	0.0	0.0	0.0
39	8.0	18479.2	0.0	1465.5	0.0	0.0	0.0	0.0	0.0
40	0.7	1534.2	0.0	11.8	0.0	0.0	0.0	0.0	0.0
41	7.1	12852.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	7.7	10362.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	7.5	6250.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	4.2	1687.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	2.0	247.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	530.53	436.00
2	540.41	434.48
3	550.33	433.20
4	560.27	432.14
5	570.24	431.31
6	580.22	430.72
7	590.21	430.35
8	600.21	430.22
9	610.21	430.32
10	620.21	430.65
11	630.19	431.21
12	640.16	432.01
13	650.11	433.03
14	660.03	434.28
15	669.92	435.77
16	679.77	437.48
17	689.58	439.42
18	699.34	441.59
19	709.05	443.98
20	718.70	446.59
21	728.29	449.43
22	737.81	452.49
23	747.26	455.77
24	756.63	459.27
25	765.91	462.99
26	775.11	466.91
27	784.21	471.05
28	793.21	475.40
29	802.12	479.96
30	810.91	484.72
31	819.59	489.69
32	828.15	494.85
33	836.59	500.22
34	844.91	505.77

35	853.09	511.52
36	861.14	517.45
37	869.05	523.57
38	876.82	529.87
39	884.43	536.35
40	886.28	538.00

Circle Center At X = 600.9 ; Y = 861.8 and Radius, 431.6

*** 1.522 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	524.21	436.00
2	534.10	434.49
3	544.01	433.20
4	553.96	432.13
5	563.92	431.29
6	573.90	430.67
7	583.89	430.28
8	593.89	430.12
9	603.89	430.17
10	613.89	430.46
11	623.87	430.97
12	633.85	431.70
13	643.80	432.66
14	653.73	433.85
15	663.63	435.26
16	673.50	436.89
17	683.32	438.74
18	693.11	440.81
19	702.84	443.10
20	712.52	445.62
21	722.14	448.35
22	731.70	451.29
23	741.18	454.45
24	750.60	457.83
25	759.93	461.41
26	769.18	465.21
27	778.35	469.21
28	787.42	473.42
29	796.39	477.83
30	805.27	482.44
31	814.03	487.25
32	822.69	492.26
33	831.23	497.46
34	839.65	502.86
35	847.95	508.44
36	856.12	514.20
37	864.16	520.15
38	872.06	526.28
39	879.82	532.59
40	886.18	538.00

Circle Center At X = 596.3 ; Y = 873.6 and Radius, 443.5

*** 1.524 ***

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	530.53	436.00
2	540.40	434.39
3	550.30	433.03
4	560.24	431.93
5	570.21	431.07
6	580.19	430.47
7	590.18	430.12
8	600.18	430.02
9	610.18	430.17
10	620.17	430.58
11	630.15	431.24
12	640.11	432.16
13	650.04	433.32
14	659.94	434.74

15	669.80	436.40
16	679.61	438.32
17	689.38	440.48
18	699.08	442.89
19	708.72	445.54
20	718.30	448.44
21	727.79	451.58
22	737.20	454.96
23	746.53	458.57
24	755.76	462.42
25	764.89	466.50
26	773.91	470.81
27	782.82	475.35
28	791.61	480.11
29	800.28	485.09
30	808.83	490.29
31	817.23	495.71
32	825.50	501.33
33	833.62	507.17
34	841.60	513.20
35	849.41	519.44
36	857.07	525.87
37	864.32	532.28

Circle Center At X = 599.0 ; Y = 825.3 and Radius, 395.2

*** 1.525 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	524.21	436.00
2	534.10	434.49
3	544.01	433.21
4	553.96	432.15
5	563.92	431.32
6	573.91	430.72
7	583.90	430.35
8	593.90	430.21
9	603.90	430.30
10	613.89	430.62
11	623.88	431.17
12	633.85	431.94
13	643.80	432.95
14	653.72	434.18
15	663.61	435.64
16	673.47	437.32
17	683.29	439.23
18	693.06	441.37
19	702.77	443.73
20	712.43	446.31
21	722.03	449.11
22	731.57	452.13
23	741.03	455.37
24	750.41	458.83
25	759.71	462.50
26	768.93	466.38
27	778.05	470.47
28	787.08	474.77
29	796.01	479.28
30	804.83	483.98
31	813.54	488.90
32	822.14	494.00
33	830.62	499.31
34	838.97	504.81
35	847.19	510.49
36	855.29	516.37
37	863.24	522.43
38	871.06	528.67
39	878.73	535.08
40	882.05	538.00

Circle Center At X = 595.0 ; Y = 866.2 and Radius, 436.0

*** 1.527 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	536.84	436.00
2	546.74	434.54
3	556.66	433.29
4	566.60	432.26
5	576.57	431.45
6	586.55	430.86
7	596.55	430.48
8	606.55	430.33
9	616.54	430.39
10	626.54	430.67
11	636.53	431.17
12	646.50	431.89
13	656.46	432.83
14	666.39	433.98
15	676.30	435.35
16	686.17	436.94
17	696.01	438.75
18	705.80	440.76
19	715.55	443.00
20	725.24	445.44
21	734.89	448.10
22	744.47	450.96
23	753.98	454.04
24	763.43	457.32
25	772.80	460.81
26	782.09	464.50
27	791.30	468.40
28	800.42	472.49
29	809.46	476.79
30	818.39	481.28
31	827.22	485.97
32	835.95	490.84
33	844.58	495.91
34	853.08	501.17
35	861.47	506.61
36	869.74	512.23
37	877.89	518.03
38	885.91	524.01
39	893.79	530.16
40	901.54	536.48
41	903.31	538.00

Circle Center At X = 608.7 ; Y = 887.4 and Radius, 457.1

*** 1.528 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	530.53	436.00
2	540.40	434.43
3	550.32	433.11
4	560.26	432.03
5	570.22	431.21
6	580.21	430.63
7	590.20	430.30
8	600.20	430.22
9	610.20	430.38
10	620.19	430.80
11	630.17	431.47
12	640.13	432.38
13	650.06	433.54
14	659.96	434.95
15	669.82	436.61
16	679.64	438.51
17	689.41	440.65
18	699.12	443.04
19	708.76	445.67
20	718.34	448.54
21	727.85	451.64

22	737.27	454.99
23	746.61	458.56
24	755.86	462.37
25	765.01	466.41
26	774.06	470.67
27	782.99	475.16
28	791.81	479.86
29	800.52	484.79
30	809.09	489.93
31	817.54	495.29
32	825.85	500.85
33	834.02	506.62
34	842.04	512.59
35	849.91	518.76
36	857.63	525.12
37	865.18	531.67
38	866.74	533.09

Circle Center At X = 598.5 ; Y = 831.5 and Radius, 401.3

*** 1.528 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	549.47	437.33
2	559.33	435.63
3	569.22	434.17
4	579.15	432.97
5	589.10	432.01
6	599.08	431.31
7	609.07	430.86
8	619.07	430.67
9	629.07	430.72
10	639.06	431.04
11	649.04	431.60
12	659.01	432.42
13	668.95	433.49
14	678.87	434.81
15	688.74	436.38
16	698.57	438.20
17	708.36	440.27
18	718.09	442.59
19	727.75	445.15
20	737.35	447.96
21	746.87	451.00
22	756.32	454.29
23	765.68	457.82
24	774.94	461.58
25	784.11	465.58
26	793.17	469.81
27	802.12	474.26
28	810.96	478.94
29	819.67	483.85
30	828.26	488.97
31	836.72	494.31
32	845.04	499.86
33	853.21	505.62
34	861.24	511.59
35	869.11	517.75
36	876.82	524.12
37	884.37	530.67
38	891.75	537.42
39	892.36	538.00

Circle Center At X = 621.8 ; Y = 825.4 and Radius, 394.7

*** 1.529 ***

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	524.21	436.00
2	534.08	434.40
3	543.99	433.04
4	553.93	431.93

5	563.89	431.08
6	573.87	430.47
7	583.87	430.11
8	593.87	430.00
9	603.86	430.15
10	613.86	430.54
11	623.84	431.19
12	633.80	432.08
13	643.73	433.23
14	653.63	434.62
15	663.50	436.26
16	673.32	438.15
17	683.09	440.28
18	692.80	442.66
19	702.45	445.28
20	712.03	448.14
21	721.54	451.24
22	730.97	454.57
23	740.31	458.14
24	749.56	461.95
25	758.71	465.99
26	767.75	470.25
27	776.69	474.74
28	785.51	479.45
29	794.21	484.38
30	802.78	489.53
31	811.22	494.89
32	819.53	500.46
33	827.69	506.24
34	835.70	512.22
35	843.57	518.40
36	851.27	524.77
37	857.16	529.90

Circle Center At X = 593.1 ; Y = 829.0 and Radius, 399.0

*** 1.530 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	536.84	436.00
2	546.71	434.37
3	556.61	433.00
4	566.55	431.90
5	576.52	431.08
6	586.51	430.53
7	596.50	430.25
8	606.50	430.24
9	616.50	430.51
10	626.48	431.04
11	636.45	431.85
12	646.39	432.93
13	656.30	434.29
14	666.17	435.91
15	675.99	437.79
16	685.75	439.95
17	695.46	442.37
18	705.09	445.06
19	714.64	448.00
20	724.12	451.21
21	733.50	454.67
22	742.78	458.38
23	751.96	462.35
24	761.03	466.57
25	769.98	471.03
26	778.80	475.74
27	787.50	480.68
28	796.05	485.86
29	804.46	491.27
30	812.72	496.90
31	820.83	502.76
32	828.77	508.84

```
      33        836.54      515.13
      34        844.14      521.63
      35        851.01      527.85
Circle Center At X =  601.8 ; Y =  797.2  and Radius,  367.0
     ***     1.531   ***
```

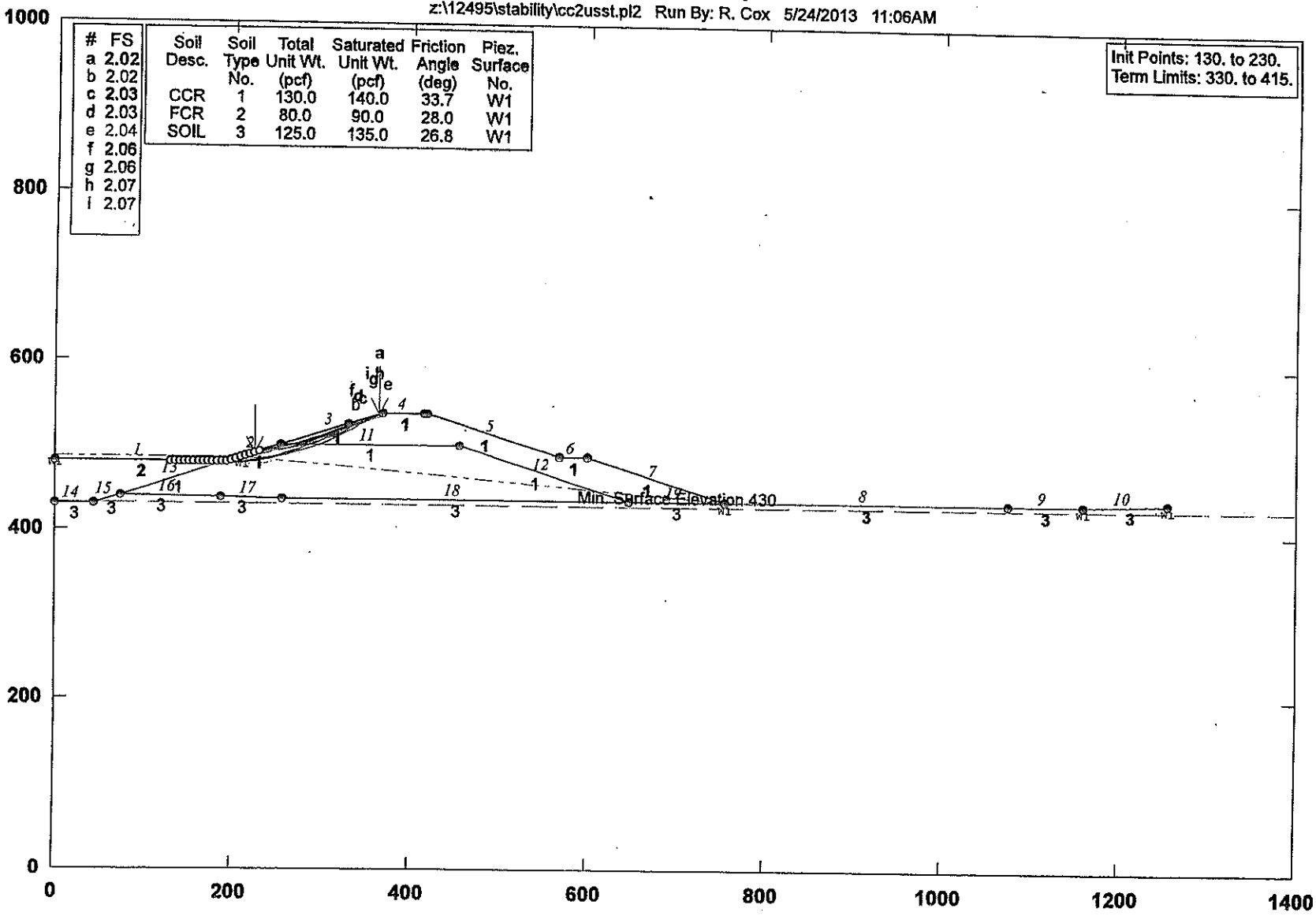
Section C-C Phase 10 Upstream Static

z:\12495\stability\cc2usst.pl2 Run By: R. Cox 5/24/2013 11:06AM

#	FS
a	2.02
b	2.02
c	2.03
d	2.03
e	2.04
f	2.06
g	2.06
h	2.07
i	2.07

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 130. to 230.
Term Limits: 330. to 415.



PCSTABL5M/si FSmin=2.02

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:06AM
Run By: R. Cox
Input Data Filename: Z:cc2usst.in
Output Filename: Z:cc2usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc2usst.PLT
PROBLEM DESCRIPTION Section C-C Phase 10 Upstream Static
BOUNDARY COORDINATES
10 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	479.60	193.20	479.60	2
2	193.20	479.60	254.40	500.00	1
3	254.40	500.00	368.50	538.00	1
4	368.50	538.00	418.50	538.00	1
5	418.50	538.00	568.50	488.00	1
6	568.50	488.00	598.50	488.00	1
7	598.50	488.00	754.50	436.00	1
8	754.50	436.00	1074.80	436.00	3
9	1074.80	436.00	1159.70	436.00	3
10	1159.70	436.00	1254.70	439.80	3
11	254.40	500.00	454.40	500.00	1
12	454.40	500.00	646.50	436.00	1
13	73.40	439.60	193.20	479.60	1
14	0.00	430.00	44.60	430.00	3
15	44.60	430.00	73.40	439.60	3
16	73.40	439.60	186.30	438.00	3
17	186.30	438.00	255.60	436.00	3
18	255.60	436.00	646.50	436.00	3
19	646.50	436.00	754.50	436.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	485.00
2	209.40	485.00
3	754.50	436.00
4	1159.70	436.00
5	1254.70	439.80

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 130.00 ft.
and X = 230.00 ft.
Each Surface Terminates Between X = 330.00 ft.
and X = 415.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	224.74	490.11
2	234.57	491.95
3	244.36	493.98
4	254.11	496.21
5	263.81	498.63
6	273.46	501.25
7	283.06	504.05
8	292.60	507.05
9	302.08	510.24
10	311.49	513.62
11	320.83	517.19
12	330.10	520.94
13	339.29	524.87
14	348.41	528.99
15	357.43	533.29
16	363.51	536.34

Circle Center At X = 138.0 ; Y = 981.9 and Radius, 499.4
*** 2.022 ***
Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.8	920.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	9.8	2616.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	9.7	4033.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.3	141.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	9.4	5027.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	5.1	3059.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4.6	2965.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	9.6	6607.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	9.5	6918.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	9.5	6963.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	9.4	6746.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	9.3	6273.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	9.3	5550.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	9.2	4584.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	9.1	3384.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	9.0	1958.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	6.1	403.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	219.47	488.36
2	229.30	490.20
3	239.08	492.28
4	248.81	494.60
5	258.48	497.14
6	268.09	499.91
7	277.63	502.91
8	287.10	506.14
9	296.48	509.59
10	305.78	513.26
11	314.99	517.16
12	324.11	521.27
13	333.12	525.60
14	336.63	527.39

Circle Center At X = 147.2 ; Y = 900.7 and Radius, 418.6
*** 2.022 ***
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	230.00	491.87
2	239.85	493.58
3	249.66	495.55
4	259.40	497.79

5	269.09	500.29
6	278.70	503.04
7	288.24	506.05
8	297.69	509.31
9	307.05	512.83
10	316.31	516.59
11	325.48	520.60
12	334.53	524.86
13	343.46	529.35
14	344.98	530.17

Circle Center At X = 171.0 ; Y = 860.7 and Radius, 373.5

*** 2.026 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	208.95	484.85
2	218.84	486.31
3	228.69	488.03
4	238.49	490.02
5	248.23	492.28
6	257.91	494.79
7	267.52	497.57
8	277.05	500.61
9	286.49	503.90
10	295.84	507.45
11	305.09	511.25
12	314.23	515.30
13	323.26	519.59
14	332.17	524.13
15	340.57	528.70

Circle Center At X = 160.1 ; Y = 851.1 and Radius, 369.5

*** 2.034 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	230.00	491.87
2	239.81	493.83
3	249.58	495.94
4	259.32	498.22
5	269.02	500.65
6	278.68	503.23
7	288.30	505.96
8	297.87	508.85
9	307.40	511.90
10	316.87	515.09
11	326.30	518.43
12	335.67	521.93
13	344.98	525.57
14	354.23	529.36
15	363.43	533.30
16	372.55	537.39
17	373.87	538.00

Circle Center At X = 112.1 ; Y = 1107.2 and Radius, 626.5

*** 2.040 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	145.79	479.60
2	155.72	478.44
3	165.69	477.67
4	175.69	477.28
5	185.69	477.27
6	195.68	477.65
7	205.65	478.41
8	215.58	479.56
9	225.47	481.09
10	235.28	482.99
11	245.02	485.27
12	254.66	487.93
13	264.19	490.95

14	273.60	494.34
15	282.87	498.09
16	291.99	502.19
17	300.95	506.64
18	309.72	511.43
19	318.31	516.56
20	326.69	522.01
21	332.23	525.92

Circle Center At X = 180.8 ; Y = 737.1 and Radius, 259.9

*** 2.056 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	151.05	479.60
2	161.01	478.66
3	170.99	478.06
4	180.99	477.80
5	190.99	477.88
6	200.98	478.30
7	210.95	479.06
8	220.89	480.15
9	230.79	481.58
10	240.63	483.35
11	250.41	485.44
12	260.11	487.87
13	269.72	490.62
14	279.24	493.70
15	288.64	497.10
16	297.92	500.82
17	307.08	504.85
18	316.09	509.19
19	324.95	513.83
20	333.64	518.76
21	342.17	523.99
22	350.51	529.51
23	357.12	534.21

Circle Center At X = 183.7 ; Y = 772.8 and Radius, 295.0

*** 2.057 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	224.74	490.11
2	234.71	490.86
3	244.65	491.97
4	254.54	493.43
5	264.38	495.24
6	274.14	497.40
7	283.82	499.90
8	293.41	502.75
9	302.89	505.94
10	312.25	509.46
11	321.47	513.31
12	330.56	517.49
13	339.49	521.98
14	348.26	526.80
15	356.85	531.92
16	363.89	536.46

Circle Center At X = 208.6 ; Y = 770.5 and Radius, 280.8

*** 2.066 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	224.74	490.11
2	234.72	490.75
3	244.66	491.80
4	254.55	493.26
5	264.38	495.14
6	274.11	497.43
7	283.74	500.12
8	293.25	503.21

9	302.62	506.70
10	311.84	510.58
11	320.89	514.84
12	329.75	519.47
13	338.41	524.47
14	346.85	529.83
15	349.51	531.67

Circle Center At X = 214.6 ; Y = 728.9 and Radius, 239.0

*** 2.073 ***

Failure Surface Specified By 20 Coordinate Points

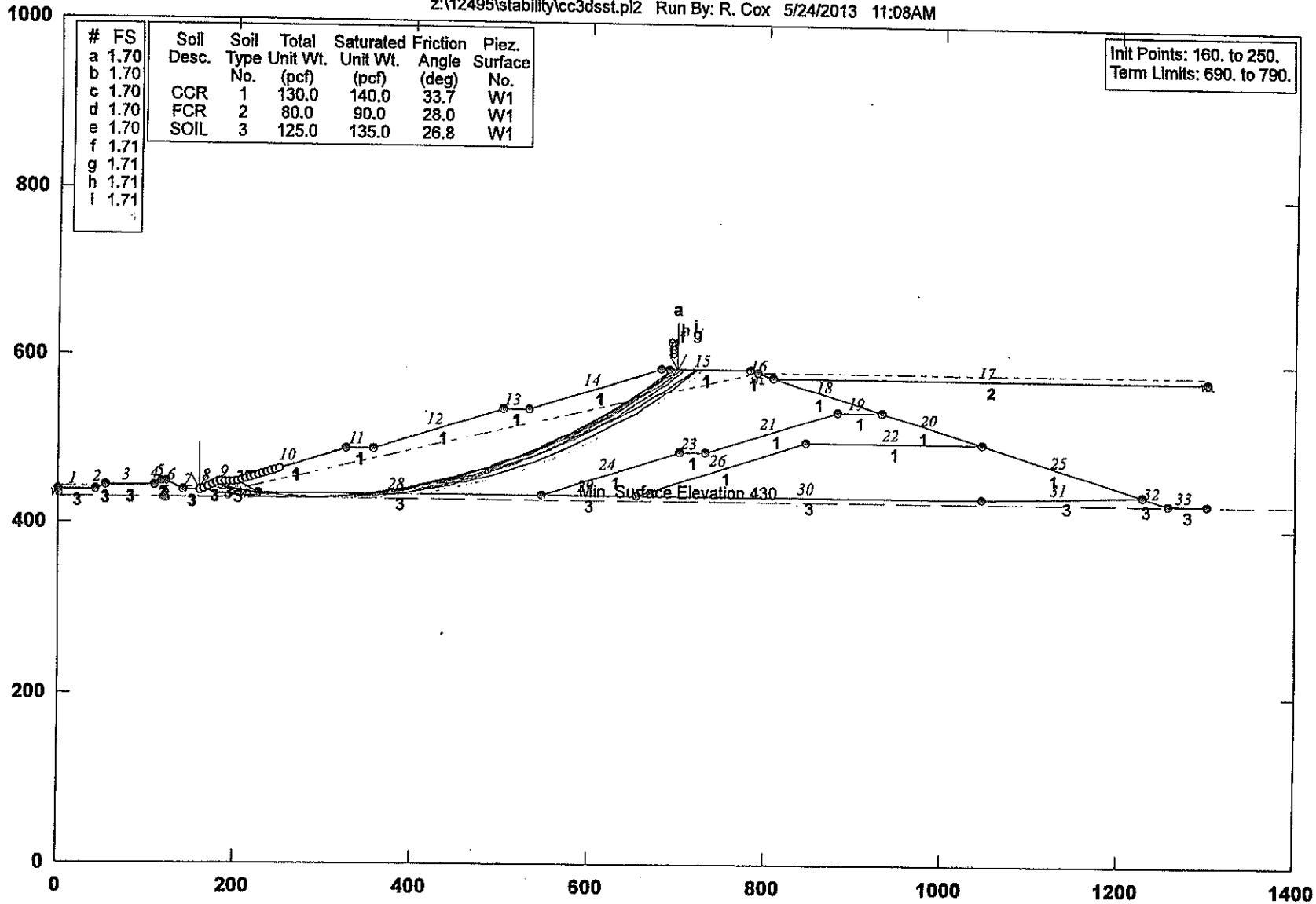
Point No.	X-Surf (ft)	Y-Surf (ft)
1	161.58	479.60
2	171.41	477.74
3	181.31	476.39
4	191.28	475.55
5	201.27	475.22
6	211.27	475.40
7	221.25	476.10
8	231.17	477.30
9	241.03	479.01
10	250.78	481.23
11	260.40	483.94
12	269.88	487.14
13	279.17	490.82
14	288.27	494.98
15	297.14	499.59
16	305.77	504.66
17	314.12	510.16
18	322.18	516.07
19	329.92	522.40
20	334.73	526.75

Circle Center At X = 202.7 ; Y = 670.0 and Radius, 194.8

*** 2.075 ***

Section C-C Phase 11 Downstream Static Deep Circle

z:\12495\stability\cc3dsst.pl2 Run By: R. Cox 5/24/2013 11:08AM



PCSTABL5M/si FSmin=1.70

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:08AM
Run By: R. Cox
Input Data Filename: Z:cc3dsst.
Output Filename: Z:cc3dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc3dsst.PLT
PROBLEM DESCRIPTION Section C-C Phase 11
Downstream Static Deep Circle

BOUNDARY COORDINATES
17 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	438.00	41.63	438.00	3
2	41.63	438.00	53.63	444.00	3
3	53.63	444.00	108.40	444.00	3
4	108.40	444.00	116.28	448.00	3
5	116.28	448.00	121.28	448.00	3
6	121.28	448.00	141.28	438.00	3
7	141.28	438.00	161.28	438.00	3
8	161.28	438.00	181.28	448.00	3
9	181.28	448.00	201.28	448.00	3
10	201.28	448.00	325.28	489.27	1
11	325.28	489.27	355.28	489.27	1
12	355.28	489.27	501.47	538.00	1
13	501.47	538.00	531.47	538.00	1
14	531.47	538.00	681.47	588.00	1
15	681.47	588.00	781.47	588.00	1
16	781.47	588.00	807.87	579.20	1
17	807.87	579.20	1300.00	579.20	2
18	807.87	579.20	931.57	538.00	1
19	881.47	538.00	931.57	538.00	1
20	931.57	538.00	1045.61	500.00	1
21	731.47	488.00	881.47	538.00	1
22	845.61	500.00	1045.61	500.00	1
23	701.47	488.00	731.47	488.00	1
24	545.47	436.00	701.47	488.00	1
25	1045.61	500.00	1226.55	439.64	1
26	653.54	435.98	845.61	500.00	1
27	201.28	448.00	225.34	436.00	3
28	225.34	436.00	545.47	436.00	3
29	545.47	436.00	653.54	435.98	3
30	653.54	435.98	1044.41	436.00	3
31	1044.41	436.00	1226.55	439.64	3
32	1226.55	439.64	1255.44	430.00	3
33	1255.44	430.00	1300.00	430.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	442.00
2	213.16	442.00
3	790.47	585.00
4	1300.00	585.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 160.00 ft.
and X = 250.00 ft.
Each Surface Terminates Between X = 690.00 ft.
and X = 790.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 59 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00
2	169.89	436.54
3	179.81	435.23
4	189.74	434.06
5	199.69	433.04
6	209.65	432.17
7	219.62	431.45
8	229.61	430.87
9	239.60	430.44
10	249.59	430.16
11	259.59	430.02
12	269.59	430.04
13	279.59	430.20
14	289.59	430.51
15	299.58	430.96
16	309.56	431.57
17	319.53	432.32
18	329.49	433.21
19	339.43	434.26
20	349.36	435.45
21	359.27	436.79
22	369.16	438.27
23	379.03	439.90
24	388.87	441.68
25	398.68	443.60
26	408.47	445.67
27	418.22	447.88
28	427.94	450.23
29	437.62	452.73
30	447.27	455.37
31	456.87	458.15
32	466.44	461.07
33	475.95	464.14
34	485.43	467.34
35	494.85	470.69
36	504.22	474.17
37	513.55	477.79
38	522.81	481.55
39	532.02	485.45
40	541.17	489.48
41	550.27	493.64
42	559.29	497.94
43	568.26	502.37
44	577.16	506.94
45	585.99	511.63
46	594.75	516.46
47	603.43	521.41
48	612.05	526.49
49	620.58	531.70
50	629.04	537.03
51	637.42	542.49
52	645.72	548.07

53	653.93	553.77
54	662.06	559.60
55	670.10	565.54
56	678.06	571.60
57	685.92	577.78
58	693.69	584.07
59	698.40	588.00

Circle Center At X = 263.7 ; Y = 1107.1 and Radius, 677.1

*** 1.700 ***

Individual data on the 71 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	16.3	319.4	330.4	0.0	0.0	0.0	0.0	0.0
2	8.6	3461.7	1109.7	2620.6	0.0	0.0	0.0	0.0	0.0
3	9.9	11634.8	0.0	3815.6	0.0	0.0	0.0	0.0	0.0
4	1.5	2400.5	0.0	634.6	0.0	0.0	0.0	0.0	0.0
5	8.5	14840.6	0.0	3954.2	0.0	0.0	0.0	0.0	0.0
6	9.9	18803.9	0.0	5270.4	0.0	0.0	0.0	0.0	0.0
7	1.6	3136.0	0.0	900.7	0.0	0.0	0.0	0.0	0.0
8	8.4	18568.2	0.0	4959.7	0.0	0.0	0.0	0.0	0.0
9	3.5	8979.1	0.0	2186.9	0.0	0.0	0.0	0.0	0.0
10	0.1	266.1	0.0	61.5	0.0	0.0	0.0	0.0	0.0
11	6.4	18081.8	0.0	4303.8	0.0	0.0	0.0	0.0	0.0
12	5.7	18218.2	0.0	4520.7	0.0	0.0	0.0	0.0	0.0
13	4.3	14761.2	0.0	3767.7	0.0	0.0	0.0	0.0	0.0
14	10.0	38279.6	0.0	10092.6	0.0	0.0	0.0	0.0	0.0
15	10.0	43341.7	0.0	11808.3	0.0	0.0	0.0	0.0	0.0
16	10.0	48201.3	0.0	13435.2	0.0	0.0	0.0	0.0	0.0
17	10.0	52854.6	0.0	14973.0	0.0	0.0	0.0	0.0	0.0
18	10.0	57297.0	0.0	16421.1	0.0	0.0	0.0	0.0	0.0
19	10.0	61524.9	0.0	17779.5	0.0	0.0	0.0	0.0	0.0
20	10.0	65534.8	0.0	19047.7	0.0	0.0	0.0	0.0	0.0
21	10.0	69323.6	0.0	20225.5	0.0	0.0	0.0	0.0	0.0
22	10.0	72888.1	0.0	21312.6	0.0	0.0	0.0	0.0	0.0
23	5.8	43611.7	0.0	12766.4	0.0	0.0	0.0	0.0	0.0
24	4.2	32231.3	0.0	9542.4	0.0	0.0	0.0	0.0	0.0
25	9.9	75384.8	0.0	23214.0	0.0	0.0	0.0	0.0	0.0
26	9.9	74000.8	0.0	24027.7	0.0	0.0	0.0	0.0	0.0
27	4.1	29863.4	0.0	10061.6	0.0	0.0	0.0	0.0	0.0
28	1.9	13560.4	0.0	4636.2	0.0	0.0	0.0	0.0	0.0
29	4.0	29319.1	0.0	10052.1	0.0	0.0	0.0	0.0	0.0
30	9.9	74366.1	0.0	25380.6	0.0	0.0	0.0	0.0	0.0
31	9.9	76503.7	0.0	25919.5	0.0	0.0	0.0	0.0	0.0
32	9.8	78402.2	0.0	26366.4	0.0	0.0	0.0	0.0	0.0
33	9.8	80061.3	0.0	26721.3	0.0	0.0	0.0	0.0	0.0
34	9.8	81481.6	0.0	26984.2	0.0	0.0	0.0	0.0	0.0
35	9.8	82662.9	0.0	27154.9	0.0	0.0	0.0	0.0	0.0
36	9.7	83606.4	0.0	27233.4	0.0	0.0	0.0	0.0	0.0
37	9.7	84313.7	0.0	27219.8	0.0	0.0	0.0	0.0	0.0
38	9.6	84785.3	0.0	27113.8	0.0	0.0	0.0	0.0	0.0
39	9.6	85024.0	0.0	26915.7	0.0	0.0	0.0	0.0	0.0
40	9.6	85031.7	0.0	26625.6	0.0	0.0	0.0	0.0	0.0
41	9.5	84810.6	0.0	26243.4	0.0	0.0	0.0	0.0	0.0
42	9.5	84363.8	0.0	25769.2	0.0	0.0	0.0	0.0	0.0
43	9.4	83694.2	0.0	25203.1	0.0	0.0	0.0	0.0	0.0
44	6.6	58528.6	0.0	17405.4	0.0	0.0	0.0	0.0	0.0
45	2.8	24112.5	0.0	7139.8	0.0	0.0	0.0	0.0	0.0
46	9.3	78706.2	0.0	23795.8	0.0	0.0	0.0	0.0	0.0
47	9.3	73675.8	0.0	22954.8	0.0	0.0	0.0	0.0	0.0
48	8.7	64530.0	0.0	20728.2	0.0	0.0	0.0	0.0	0.0
49	0.6	3983.6	0.0	1294.5	0.0	0.0	0.0	0.0	0.0
50	9.2	65240.9	0.0	20999.4	0.0	0.0	0.0	0.0	0.0
51	9.1	63397.7	0.0	19885.4	0.0	0.0	0.0	0.0	0.0
52	9.0	61364.8	0.0	18680.7	0.0	0.0	0.0	0.0	0.0
53	9.0	59147.6	0.0	17385.7	0.0	0.0	0.0	0.0	0.0
54	8.9	56752.7	0.0	16000.7	0.0	0.0	0.0	0.0	0.0
55	8.8	54185.7	0.0	14526.0	0.0	0.0	0.0	0.0	0.0
56	8.8	51452.8	0.0	12961.7	0.0	0.0	0.0	0.0	0.0

57	8.7	48560.9	0.0	11308.4	0.0	0.0	0.0	0.0	0.0
58	8.6	45516.7	0.0	9566.4	0.0	0.0	0.0	0.0	0.0
59	8.5	42327.5	0.0	7736.1	0.0	0.0	0.0	0.0	0.0
60	8.5	39000.3	0.0	5817.7	0.0	0.0	0.0	0.0	0.0
61	8.4	35543.3	0.0	3812.0	0.0	0.0	0.0	0.0	0.0
62	8.3	31963.6	0.0	1719.0	0.0	0.0	0.0	0.0	0.0
63	2.4	8635.5	0.0	95.3	0.0	0.0	0.0	0.0	0.0
64	5.8	19707.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	8.1	24824.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	8.0	21226.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67	8.0	17543.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68	3.4	6426.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	4.5	6926.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	7.8	7146.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	4.7	1201.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 59 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00
2	169.89	436.53
3	179.80	435.21
4	189.73	434.03
5	199.68	433.01
6	209.64	432.13
7	219.62	431.41
8	229.60	430.83
9	239.59	430.40
10	249.59	430.13
11	259.59	430.00
12	269.59	430.02
13	279.59	430.20
14	289.58	430.52
15	299.57	431.00
16	309.55	431.62
17	319.52	432.39
18	329.48	433.32
19	339.42	434.39
20	349.34	435.61
21	359.25	436.98
22	369.13	438.50
23	378.99	440.17
24	388.83	441.98
25	398.63	443.94
26	408.41	446.05
27	418.15	448.31
28	427.86	450.71
29	437.53	453.25
30	447.16	455.95
31	456.75	458.78
32	466.30	461.76
33	475.80	464.88
34	485.25	468.15
35	494.65	471.55
36	504.00	475.10
37	513.30	478.79
38	522.53	482.61
39	531.72	486.58
40	540.84	490.68
41	549.89	494.91
42	558.89	499.29
43	567.81	503.80
44	576.67	508.44
45	585.46	513.21
46	594.17	518.11
47	602.81	523.15
48	611.38	528.31
49	619.86	533.60
50	628.27	539.02
51	636.59	544.57
52	644.83	550.24

53	652.98	556.03
54	661.04	561.94
55	669.02	567.97
56	676.90	574.13
57	684.69	580.40
58	692.39	586.78
59	693.81	588.00

Circle Center At X = 263.0 ; Y = 1096.4 and Radius, 666.4

*** 1.700 ***

Failure Surface Specified By 58 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	174.21	444.47
2	183.98	442.33
3	193.79	440.38
4	203.63	438.59
5	213.50	436.98
6	223.39	435.54
7	233.31	434.27
8	243.25	433.18
9	253.21	432.26
10	263.18	431.52
11	273.17	430.95
12	283.16	430.56
13	293.16	430.34
14	303.16	430.30
15	313.15	430.44
16	323.15	430.75
17	333.14	431.23
18	343.12	431.89
19	353.08	432.73
20	363.03	433.74
21	372.96	434.93
22	382.87	436.29
23	392.75	437.82
24	402.60	439.52
25	412.42	441.40
26	422.21	443.45
27	431.96	445.68
28	441.67	448.07
29	451.34	450.63
30	460.96	453.37
31	470.53	456.27
32	480.04	459.34
33	489.51	462.57
34	498.91	465.97
35	508.25	469.54
36	517.53	473.26
37	526.74	477.16
38	535.89	481.21
39	544.96	485.42
40	553.95	489.79
41	562.87	494.32
42	571.70	499.00
43	580.45	503.84
44	589.12	508.83
45	597.70	513.97
46	606.18	519.26
47	614.57	524.70
48	622.87	530.29
49	631.06	536.02
50	639.15	541.89
51	647.14	547.91
52	655.02	554.06
53	662.80	560.35
54	670.46	566.78
55	678.01	573.34
56	685.44	580.04
57	692.75	586.86
58	693.93	588.00

Circle Center At X = 300.5 ; Y = 999.9 and Radius, 569.7
*** 1.700 ***
Failure Surface Specified By 59 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00
2	169.89	436.53
3	179.81	435.22
4	189.74	434.05
5	199.68	433.03
6	209.65	432.16
7	219.62	431.43
8	229.60	430.86
9	239.60	430.44
10	249.59	430.16
11	259.59	430.04
12	269.59	430.06
13	279.59	430.23
14	289.58	430.56
15	299.57	431.03
16	309.55	431.65
17	319.52	432.42
18	329.48	433.34
19	339.42	434.41
20	349.35	435.62
21	359.26	436.99
22	369.14	438.50
23	379.00	440.16
24	388.84	441.97
25	398.65	443.92
26	408.42	446.02
27	418.17	448.27
28	427.88	450.66
29	437.55	453.20
30	447.18	455.88
31	456.78	458.70
32	466.33	461.67
33	475.83	464.78
34	485.29	468.03
35	494.69	471.42
36	504.05	474.95
37	513.35	478.62
38	522.60	482.44
39	531.78	486.38
40	540.91	490.47
41	549.98	494.69
42	558.98	499.04
43	567.91	503.53
44	576.78	508.16
45	585.58	512.91
46	594.30	517.80
47	602.96	522.81
48	611.53	527.96
49	620.03	533.23
50	628.45	538.63
51	636.78	544.15
52	645.03	549.80
53	653.20	555.57
54	661.28	561.46
55	669.27	567.47
56	677.17	573.60
57	684.98	579.85
58	692.70	586.21
59	694.80	588.00

Circle Center At X = 263.0 ; Y = 1099.2 and Radius, 669.2
*** 1.700 ***
Failure Surface Specified By 58 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00

2	169.89	436.54
3	179.81	435.23
4	189.74	434.06
5	199.69	433.05
6	209.65	432.19
7	219.62	431.47
8	229.61	430.91
9	239.60	430.50
10	249.60	430.24
11	259.60	430.13
12	269.60	430.17
13	279.59	430.36
14	289.59	430.70
15	299.58	431.19
16	309.56	431.84
17	319.52	432.63
18	329.48	433.57
19	339.42	434.66
20	349.34	435.91
21	359.24	437.30
22	369.13	438.84
23	378.98	440.53
24	388.81	442.37
25	398.61	444.36
26	408.38	446.49
27	418.12	448.77
28	427.82	451.20
29	437.48	453.77
30	447.11	456.49
31	456.69	459.35
32	466.22	462.36
33	475.71	465.51
34	485.16	468.80
35	494.55	472.24
36	503.89	475.82
37	513.17	479.53
38	522.40	483.39
39	531.56	487.39
40	540.67	491.52
41	549.71	495.79
42	558.69	500.19
43	567.60	504.73
44	576.44	509.41
45	585.21	514.21
46	593.90	519.15
47	602.52	524.22
48	611.07	529.42
49	619.53	534.75
50	627.91	540.20
51	636.21	545.78
52	644.43	551.48
53	652.55	557.31
54	660.59	563.26
55	668.54	569.33
56	676.40	575.51
57	684.16	581.82
58	691.53	588.00

Circle Center At X = 261.9 ; Y = 1093.6 and Radius, 663.4

*** 1.702 ***

Failure Surface Specified By 60 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00
2	169.90	436.59
3	179.82	435.33
4	189.76	434.21
5	199.71	433.23
6	209.67	432.39
7	219.65	431.70
8	229.64	431.16

9	239.63	430.75
10	249.62	430.49
11	259.62	430.38
12	269.62	430.41
13	279.62	430.58
14	289.62	430.89
15	299.61	431.35
16	309.59	431.96
17	319.56	432.70
18	329.52	433.59
19	339.47	434.63
20	349.40	435.81
21	359.31	437.13
22	369.20	438.59
23	379.07	440.19
24	388.92	441.94
25	398.74	443.83
26	408.53	445.86
27	418.29	448.03
28	428.02	450.34
29	437.72	452.79
30	447.38	455.38
31	457.00	458.10
32	466.58	460.97
33	476.12	463.98
34	485.61	467.12
35	495.06	470.39
36	504.46	473.81
37	513.81	477.36
38	523.10	481.04
39	532.35	484.85
40	541.53	488.80
41	550.66	492.88
42	559.73	497.09
43	568.74	501.43
44	577.69	505.91
45	586.57	510.50
46	595.38	515.23
47	604.12	520.08
48	612.80	525.06
49	621.40	530.16
50	629.92	535.39
51	638.37	540.74
52	646.74	546.21
53	655.04	551.79
54	663.25	557.50
55	671.38	563.33
56	679.42	569.27
57	687.38	575.33
58	695.25	581.50
59	703.03	587.78
60	703.29	588.00

Circle Center At X = 262.7 ; Y = 1125.0 and Radius, 694.6

*** 1.706 ***

Failure Surface Specified By 60 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	174.21	444.47
2	184.01	442.46
3	193.84	440.61
4	203.69	438.92
5	213.57	437.38
6	223.48	436.00
7	233.40	434.78
8	243.35	433.72
9	253.30	432.82
10	263.28	432.07
11	273.26	431.48
12	283.25	431.05
13	293.25	430.78

14	303.25	430.67
15	313.25	430.72
16	323.24	430.93
17	333.24	431.30
18	343.22	431.82
19	353.20	432.51
20	363.16	433.35
21	373.11	434.35
22	383.05	435.51
23	392.96	436.83
24	402.85	438.31
25	412.72	439.94
26	422.55	441.73
27	432.36	443.67
28	442.14	445.78
29	451.88	448.03
30	461.59	450.44
31	471.25	453.01
32	480.88	455.73
33	490.45	458.60
34	499.99	461.62
35	509.47	464.80
36	518.90	468.12
37	528.28	471.60
38	537.60	475.22
39	546.86	478.99
40	556.06	482.91
41	565.20	486.98
42	574.27	491.19
43	583.27	495.54
44	592.20	500.03
45	601.06	504.67
46	609.85	509.45
47	618.55	514.37
48	627.18	519.42
49	635.73	524.61
50	644.19	529.94
51	652.57	535.40
52	660.86	540.99
53	669.06	546.71
54	677.17	552.57
55	685.18	558.55
56	693.10	564.66
57	700.92	570.89
58	708.64	577.25
59	716.25	583.73
60	721.11	588.00

Circle Center At X = 305.2 ; Y = 1059.2 and Radius, 628.5

*** 1.709 ***

Failure Surface Specified By 59 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	169.47	442.10
2	179.31	440.32
3	189.18	438.69
4	199.07	437.22
5	208.99	435.90
6	218.92	434.74
7	228.87	433.74
8	238.83	432.89
9	248.81	432.20
10	258.79	431.66
11	268.79	431.28
12	278.78	431.06
13	288.78	431.00
14	298.78	431.09
15	308.78	431.34
16	318.77	431.74
17	328.76	432.30
18	338.73	433.02

19	348.69	433.90
20	358.64	434.93
21	368.57	436.12
22	378.48	437.46
23	388.36	438.96
24	398.23	440.61
25	408.06	442.42
26	417.87	444.38
27	427.64	446.50
28	437.38	448.76
29	447.08	451.19
30	456.75	453.76
31	466.37	456.48
32	475.95	459.36
33	485.48	462.38
34	494.96	465.56
35	504.39	468.88
36	513.77	472.35
37	523.09	475.96
38	532.36	479.73
39	541.57	483.63
40	550.71	487.68
41	559.79	491.88
42	568.80	496.21
43	577.74	500.69
44	586.61	505.31
45	595.41	510.06
46	604.13	514.95
47	612.77	519.98
48	621.34	525.15
49	629.82	530.44
50	638.22	535.87
51	646.53	541.43
52	654.75	547.12
53	662.88	552.94
54	670.92	558.89
55	678.87	564.96
56	686.72	571.15
57	694.47	577.47
58	702.12	583.91
59	706.83	588.00

Circle Center At X = 287.9 ; Y = 1068.4 and Radius, 637.4

*** 1.709 ***

Failure Surface Specified By 61 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.00	438.00
2	169.91	436.62
3	179.83	435.38
4	189.77	434.28
5	199.72	433.31
6	209.68	432.47
7	219.66	431.78
8	229.64	431.22
9	239.64	430.80
10	249.63	430.51
11	259.63	430.36
12	269.63	430.35
13	279.63	430.48
14	289.63	430.74
15	299.62	431.14
16	309.60	431.67
17	319.58	432.35
18	329.55	433.16
19	339.50	434.11
20	349.44	435.19
21	359.37	436.41
22	369.28	437.76
23	379.17	439.25
24	389.03	440.88

25	398.88	442.64
26	408.70	444.54
27	418.49	446.57
28	428.25	448.73
29	437.98	451.03
30	447.68	453.46
31	457.35	456.03
32	466.98	458.72
33	476.57	461.55
34	486.12	464.51
35	495.63	467.60
36	505.10	470.82
37	514.52	474.17
38	523.90	477.65
39	533.22	481.25
40	542.50	484.99
41	551.73	488.85
42	560.90	492.83
43	570.01	496.95
44	579.07	501.18
45	588.07	505.54
46	597.01	510.03
47	605.88	514.63
48	614.70	519.36
49	623.44	524.21
50	632.12	529.17
51	640.73	534.26
52	649.27	539.46
53	657.74	544.78
54	666.14	550.21
55	674.46	555.76
56	682.70	561.42
57	690.86	567.20
58	698.95	573.09
59	706.95	579.08
60	714.87	585.19
61	718.41	588.00

Circle Center At X = 265.5 ; Y = 1159.9 and Radius, 729.6

*** 1.709 ***

Failure Surface Specified By 60 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	178.95	446.83
2	188.69	444.57
3	198.46	442.46
4	208.27	440.52
5	218.11	438.74
6	227.98	437.13
7	237.88	435.68
8	247.79	434.39
9	257.73	433.27
10	267.68	432.31
11	277.65	431.52
12	287.63	430.89
13	297.62	430.43
14	307.62	430.13
15	317.62	430.00
16	327.62	430.04
17	337.62	430.24
18	347.61	430.60
19	357.59	431.14
20	367.57	431.83
21	377.53	432.70
22	387.48	433.72
23	397.41	434.92
24	407.32	436.27
25	417.20	437.79
26	427.06	439.48
27	436.88	441.33
28	446.68	443.34

29	456.44	445.51
30	466.17	447.84
31	475.85	450.34
32	485.49	452.99
33	495.09	455.81
34	504.63	458.78
35	514.13	461.91
36	523.57	465.20
37	532.96	468.65
38	542.29	472.25
39	551.56	476.00
40	560.77	479.91
41	569.91	483.96
42	578.98	488.17
43	587.98	492.53
44	596.90	497.04
45	605.75	501.70
46	614.53	506.50
47	623.22	511.44
48	631.82	516.53
49	640.35	521.76
50	648.78	527.14
51	657.13	532.65
52	665.38	538.30
53	673.54	544.08
54	681.60	550.00
55	689.56	556.05
56	697.42	562.23
57	705.17	568.55
58	712.82	574.99
59	720.36	581.55
60	727.53	588.00

Circle Center At X = 320.5 ; Y = 1033.3 and Radius, 603.3

*** 1.710 ***

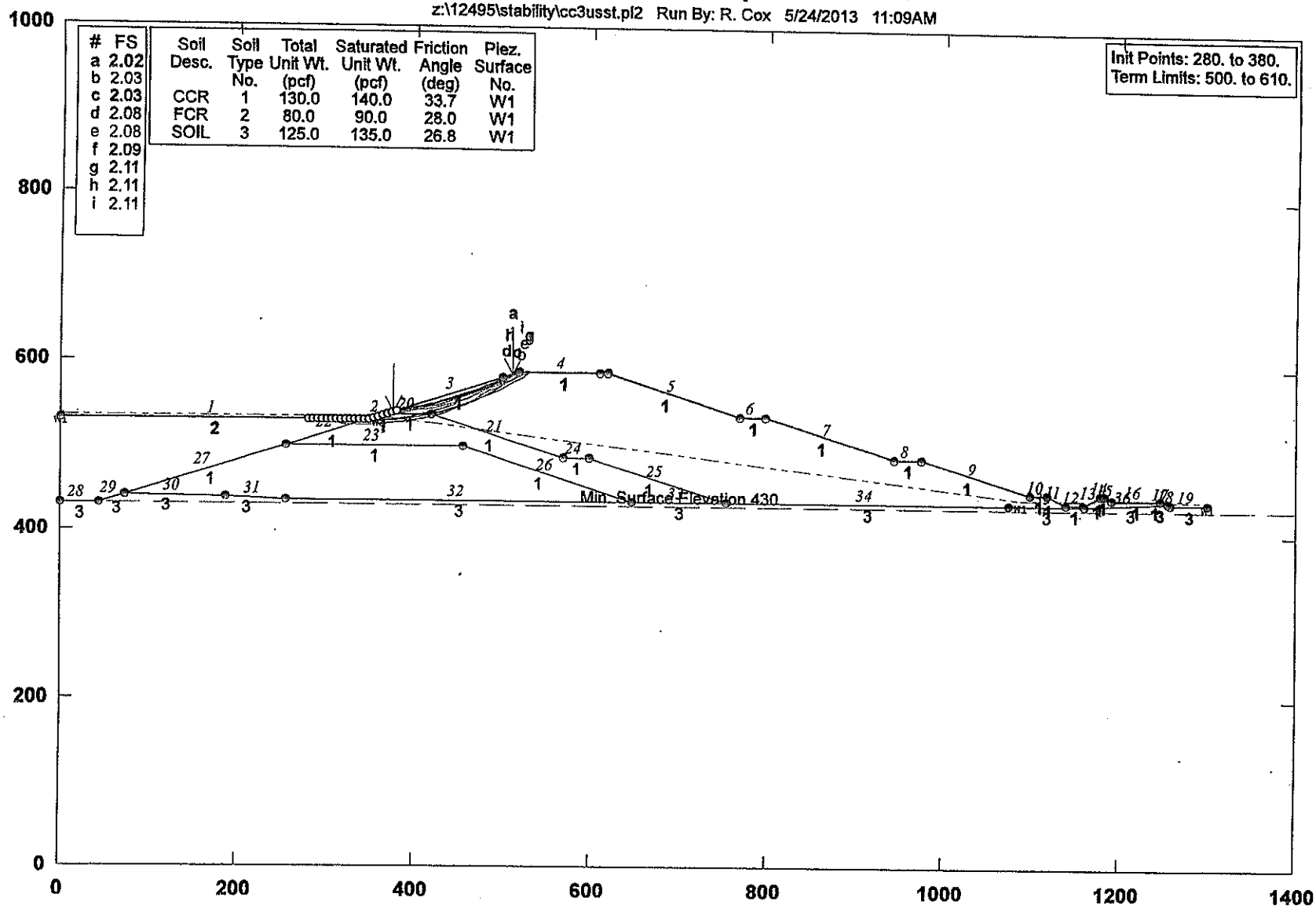
Section C-C Phase 11 Upstream Static

z:\12495\stability\cc3usst.pl2 Run By: R. Cox 5/24/2013 11:09AM

#	FS
a	2.02
b	2.03
c	2.03
d	2.08
e	2.08
f	2.09
g	2.11
h	2.11
i	2.11

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 280. to 380.
Term Limits: 500. to 610.



PCSTABL5M/si FSmin=2.02

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:09AM
Run By: R. Cox
Input Data Filename: Z:cc3usst.in
Output Filename: Z:cc3usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc3usst.PLT
PROBLEM DESCRIPTION Section C-C Phase 11 Upstream Static
BOUNDARY COORDINATES
19 Top Boundaries
36 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	531.20	348.10	531.20	2
2	348.10	531.20	368.50	538.00	1
3	368.50	538.00	518.50	588.00	1
4	518.50	588.00	618.50	588.00	1
5	618.50	588.00	768.50	538.00	1
6	768.50	538.00	798.50	538.00	1
7	798.50	538.00	944.70	489.30	1
8	944.70	489.30	974.70	489.30	1
9	974.70	489.30	1098.70	447.90	1
10	1098.70	447.90	1118.70	447.90	1
11	1118.70	447.90	1138.70	437.90	1
12	1138.70	437.90	1158.70	437.90	1
13	1158.70	437.90	1178.70	447.90	1
14	1178.70	447.90	1183.70	447.90	1
15	1183.70	447.90	1191.60	444.00	1
16	1191.60	444.00	1246.40	444.00	1
17	1246.40	444.00	1254.70	439.80	1
18	1254.70	439.80	1258.40	438.00	3
19	1258.40	438.00	1300.00	438.00	3
20	368.50	538.00	418.50	538.00	1
21	418.50	538.00	568.50	488.00	1
22	254.40	500.00	348.10	531.20	1
23	254.40	500.00	454.40	500.00	1
24	568.50	488.00	598.50	488.00	1
25	598.50	488.00	754.50	436.00	1
26	454.40	500.00	646.50	436.00	1
27	73.40	439.60	254.40	500.00	1
28	0.00	430.00	44.60	430.00	3
29	44.60	430.00	73.40	439.60	3
30	73.40	439.60	186.30	438.00	3
31	186.30	438.00	255.60	436.00	3
32	255.60	436.00	646.50	436.00	3
33	646.50	436.00	754.50	436.00	3
34	754.50	436.00	1074.80	436.00	3
35	1074.80	436.00	1159.70	436.00	3
36	1159.70	436.00	1254.70	439.80	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	535.00
2	359.50	535.00

3	1086.80	442.00
4	1300.00	442.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 280.00 ft.
and X = 380.00 ft.
Each Surface Terminates Between X = 500.00 ft.
and X = 610.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	374.74	540.08
2	384.57	541.93
3	394.35	543.97
4	404.10	546.22
5	413.79	548.66
6	423.44	551.30
7	433.03	554.14
8	442.56	557.18
9	452.02	560.41
10	461.42	563.83
11	470.74	567.44
12	479.99	571.24
13	489.16	575.23
14	498.25	579.41
15	507.25	583.77
16	509.94	585.15

Circle Center At X = 289.6 ; Y = 1020.9 and Radius, 488.3
*** 2.020 ***
Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.8	913.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	9.8	2593.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	9.7	3987.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	9.7	5095.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	9.6	5920.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	9.6	6466.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	9.5	6734.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	9.5	6731.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	9.4	6461.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	9.3	5931.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	9.2	5147.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	9.2	4118.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	9.1	2850.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	9.0	1355.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	2.7	83.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	380.00	541.83
2	389.85	543.55
3	399.67	545.47
4	409.44	547.59
5	419.16	549.93
6	428.83	552.46
7	438.45	555.20
8	448.01	558.15
9	457.50	561.29

10	466.93	564.63
11	476.28	568.18
12	485.55	571.91
13	494.75	575.85
14	503.86	579.97
15	512.88	584.29
16	520.22	588.00

Circle Center At X = 303.9 ; Y = 1008.9 and Radius, 473.2

*** 2.026 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.95	534.82
2	368.84	536.27
3	378.70	537.95
4	388.52	539.85
5	398.29	541.97
6	408.01	544.31
7	417.68	546.87
8	427.29	549.64
9	436.83	552.63
10	446.30	555.83
11	455.70	559.24
12	465.02	562.87
13	474.26	566.70
14	483.41	570.74
15	492.46	574.98
16	501.42	579.43
17	510.28	584.08
18	515.65	587.05

Circle Center At X = 299.2 ; Y = 975.2 and Radius, 444.4

*** 2.032 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	295.79	531.20
2	305.72	530.04
3	315.69	529.23
4	325.68	528.76
5	335.68	528.63
6	345.68	528.85
7	355.66	529.41
8	365.62	530.32
9	375.54	531.57
10	385.41	533.16
11	395.22	535.10
12	404.96	537.36
13	414.62	539.97
14	424.18	542.90
15	433.63	546.16
16	442.97	549.75
17	452.17	553.65
18	461.24	557.87
19	470.15	562.40
20	478.91	567.24
21	487.49	572.37
22	495.89	577.80
23	503.22	582.91

Circle Center At X = 334.3 ; Y = 818.6 and Radius, 290.0

*** 2.080 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	374.74	540.08
2	384.72	540.71
3	394.67	541.68
4	404.59	542.98
5	414.45	544.61
6	424.26	546.57
7	433.99	548.86

8	443.65	551.47
9	453.21	554.40
10	462.66	557.66
11	472.00	561.22
12	481.22	565.10
13	490.31	569.28
14	499.24	573.77
15	508.03	578.55
16	516.64	583.62
17	523.55	588.00

Circle Center At X = 360.8 ; Y = 838.6 and Radius, 298.8

*** 2.081 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	374.74	540.08
2	384.57	541.92
3	394.37	543.90
4	404.14	546.03
5	413.87	548.31
6	423.58	550.74
7	433.24	553.32
8	442.86	556.04
9	452.44	558.91
10	461.98	561.92
11	471.47	565.07
12	480.91	568.37
13	490.30	571.81
14	499.63	575.40
15	508.91	579.12
16	518.13	582.98
17	527.30	586.99
18	529.52	588.00

Circle Center At X = 258.6 ; Y = 1189.0 and Radius, 659.2

*** 2.085 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	301.05	531.20
2	311.01	530.26
3	320.99	529.62
4	330.98	529.27
5	340.98	529.21
6	350.98	529.45
7	360.97	529.98
8	370.93	530.80
9	380.87	531.92
10	390.77	533.32
11	400.62	535.02
12	410.43	537.00
13	420.16	539.28
14	429.83	541.83
15	439.42	544.67
16	448.92	547.79
17	458.33	551.19
18	467.63	554.86
19	476.82	558.81
20	485.89	563.02
21	494.83	567.49
22	503.64	572.23
23	512.30	577.23
24	520.81	582.47
25	529.17	587.96
26	529.22	588.00

Circle Center At X = 337.9 ; Y = 869.7 and Radius, 340.5

*** 2.109 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	311.58	531.20

2	321.41	529.34
3	331.31	527.93
4	341.26	526.97
5	351.25	526.46
6	361.25	526.40
7	371.24	526.79
8	381.20	527.63
9	391.12	528.92
10	400.97	530.66
11	410.73	532.84
12	420.38	535.46
13	429.90	538.51
14	439.27	541.99
15	448.48	545.89
16	457.51	550.20
17	466.32	554.92
18	474.92	560.02
19	483.28	565.52
20	491.38	571.38
21	499.21	577.60
22	506.58	584.03

Circle Center At X = 357.6 ; Y = 747.7 and Radius, 221.3

*** 2.112 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	280.00	531.20
2	289.81	529.26
3	299.68	527.66
4	309.60	526.40
5	319.56	525.50
6	329.55	524.94
7	339.54	524.74
8	349.54	524.88
9	359.53	525.38
10	369.49	526.22
11	379.42	527.41
12	389.30	528.95
13	399.13	530.84
14	408.87	533.06
15	418.54	535.63
16	428.11	538.53
17	437.57	541.77
18	446.91	545.33
19	456.13	549.22
20	465.20	553.43
21	474.11	557.96
22	482.87	562.79
23	491.45	567.93
24	499.84	573.37
25	508.04	579.09
26	516.03	585.10
27	519.62	588.00

Circle Center At X = 340.4 ; Y = 810.4 and Radius, 285.6

*** 2.114 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	374.74	540.08
2	384.74	539.99
3	394.73	540.40
4	404.69	541.30
5	414.59	542.68
6	424.42	544.55
7	434.13	546.91
8	443.73	549.73
9	453.17	553.03
10	462.44	556.78
11	471.51	560.99
12	480.36	565.64

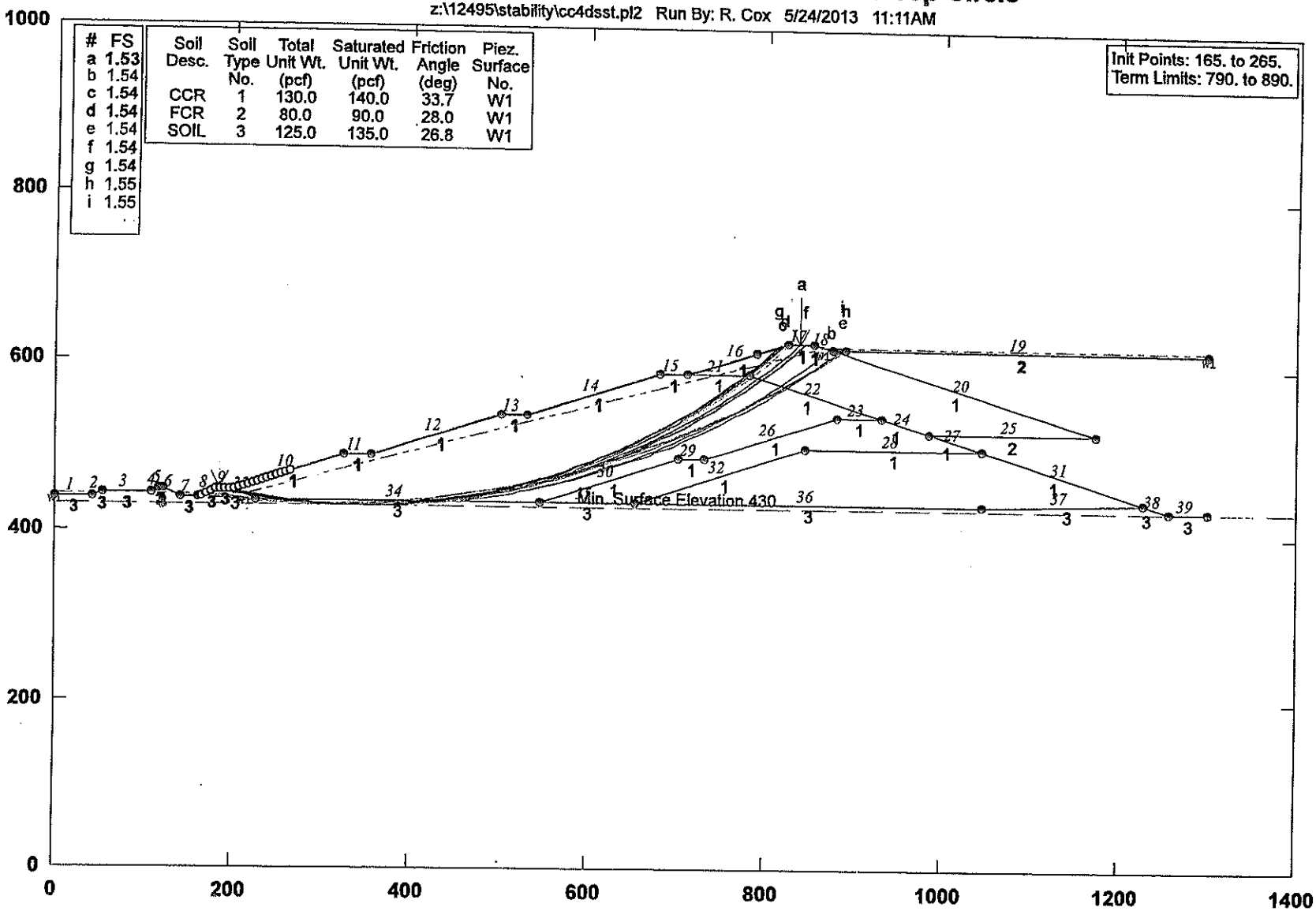
13	488.98	570.72
14	497.33	576.21
15	505.41	582.11
16	508.61	584.70

Circle Center At X = 381.5 ; Y = 742.8 and Radius, 202.8

*** 2.116 ***

Section C-C Phase 12 Downstream Static Deep Circle

z:\12495\stability\cc4dsst.pl2 Run By: R. Cox 5/24/2013 11:11AM



PCSTABL5M/si FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:11AM
Run By: R. Cox
Input Data Filename: Z:cc4dsst.
Output Filename: Z:cc4dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc4dsst.PLT
PROBLEM DESCRIPTION Section C-C Phase 12
Downstream Static Deep Circle

BOUNDARY COORDINATES
19 Top Boundaries
39 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	438.00	41.63	438.00	3
2	41.63	438.00	53.63	444.00	3
3	53.63	444.00	108.40	444.00	3
4	108.40	444.00	116.28	448.00	3
5	116.28	448.00	121.28	448.00	3
6	121.28	448.00	141.28	438.00	3
7	141.28	438.00	161.28	438.00	3
8	161.28	438.00	181.28	448.00	3
9	181.28	448.00	201.28	448.00	3
10	201.28	448.00	325.28	489.27	1
11	325.28	489.27	355.28	489.27	1
12	355.28	489.27	501.47	538.00	1
13	501.47	538.00	531.47	538.00	1
14	531.47	538.00	681.47	588.00	1
15	681.47	588.00	711.47	588.00	1
16	711.47	588.00	825.47	626.00	1
17	825.47	626.00	855.47	626.00	1
18	855.47	626.00	875.87	619.20	1
19	875.87	619.20	1300.00	619.20	2
20	875.87	619.20	1173.47	520.00	1
21	711.47	588.00	781.47	588.00	1
22	781.47	588.00	931.57	538.00	1
23	881.47	538.00	931.57	538.00	1
24	931.57	538.00	985.53	520.00	1
25	985.53	520.00	1173.47	520.00	2
26	731.47	488.00	881.47	538.00	1
27	985.53	520.00	1045.61	500.00	1
28	845.61	500.00	1045.61	500.00	1
29	701.47	488.00	731.47	488.00	1
30	545.47	436.00	701.47	488.00	1
31	1045.61	500.00	1226.55	439.64	1
32	653.54	435.98	845.61	500.00	1
33	201.28	448.00	225.34	436.00	3
34	225.34	436.00	545.47	436.00	3
35	545.47	436.00	653.54	435.98	3
36	653.54	435.98	1044.41	436.00	3
37	1044.41	436.00	1226.55	439.64	3
38	1226.55	439.64	1255.44	430.00	3
39	1255.44	430.00	1300.00	430.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	442.00
2	213.16	442.00
3	864.47	623.00
4	1300.00	623.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 165.00 ft.
and X = 265.00 ft.
Each Surface Terminates Between X = 790.00 ft.
and X = 890.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 72 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.05	448.00
2	195.82	445.84
3	205.61	443.82
4	215.43	441.94
5	225.28	440.19
6	235.15	438.59
7	245.04	437.12
8	254.95	435.78
9	264.88	434.59
10	274.82	433.53
11	284.78	432.62
12	294.75	431.84
13	304.73	431.20
14	314.72	430.70
15	324.71	430.34
16	334.71	430.12
17	344.71	430.04
18	354.71	430.10
19	364.71	430.29
20	374.70	430.63
21	384.69	431.11
22	394.67	431.72
23	404.64	432.48
24	414.60	433.37
25	424.55	434.41
26	434.48	435.58
27	444.39	436.89
28	454.29	438.34
29	464.16	439.92
30	474.01	441.65
31	483.84	443.51
32	493.64	445.50
33	503.41	447.64
34	513.14	449.91
35	522.85	452.32
36	532.52	454.86
37	542.16	457.53
38	551.75	460.34
39	561.31	463.28
40	570.83	466.36
41	580.30	469.57
42	589.72	472.91
43	599.10	476.38
44	608.43	479.98
45	617.71	483.72
46	626.93	487.58

47	636.10	491.57
48	645.22	495.68
49	654.27	499.93
50	663.27	504.30
51	672.20	508.79
52	681.07	513.41
53	689.87	518.15
54	698.61	523.02
55	707.28	528.00
56	715.88	533.11
57	724.40	538.33
58	732.85	543.68
59	741.23	549.14
60	749.53	554.72
61	757.75	560.41
62	765.89	566.22
63	773.95	572.14
64	781.93	578.17
65	789.82	584.31
66	797.62	590.56
67	805.34	596.92
68	812.97	603.39
69	820.50	609.96
70	827.95	616.64
71	835.30	623.42
72	838.02	626.00

Circle Center At X = 345.5 ; Y = 1146.9 and Radius, 716.8

*** 1.534 ***

Individual data on the 87 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.8	1316.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	5.5	1856.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	4.3	2448.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	6.6	6233.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.8	2208.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1.5	1991.5	0.0	31.2	0.0	0.0	0.0	0.0	0.0
7	9.8	17279.1	0.0	1764.2	0.0	0.0	0.0	0.0	0.0
8	9.9	24102.2	0.0	4421.5	0.0	0.0	0.0	0.0	0.0
9	9.9	30771.6	0.0	6999.7	0.0	0.0	0.0	0.0	0.0
10	8.3	30767.9	0.0	7781.8	0.0	0.0	0.0	0.0	0.0
11	1.6	6511.9	0.0	1716.6	0.0	0.0	0.0	0.0	0.0
12	9.9	43583.3	0.0	11917.0	0.0	0.0	0.0	0.0	0.0
13	9.9	49698.1	0.0	14255.0	0.0	0.0	0.0	0.0	0.0
14	10.0	55641.9	0.0	16512.1	0.0	0.0	0.0	0.0	0.0
15	10.0	61409.4	0.0	18687.7	0.0	0.0	0.0	0.0	0.0
16	10.0	66995.5	0.0	20781.5	0.0	0.0	0.0	0.0	0.0
17	10.0	72395.3	0.0	22793.0	0.0	0.0	0.0	0.0	0.0
18	10.0	77604.4	0.0	24721.9	0.0	0.0	0.0	0.0	0.0
19	0.6	4564.3	0.0	1461.5	0.0	0.0	0.0	0.0	0.0
20	9.4	76130.1	0.0	25106.2	0.0	0.0	0.0	0.0	0.0
21	10.0	81189.4	0.0	28330.2	0.0	0.0	0.0	0.0	0.0
22	10.0	81473.8	0.0	30008.9	0.0	0.0	0.0	0.0	0.0
23	0.6	4658.8	0.0	1763.5	0.0	0.0	0.0	0.0	0.0
24	9.4	78821.5	0.0	29840.1	0.0	0.0	0.0	0.0	0.0
25	10.0	87679.0	0.0	33114.0	0.0	0.0	0.0	0.0	0.0
26	10.0	91674.0	0.0	34539.7	0.0	0.0	0.0	0.0	0.0
27	10.0	95455.4	0.0	35880.4	0.0	0.0	0.0	0.0	0.0
28	10.0	99020.9	0.0	37136.0	0.0	0.0	0.0	0.0	0.0
29	10.0	102368.0	0.0	38306.1	0.0	0.0	0.0	0.0	0.0
30	9.9	105494.6	0.0	39390.5	0.0	0.0	0.0	0.0	0.0
31	9.9	108399.1	0.0	40389.0	0.0	0.0	0.0	0.0	0.0
32	3.2	35436.3	0.0	13193.5	0.0	0.0	0.0	0.0	0.0
33	6.7	75629.1	0.0	28108.0	0.0	0.0	0.0	0.0	0.0
34	9.9	113457.0	0.0	42127.8	0.0	0.0	0.0	0.0	0.0
35	9.9	115612.8	0.0	42867.5	0.0	0.0	0.0	0.0	0.0
36	9.9	117536.2	0.0	43520.9	0.0	0.0	0.0	0.0	0.0
37	9.8	119226.6	0.0	44087.4	0.0	0.0	0.0	0.0	0.0

38	9.8	120684.0	0.0	44567.2	0.0	0.0	0.0	0.0	0.0
39	7.8	97639.3	0.0	36025.1	0.0	0.0	0.0	0.0	0.0
40	1.9	24188.5	0.0	8935.1	0.0	0.0	0.0	0.0	0.0
41	9.7	120029.8	0.0	45266.1	0.0	0.0	0.0	0.0	0.0
42	9.7	116711.9	0.0	45485.1	0.0	0.0	0.0	0.0	0.0
43	8.6	101042.7	0.0	40648.7	0.0	0.0	0.0	0.0	0.0
44	1.1	12188.3	0.0	4968.1	0.0	0.0	0.0	0.0	0.0
45	9.6	111972.0	0.0	45661.5	0.0	0.0	0.0	0.0	0.0
46	9.6	112098.0	0.0	45619.2	0.0	0.0	0.0	0.0	0.0
47	9.6	112002.1	0.0	45489.8	0.0	0.0	0.0	0.0	0.0
48	9.5	111685.7	0.0	45273.3	0.0	0.0	0.0	0.0	0.0
49	9.5	111152.0	0.0	44969.9	0.0	0.0	0.0	0.0	0.0
50	9.4	110403.0	0.0	44579.2	0.0	0.0	0.0	0.0	0.0
51	9.4	109443.1	0.0	44102.0	0.0	0.0	0.0	0.0	0.0
52	9.3	108274.8	0.0	43538.0	0.0	0.0	0.0	0.0	0.0
53	9.3	106901.6	0.0	42887.1	0.0	0.0	0.0	0.0	0.0
54	9.2	105327.3	0.0	42149.6	0.0	0.0	0.0	0.0	0.0
55	9.2	103556.5	0.0	41325.8	0.0	0.0	0.0	0.0	0.0
56	9.1	101592.9	0.0	40415.7	0.0	0.0	0.0	0.0	0.0
57	9.1	99442.2	0.0	39419.5	0.0	0.0	0.0	0.0	0.0
58	9.0	97108.6	0.0	38337.5	0.0	0.0	0.0	0.0	0.0
59	8.9	94597.0	0.0	37169.8	0.0	0.0	0.0	0.0	0.0
60	8.9	91913.3	0.0	35916.8	0.0	0.0	0.0	0.0	0.0
61	0.4	4118.8	0.0	1610.1	0.0	0.0	0.0	0.0	0.0
62	8.4	83413.9	0.0	32968.2	0.0	0.0	0.0	0.0	0.0
63	8.7	81215.0	0.0	33154.9	0.0	0.0	0.0	0.0	0.0
64	8.7	74817.3	0.0	31647.1	0.0	0.0	0.0	0.0	0.0
65	4.2	34068.2	0.0	14858.7	0.0	0.0	0.0	0.0	0.0
66	4.4	34702.2	0.0	15196.0	0.0	0.0	0.0	0.0	0.0
67	8.5	65025.3	0.0	28378.3	0.0	0.0	0.0	0.0	0.0
68	8.5	61526.9	0.0	26618.1	0.0	0.0	0.0	0.0	0.0
69	5.7	39550.4	0.0	16980.8	0.0	0.0	0.0	0.0	0.0
70	2.7	18351.3	0.0	7793.7	0.0	0.0	0.0	0.0	0.0
71	8.3	54156.9	0.0	22848.0	0.0	0.0	0.0	0.0	0.0
72	8.2	50299.4	0.0	20838.7	0.0	0.0	0.0	0.0	0.0
73	8.1	46336.5	0.0	18747.2	0.0	0.0	0.0	0.0	0.0
74	8.1	42276.0	0.0	16573.9	0.0	0.0	0.0	0.0	0.0
75	7.5	36034.1	0.0	13557.3	0.0	0.0	0.0	0.0	0.0
76	0.5	2091.1	0.0	761.8	0.0	0.0	0.0	0.0	0.0
77	7.9	33892.4	0.0	11983.3	0.0	0.0	0.0	0.0	0.0
78	0.8	3216.1	0.0	1093.3	0.0	0.0	0.0	0.0	0.0
79	7.0	26369.1	0.0	8473.6	0.0	0.0	0.0	0.0	0.0
80	7.7	25212.0	0.0	7070.5	0.0	0.0	0.0	0.0	0.0
81	7.6	20781.0	0.0	4494.5	0.0	0.0	0.0	0.0	0.0
82	7.5	16300.7	0.0	1839.4	0.0	0.0	0.0	0.0	0.0
83	1.3	2411.3	0.0	43.7	0.0	0.0	0.0	0.0	0.0
84	3.6	5973.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	2.5	3373.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	7.3	5702.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87	2.7	455.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 75 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.05	448.00
2	195.84	445.95
3	205.65	444.02
4	215.49	442.22
5	225.35	440.54
6	235.22	438.98
7	245.12	437.54
8	255.04	436.23
9	264.96	435.05
10	274.91	433.99
11	284.86	433.05
12	294.83	432.24
13	304.81	431.56
14	314.79	431.00
15	324.78	430.56
16	334.78	430.25
17	344.78	430.07

18	354.78	430.01
19	364.78	430.07
20	374.77	430.26
21	384.77	430.58
22	394.76	431.02
23	404.74	431.59
24	414.72	432.28
25	424.69	433.10
26	434.64	434.04
27	444.58	435.10
28	454.51	436.30
29	464.43	437.61
30	474.32	439.05
31	484.20	440.61
32	494.06	442.30
33	503.89	444.11
34	513.70	446.05
35	523.49	448.10
36	533.25	450.28
37	542.98	452.58
38	552.68	455.01
39	562.35	457.55
40	571.99	460.22
41	581.59	463.00
42	591.16	465.91
43	600.69	468.93
44	610.19	472.08
45	619.64	475.34
46	629.05	478.73
47	638.42	482.23
48	647.74	485.84
49	657.02	489.58
50	666.25	493.43
51	675.43	497.39
52	684.56	501.47
53	693.63	505.67
54	702.66	509.97
55	711.63	514.39
56	720.54	518.93
57	729.40	523.57
58	738.20	528.32
59	746.93	533.19
60	755.61	538.16
61	764.22	543.24
62	772.77	548.43
63	781.25	553.73
64	789.67	559.13
65	798.01	564.64
66	806.29	570.25
67	814.50	575.96
68	822.63	581.78
69	830.69	587.70
70	838.68	593.72
71	846.59	599.84
72	854.42	606.05
73	862.17	612.37
74	869.85	618.78
75	871.89	620.53

Circle Center At X = 354.5 ; Y = 1227.7 and Radius, 797.7

*** 1.535 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf. (ft)
1	180.79	447.75
2	190.55	445.59
3	200.34	443.56
4	210.16	441.67
5	220.01	439.92
6	229.88	438.32
7	239.77	436.86

8	249.69	435.54
9	259.62	434.36
10	269.56	433.32
11	279.52	432.43
12	289.49	431.68
13	299.48	431.08
14	309.47	430.62
15	319.46	430.30
16	329.46	430.12
17	339.46	430.09
18	349.46	430.21
19	359.46	430.46
20	369.45	430.86
21	379.43	431.41
22	389.41	432.10
23	399.37	432.93
24	409.33	433.90
25	419.26	435.02
26	429.18	436.28
27	439.09	437.68
28	448.97	439.22
29	458.82	440.91
30	468.65	442.74
31	478.46	444.71
32	488.23	446.82
33	497.98	449.07
34	507.69	451.46
35	517.36	453.99
36	527.00	456.65
37	536.60	459.46
38	546.15	462.40
39	555.67	465.48
40	565.14	468.70
41	574.56	472.05
42	583.93	475.54
43	593.25	479.16
44	602.52	482.92
45	611.73	486.81
46	620.89	490.83
47	629.98	494.98
48	639.02	499.26
49	648.00	503.67
50	656.91	508.22
51	665.75	512.88
52	674.53	517.68
53	683.23	522.60
54	691.87	527.64
55	700.43	532.81
56	708.91	538.10
57	717.32	543.51
58	725.65	549.05
59	733.90	554.70
60	742.07	560.47
61	750.15	566.35
62	758.15	572.36
63	766.06	578.47
64	773.89	584.70
65	781.62	591.04
66	789.26	597.49
67	796.80	604.06
68	804.26	610.72
69	811.61	617.50
70	817.93	623.49

Circle Center At X = 336.6 ; Y = 1125.8 and Radius, 695.7

*** 1.539 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	191.32	448.00
2	201.07	445.78

3	210.85	443.71
4	220.66	441.78
5	230.50	439.99
6	240.37	438.35
7	250.25	436.86
8	260.16	435.51
9	270.09	434.31
10	280.03	433.26
11	289.99	432.35
12	299.96	431.59
13	309.95	430.98
14	319.93	430.52
15	329.93	430.20
16	339.93	430.03
17	349.93	430.01
18	359.93	430.14
19	369.92	430.41
20	379.91	430.83
21	389.90	431.40
22	399.87	432.12
23	409.84	432.98
24	419.78	434.00
25	429.72	435.15
26	439.63	436.46
27	449.53	437.91
28	459.40	439.51
29	469.24	441.25
30	479.06	443.14
31	488.85	445.17
32	498.61	447.35
33	508.34	449.67
34	518.03	452.14
35	527.69	454.75
36	537.30	457.50
37	546.87	460.39
38	556.40	463.43
39	565.88	466.60
40	575.32	469.91
41	584.70	473.37
42	594.04	476.96
43	603.32	480.69
44	612.54	484.55
45	621.70	488.55
46	630.81	492.69
47	639.85	496.96
48	648.83	501.37
49	657.74	505.90
50	666.58	510.57
51	675.36	515.37
52	684.06	520.29
53	692.69	525.35
54	701.24	530.53
55	709.72	535.84
56	718.11	541.27
57	726.43	546.82
58	734.66	552.50
59	742.81	558.30
60	750.87	564.22
61	758.84	570.26
62	766.72	576.41
63	774.51	582.68
64	782.21	589.07
65	789.81	595.56
66	797.31	602.17
67	804.72	608.89
68	812.03	615.72
69	819.23	622.65
70	821.15	624.56

Circle Center At X = 346.4 ; Y = 1106.6 and Radius, 676.6

*** 1.542 ***

Failure Surface Specified By 77 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	170.26	442.49
2	180.15	441.01
3	190.06	439.63
4	199.98	438.36
5	209.91	437.18
6	219.85	436.12
7	229.80	435.16
8	239.77	434.30
9	249.74	433.54
10	259.72	432.90
11	269.70	432.35
12	279.69	431.91
13	289.69	431.58
14	299.68	431.35
15	309.68	431.22
16	319.68	431.20
17	329.68	431.29
18	339.68	431.48
19	349.68	431.77
20	359.67	432.17
21	369.66	432.67
22	379.64	433.28
23	389.61	434.00
24	399.58	434.81
25	409.54	435.74
26	419.48	436.76
27	429.42	437.89
28	439.34	439.13
29	449.25	440.47
30	459.15	441.91
31	469.03	443.46
32	478.89	445.11
33	488.74	446.86
34	498.56	448.72
35	508.37	450.68
36	518.15	452.74
37	527.92	454.91
38	537.66	457.17
39	547.37	459.54
40	557.06	462.01
41	566.72	464.58
42	576.36	467.26
43	585.97	470.03
44	595.55	472.91
45	605.09	475.88
46	614.61	478.96
47	624.09	482.13
48	633.54	485.41
49	642.95	488.78
50	652.33	492.25
51	661.67	495.82
52	670.98	499.49
53	680.24	503.25
54	689.47	507.11
55	698.65	511.07
56	707.79	515.13
57	716.89	519.28
58	725.94	523.52
59	734.95	527.86
60	743.91	532.30
61	752.83	536.82
62	761.70	541.44
63	770.52	546.16
64	779.29	550.96
65	788.01	555.86
66	796.67	560.85
67	805.29	565.93

68	813.85	571.10
69	822.35	576.36
70	830.80	581.71
71	839.20	587.14
72	847.53	592.67
73	855.81	598.28
74	864.03	603.97
75	872.19	609.76
76	880.28	615.63
77	885.11	619.20

Circle Center At X = 316.6 ; Y = 1384.8 and Radius, 953.6

*** 1.543 ***

Failure Surface Specified By 71 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	196.58	448.00
2	206.35	445.88
3	216.15	443.90
4	225.98	442.06
5	235.84	440.35
6	245.71	438.79
7	255.61	437.36
8	265.53	436.07
9	275.46	434.91
10	285.41	433.90
11	295.37	433.03
12	305.34	432.29
13	315.33	431.70
14	325.32	431.24
15	335.31	430.92
16	345.31	430.75
17	355.31	430.71
18	365.31	430.82
19	375.31	431.06
20	385.30	431.44
21	395.28	431.96
22	405.26	432.63
23	415.23	433.43
24	425.19	434.37
25	435.13	435.45
26	445.05	436.67
27	454.96	438.03
28	464.85	439.52
29	474.71	441.16
30	484.55	442.93
31	494.37	444.84
32	504.16	446.88
33	513.92	449.07
34	523.65	451.38
35	533.34	453.84
36	543.00	456.43
37	552.62	459.15
38	562.20	462.01
39	571.74	465.01
40	581.24	468.13
41	590.70	471.39
42	600.10	474.78
43	609.46	478.30
44	618.77	481.95
45	628.03	485.74
46	637.23	489.65
47	646.38	493.69
48	655.47	497.85
49	664.50	502.15
50	673.48	506.57
51	682.38	511.11
52	691.23	515.78
53	700.00	520.57
54	708.71	525.48
55	717.35	530.52

56	725.92	535.67
57	734.42	540.95
58	742.84	546.34
59	751.18	551.85
60	759.45	557.48
61	767.64	563.22
62	775.75	569.07
63	783.77	575.04
64	791.71	581.12
65	799.56	587.31
66	807.33	593.61
67	815.01	600.01
68	822.60	606.53
69	830.09	613.15
70	837.50	619.87
71	844.06	626.00

Circle Center At X = 352.9 ; Y = 1146.0 and Radius, 715.3

*** 1.544 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.05	448.00
2	195.81	445.80
3	205.60	443.75
4	215.41	441.84
5	225.25	440.07
6	235.12	438.45
7	245.01	436.97
8	254.92	435.64
9	264.85	434.46
10	274.80	433.42
11	284.76	432.52
12	294.73	431.78
13	304.71	431.18
14	314.70	430.72
15	324.70	430.42
16	334.70	430.26
17	344.70	430.24
18	354.70	430.38
19	364.69	430.66
20	374.68	431.09
21	384.67	431.66
22	394.64	432.38
23	404.60	433.25
24	414.55	434.26
25	424.48	435.42
26	434.40	436.73
27	444.29	438.18
28	454.16	439.78
29	464.01	441.52
30	473.83	443.40
31	483.62	445.43
32	493.38	447.61
33	503.11	449.92
34	512.80	452.38
35	522.46	454.98
36	532.08	457.73
37	541.65	460.61
38	551.18	463.63
39	560.67	466.80
40	570.11	470.10
41	579.50	473.54
42	588.84	477.12
43	598.12	480.84
44	607.35	484.69
45	616.52	488.68
46	625.63	492.80
47	634.68	497.05
48	643.67	501.44
49	652.59	505.96

50	661.44	510.60
51	670.23	515.38
52	678.94	520.29
53	687.58	525.33
54	696.14	530.49
55	704.63	535.77
56	713.04	541.18
57	721.37	546.72
58	729.62	552.37
59	737.78	558.15
60	745.86	564.04
61	753.85	570.05
62	761.75	576.18
63	769.56	582.43
64	777.28	588.79
65	784.90	595.26
66	792.43	601.84
67	799.86	608.54
68	807.19	615.34
69	814.42	622.25
70	814.53	622.35

Circle Center At X = 340.6 ; Y = 1110.9 and Radius, 680.7

*** 1.544 ***

Failure Surface Specified By 78 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	165.00	439.86
2	174.92	438.62
3	184.86	437.47
4	194.80	436.42
5	204.76	435.47
6	214.72	434.61
7	224.69	433.85
8	234.67	433.19
9	244.65	432.63
10	254.64	432.16
11	264.63	431.79
12	274.63	431.52
13	284.63	431.34
14	294.63	431.27
15	304.63	431.29
16	314.63	431.40
17	324.63	431.62
18	334.62	431.93
19	344.61	432.34
20	354.60	432.85
21	364.58	433.46
22	374.56	434.16
23	384.53	434.96
24	394.48	435.85
25	404.44	436.85
26	414.38	437.94
27	424.31	439.12
28	434.22	440.41
29	444.13	441.79
30	454.02	443.27
31	463.89	444.84
32	473.75	446.51
33	483.59	448.28
34	493.42	450.14
35	503.23	452.09
36	513.01	454.15
37	522.78	456.30
38	532.53	458.54
39	542.25	460.88
40	551.95	463.31
41	561.62	465.84
42	571.27	468.46
43	580.90	471.17
44	590.49	473.98

45	600.06	476.89
46	609.61	479.88
47	619.12	482.97
48	628.60	486.15
49	638.05	489.42
50	647.46	492.79
51	656.85	496.25
52	666.20	499.79
53	675.51	503.43
54	684.79	507.16
55	694.03	510.98
56	703.23	514.89
57	712.40	518.89
58	721.53	522.98
59	730.61	527.16
60	739.66	531.42
61	748.66	535.78
62	757.62	540.22
63	766.53	544.75
64	775.40	549.36
65	784.23	554.07
66	793.01	558.85
67	801.74	563.73
68	810.43	568.68
69	819.06	573.72
70	827.65	578.85
71	836.19	584.06
72	844.67	589.35
73	853.10	594.73
74	861.48	600.18
75	869.81	605.72
76	878.08	611.34
77	886.30	617.04
78	889.35	619.20

Circle Center At X = 297.5 ; Y = 1457.0 and Radius, 1025.7

*** 1.548 ***

Failure Surface Specified By 76 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	186.05	448.00
2	195.86	446.03
3	205.68	444.18
4	215.53	442.44
5	225.40	440.82
6	235.29	439.32
7	245.19	437.94
8	255.11	436.68
9	265.05	435.54
10	274.99	434.52
11	284.95	433.61
12	294.92	432.83
13	304.90	432.17
14	314.89	431.62
15	324.88	431.20
16	334.87	430.89
17	344.87	430.71
18	354.87	430.64
19	364.87	430.70
20	374.87	430.88
21	384.86	431.17
22	394.86	431.59
23	404.84	432.12
24	414.82	432.78
25	424.79	433.55
26	434.75	434.44
27	444.70	435.46
28	454.63	436.59
29	464.55	437.84
30	474.46	439.21
31	484.35	440.70

32	494.22	442.31
33	504.07	444.04
34	513.90	445.88
35	523.70	447.84
36	533.48	449.92
37	543.24	452.12
38	552.97	454.43
39	562.67	456.87
40	572.34	459.41
41	581.98	462.07
42	591.58	464.85
43	601.16	467.75
44	610.69	470.75
45	620.19	473.88
46	629.66	477.11
47	639.08	480.46
48	648.46	483.92
49	657.80	487.50
50	667.10	491.18
51	676.35	494.98
52	685.55	498.89
53	694.71	502.90
54	703.82	507.03
55	712.88	511.27
56	721.88	515.61
57	730.84	520.07
58	739.74	524.63
59	748.58	529.29
60	757.37	534.06
61	766.10	538.94
62	774.77	543.92
63	783.38	549.01
64	791.93	554.20
65	800.41	559.49
66	808.84	564.88
67	817.19	570.37
68	825.48	575.96
69	833.71	581.65
70	841.86	587.44
71	849.94	593.33
72	857.95	599.31
73	865.89	605.39
74	873.76	611.57
75	881.55	617.84
76	883.21	619.20

Circle Center At X = 355.3 ; Y = 1264.0 and Radius, 833.4

*** 1.549 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	196.58	448.00
2	206.34	445.83
3	216.13	443.80
4	225.95	441.92
5	235.80	440.18
6	245.67	438.58
7	255.57	437.13
8	265.48	435.83
9	275.42	434.67
10	285.36	433.66
11	295.33	432.79
12	305.30	432.07
13	315.28	431.50
14	325.28	431.08
15	335.27	430.80
16	345.27	430.66
17	355.27	430.68
18	365.27	430.84
19	375.26	431.15
20	385.25	431.60

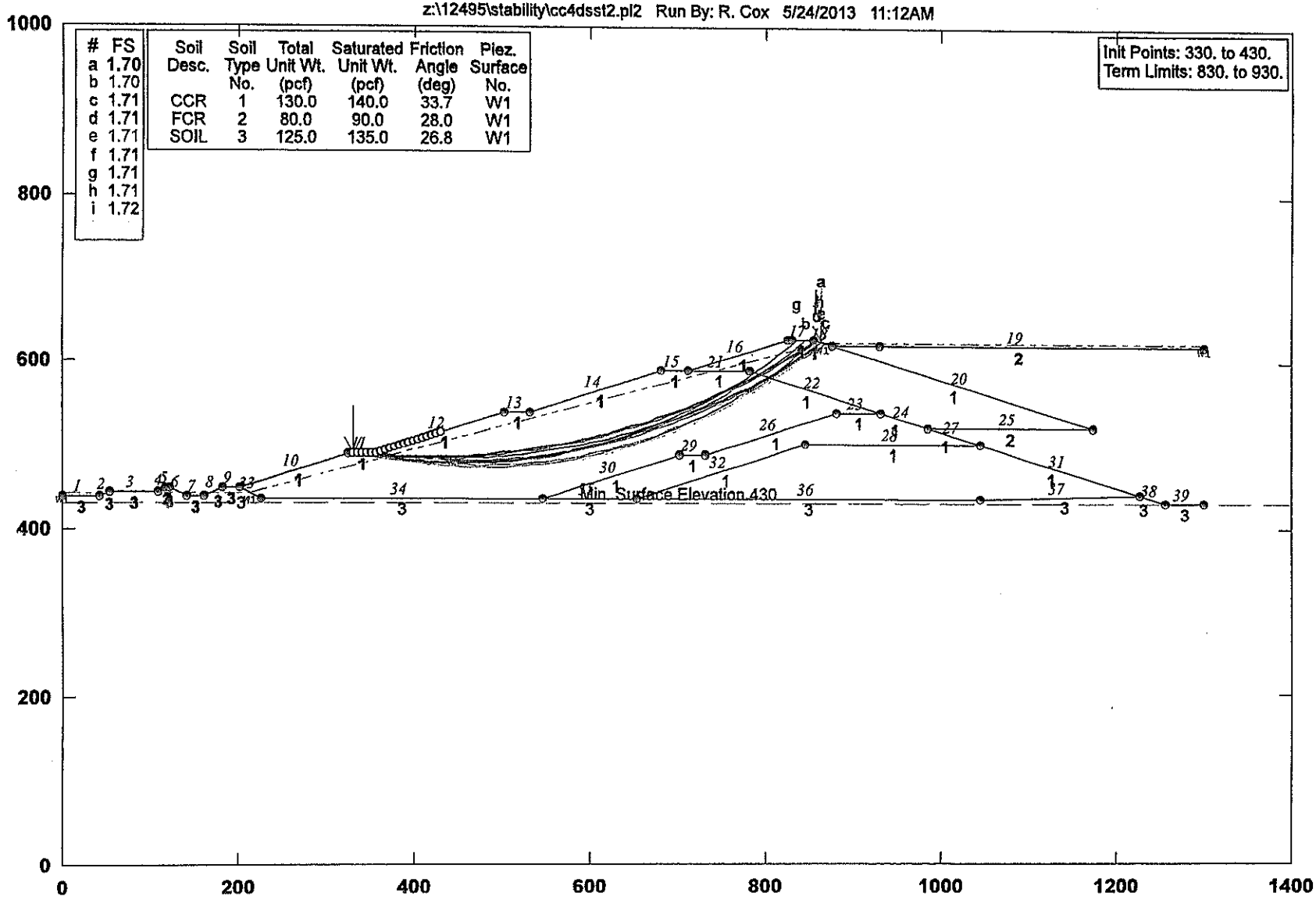
21	395.24	432.20
22	405.21	432.95
23	415.17	433.85
24	425.11	434.89
25	435.04	436.07
26	444.95	437.40
27	454.84	438.88
28	464.71	440.51
29	474.55	442.27
30	484.37	444.18
31	494.16	446.24
32	503.91	448.44
33	513.63	450.78
34	523.32	453.27
35	532.97	455.89
36	542.58	458.66
37	552.14	461.57
38	561.67	464.62
39	571.15	467.81
40	580.58	471.14
41	589.96	474.60
42	599.28	478.21
43	608.56	481.95
44	617.78	485.82
45	626.94	489.83
46	636.04	493.98
47	645.08	498.26
48	654.05	502.67
49	662.96	507.21
50	671.80	511.88
51	680.57	516.68
52	689.28	521.61
53	697.90	526.67
54	706.45	531.85
55	714.93	537.16
56	723.33	542.59
57	731.64	548.15
58	739.87	553.82
59	748.02	559.62
60	756.08	565.53
61	764.06	571.57
62	771.94	577.72
63	779.74	583.98
64	787.44	590.36
65	795.05	596.85
66	802.56	603.45
67	809.97	610.17
68	817.28	616.99
69	824.50	623.91
70	826.61	626.00

Circle Center At X = 349.3 ; Y = 1111.4 and Radius, 680.8

*** 1.549 ***

Section C-C Phase 12 Downstream Static Shallow Circle

z:\12495\stability\cc4dsst2.pl2 Run By: R. Cox 5/24/2013 11:12AM



PCSTABL5M/si FSmin=1.70

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:12AM
Run By: R. Cox
Input Data Filename: Z:cc4dsst2.
Output Filename: Z:cc4dsst2.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc4dsst2.PLT
PROBLEM DESCRIPTION Section C-C Phase 12
Downstream Static Shallow Circle

BOUNDARY COORDINATES
19 Top Boundaries
39 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	438.00	41.63	438.00	3
2	41.63	438.00	53.63	444.00	3
3	53.63	444.00	108.40	444.00	3
4	108.40	444.00	116.28	448.00	3
5	116.28	448.00	121.28	448.00	3
6	121.28	448.00	141.28	438.00	3
7	141.28	438.00	161.28	438.00	3
8	161.28	438.00	181.28	448.00	3
9	181.28	448.00	201.28	448.00	3
10	201.28	448.00	325.28	489.27	1
11	325.28	489.27	355.28	489.27	1
12	355.28	489.27	501.47	538.00	1
13	501.47	538.00	531.47	538.00	1
14	531.47	538.00	681.47	588.00	1
15	681.47	588.00	711.47	588.00	1
16	711.47	588.00	825.47	626.00	1
17	825.47	626.00	855.47	626.00	1
18	855.47	626.00	875.87	619.20	1
19	875.87	619.20	1300.00	619.20	2
20	875.87	619.20	1173.47	520.00	1
21	711.47	588.00	781.47	588.00	1
22	781.47	588.00	931.57	538.00	1
23	881.47	538.00	931.57	538.00	1
24	931.57	538.00	985.53	520.00	1
25	985.53	520.00	1173.47	520.00	2
26	731.47	488.00	881.47	538.00	1
27	985.53	520.00	1045.61	500.00	1
28	845.61	500.00	1045.61	500.00	1
29	701.47	488.00	731.47	488.00	1
30	545.47	436.00	701.47	488.00	1
31	1045.61	500.00	1226.55	439.64	1
32	653.54	435.98	845.61	500.00	1
33	201.28	448.00	225.34	436.00	3
34	225.34	436.00	545.47	436.00	3
35	545.47	436.00	653.54	435.98	3
36	653.54	435.98	1044.41	436.00	3
37	1044.41	436.00	1226.55	439.64	3
38	1226.55	439.64	1255.44	430.00	3
39	1255.44	430.00	1300.00	430.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	442.00
2	213.16	442.00
3	864.47	623.00
4	1300.00	623.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 330.00 ft.
and X = 430.00 ft.
Each Surface Terminates Between X = 830.00 ft.
and X = 930.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 58 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	330.00	489.27
2	339.86	487.58
3	349.74	486.03
4	359.64	484.63
5	369.56	483.38
6	379.50	482.28
7	389.45	481.33
8	399.42	480.53
9	409.40	479.88
10	419.39	479.37
11	429.38	479.02
12	439.38	478.82
13	449.38	478.77
14	459.38	478.87
15	469.37	479.11
16	479.37	479.51
17	489.35	480.06
18	499.33	480.76
19	509.29	481.60
20	519.24	482.60
21	529.18	483.75
22	539.09	485.04
23	548.99	486.49
24	558.86	488.08
25	568.71	489.82
26	578.53	491.70
27	588.32	493.74
28	598.08	495.92
29	607.80	498.25
30	617.49	500.72
31	627.14	503.34
32	636.75	506.10
33	646.32	509.01
34	655.85	512.06
35	665.32	515.25
36	674.75	518.59
37	684.13	522.06
38	693.45	525.68
39	702.72	529.43
40	711.93	533.33
41	721.08	537.36
42	730.17	541.53
43	739.20	545.83
44	748.16	550.27
45	757.05	554.84
46	765.87	559.55

47	774.62	564.39
48	783.30	569.36
49	791.90	574.46
50	800.43	579.68
51	808.88	585.04
52	817.24	590.52
53	825.52	596.13
54	833.72	601.85
55	841.83	607.71
56	849.85	613.68
57	857.78	619.77
58	862.63	623.61

Circle Center At X = 447.9 ; Y = 1145.0 and Radius, 666.3

*** 1.701 ***

Individual data on the 69 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	1085.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	9.9	3169.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	5.5	2618.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4.4	2865.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.8	4451.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	5.2	6395.7	0.0	325.5	0.0	0.0	0.0	0.0	0.0
7	9.9	16994.7	0.0	2414.6	0.0	0.0	0.0	0.0	0.0
8	10.0	23003.1	0.0	4694.8	0.0	0.0	0.0	0.0	0.0
9	10.0	28821.9	0.0	6887.5	0.0	0.0	0.0	0.0	0.0
10	10.0	34445.4	0.0	8992.2	0.0	0.0	0.0	0.0	0.0
11	10.0	39867.8	0.0	11008.5	0.0	0.0	0.0	0.0	0.0
12	10.0	45083.5	0.0	12935.9	0.0	0.0	0.0	0.0	0.0
13	10.0	50087.6	0.0	14773.8	0.0	0.0	0.0	0.0	0.0
14	10.0	54875.5	0.0	16522.1	0.0	0.0	0.0	0.0	0.0
15	10.0	59442.3	0.0	18180.2	0.0	0.0	0.0	0.0	0.0
16	10.0	63784.5	0.0	19747.8	0.0	0.0	0.0	0.0	0.0
17	10.0	67897.9	0.0	21224.4	0.0	0.0	0.0	0.0	0.0
18	10.0	71779.5	0.0	22610.0	0.0	0.0	0.0	0.0	0.0
19	10.0	75425.8	0.0	23903.9	0.0	0.0	0.0	0.0	0.0
20	2.1	16664.6	0.0	5300.6	0.0	0.0	0.0	0.0	0.0
21	7.8	60844.1	0.0	19805.5	0.0	0.0	0.0	0.0	0.0
22	10.0	76484.6	0.0	26216.1	0.0	0.0	0.0	0.0	0.0
23	9.9	75139.7	0.0	27233.9	0.0	0.0	0.0	0.0	0.0
24	2.3	17157.9	0.0	6436.6	0.0	0.0	0.0	0.0	0.0
25	7.6	57675.8	0.0	21722.5	0.0	0.0	0.0	0.0	0.0
26	9.9	77182.8	0.0	28991.4	0.0	0.0	0.0	0.0	0.0
27	9.9	79402.8	0.0	29730.9	0.0	0.0	0.0	0.0	0.0
28	9.8	81378.4	0.0	30377.1	0.0	0.0	0.0	0.0	0.0
29	9.8	83109.9	0.0	30930.1	0.0	0.0	0.0	0.0	0.0
30	9.8	84597.3	0.0	31389.8	0.0	0.0	0.0	0.0	0.0
31	9.8	85841.0	0.0	31756.0	0.0	0.0	0.0	0.0	0.0
32	9.7	86841.6	0.0	32028.6	0.0	0.0	0.0	0.0	0.0
33	9.7	87599.7	0.0	32207.4	0.0	0.0	0.0	0.0	0.0
34	9.7	88117.7	0.0	32292.6	0.0	0.0	0.0	0.0	0.0
35	9.6	88397.5	0.0	32284.3	0.0	0.0	0.0	0.0	0.0
36	9.6	88440.5	0.0	32182.1	0.0	0.0	0.0	0.0	0.0
37	9.5	88249.7	0.0	31986.3	0.0	0.0	0.0	0.0	0.0
38	9.5	87827.4	0.0	31696.8	0.0	0.0	0.0	0.0	0.0
39	9.4	87177.6	0.0	31313.8	0.0	0.0	0.0	0.0	0.0
40	6.7	61901.3	0.0	22152.9	0.0	0.0	0.0	0.0	0.0
41	2.7	24249.2	0.0	8684.4	0.0	0.0	0.0	0.0	0.0
42	9.3	82251.7	0.0	30267.3	0.0	0.0	0.0	0.0	0.0
43	9.3	77224.8	0.0	29604.2	0.0	0.0	0.0	0.0	0.0
44	8.8	68577.2	0.0	27429.2	0.0	0.0	0.0	0.0	0.0
45	0.5	3482.5	0.0	1418.7	0.0	0.0	0.0	0.0	0.0
46	9.2	68747.5	0.0	27998.8	0.0	0.0	0.0	0.0	0.0
47	9.1	66895.5	0.0	27056.9	0.0	0.0	0.0	0.0	0.0
48	8.4	60093.1	0.0	24127.8	0.0	0.0	0.0	0.0	0.0
49	0.7	4756.4	0.0	1894.6	0.0	0.0	0.0	0.0	0.0
50	9.0	62615.5	0.0	24895.6	0.0	0.0	0.0	0.0	0.0
51	8.9	60199.3	0.0	23676.9	0.0	0.0	0.0	0.0	0.0

52	8.8	57607.2	0.0	22366.3	0.0	0.0	0.0	0.0	0.0
53	8.8	54846.1	0.0	20964.4	0.0	0.0	0.0	0.0	0.0
54	6.8	41171.2	0.0	15487.8	0.0	0.0	0.0	0.0	0.0
55	1.8	10751.0	0.0	3983.4	0.0	0.0	0.0	0.0	0.0
56	8.6	48843.2	0.0	17887.2	0.0	0.0	0.0	0.0	0.0
57	8.5	45616.3	0.0	16212.8	0.0	0.0	0.0	0.0	0.0
58	2.1	10625.8	0.0	3705.2	0.0	0.0	0.0	0.0	0.0
59	6.4	31623.2	0.0	10743.2	0.0	0.0	0.0	0.0	0.0
60	8.4	38749.2	0.0	12594.2	0.0	0.0	0.0	0.0	0.0
61	8.2	34918.7	0.0	10591.2	0.0	0.0	0.0	0.0	0.0
62	0.1	206.2	0.0	59.5	0.0	0.0	0.0	0.0	0.0
63	8.2	29911.1	0.0	8618.5	0.0	0.0	0.0	0.0	0.0
64	8.1	23214.0	0.0	6497.7	0.0	0.0	0.0	0.0	0.0
65	8.0	16511.9	0.0	4289.2	0.0	0.0	0.0	0.0	0.0
66	5.6	7638.5	0.0	1654.8	0.0	0.0	0.0	0.0	0.0
67	2.3	2061.2	0.0	338.5	0.0	0.0	0.0	0.0	0.0
68	2.7	1388.0	0.0	139.8	0.0	0.0	0.0	0.0	0.0
69	2.2	350.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 57 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	330.00	489.27
2	339.81	487.33
3	349.65	485.55
4	359.52	483.93
5	369.41	482.48
6	379.33	481.20
7	389.27	480.09
8	399.22	479.14
9	409.19	478.35
10	419.17	477.74
11	429.16	477.29
12	439.16	477.01
13	449.16	476.89
14	459.16	476.95
15	469.16	477.17
16	479.15	477.56
17	489.13	478.11
18	499.11	478.84
19	509.07	479.73
20	519.01	480.78
21	528.94	482.01
22	538.84	483.39
23	548.72	484.95
24	558.57	486.67
25	568.39	488.55
26	578.18	490.60
27	587.93	492.82
28	597.64	495.19
29	607.32	497.73
30	616.94	500.43
31	626.53	503.29
32	636.06	506.31
33	645.54	509.49
34	654.97	512.83
35	664.34	516.32
36	673.64	519.98
37	682.89	523.78
38	692.07	527.75
39	701.19	531.86
40	710.23	536.13
41	719.20	540.55
42	728.10	545.11
43	736.92	549.83
44	745.65	554.69
45	754.31	559.70
46	762.88	564.85
47	771.36	570.15
48	779.76	575.59
49	788.06	581.16

50	796.26	586.88
51	804.37	592.73
52	812.38	598.72
53	820.29	604.84
54	828.09	611.09
55	835.79	617.47
56	843.38	623.98
57	845.66	626.00

Circle Center At X = 451.0 ; Y = 1073.9 and Radius, 597.0

*** 1.703 ***

Failure Surface Specified By 57 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.53	489.27
2	350.45	488.06
3	360.39	486.98
4	370.35	486.03
5	380.32	485.22
6	390.29	484.54
7	400.28	484.00
8	410.27	483.59
9	420.27	483.31
10	430.27	483.17
11	440.27	483.17
12	450.26	483.30
13	460.26	483.56
14	470.25	483.96
15	480.24	484.49
16	490.22	485.16
17	500.18	485.96
18	510.14	486.90
19	520.08	487.97
20	530.01	489.17
21	539.92	490.51
22	549.81	491.98
23	559.68	493.58
24	569.53	495.31
25	579.36	497.18
26	589.15	499.18
27	598.92	501.31
28	608.66	503.58
29	618.37	505.97
30	628.05	508.50
31	637.69	511.15
32	647.29	513.94
33	656.86	516.85
34	666.39	519.89
35	675.87	523.06
36	685.31	526.36
37	694.71	529.78
38	704.06	533.33
39	713.36	537.01
40	722.61	540.81
41	731.80	544.73
42	740.95	548.78
43	750.04	552.95
44	759.07	557.24
45	768.04	561.66
46	776.95	566.19
47	785.81	570.84
48	794.59	575.62
49	803.32	580.51
50	811.97	585.51
51	820.56	590.64
52	829.08	595.88
53	837.52	601.23
54	845.90	606.70
55	854.20	612.27
56	862.42	617.96
57	867.89	621.86

Circle Center At X = 435.7 ; Y = 1226.0 and Radius, 742.9
*** 1.706 ***
Failure Surface Specified By 57 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	335.26	489.27
2	345.21	488.20
3	355.16	487.25
4	365.13	486.44
5	375.11	485.77
6	385.09	485.22
7	395.08	484.81
8	405.08	484.54
9	415.08	484.39
10	425.08	484.38
11	435.08	484.50
12	445.07	484.76
13	455.07	485.14
14	465.05	485.66
15	475.03	486.32
16	485.00	487.11
17	494.96	488.02
18	504.90	489.08
19	514.83	490.26
20	524.74	491.58
21	534.64	493.02
22	544.51	494.60
23	554.37	496.31
24	564.20	498.16
25	574.00	500.13
26	583.78	502.23
27	593.52	504.47
28	603.24	506.83
29	612.92	509.32
30	622.57	511.94
31	632.19	514.69
32	641.77	517.57
33	651.31	520.57
34	660.80	523.70
35	670.26	526.96
36	679.67	530.34
37	689.03	533.84
38	698.35	537.48
39	707.62	541.23
40	716.84	545.11
41	726.00	549.11
42	735.11	553.23
43	744.17	557.48
44	753.16	561.84
45	762.10	566.32
46	770.98	570.92
47	779.80	575.64
48	788.55	580.48
49	797.24	585.43
50	805.86	590.50
51	814.41	595.68
52	822.90	600.98
53	831.31	606.38
54	839.65	611.90
55	847.91	617.53
56	856.10	623.27
57	858.49	624.99

Circle Center At X = 420.9 ; Y = 1235.5 and Radius, 751.1
*** 1.706 ***
Failure Surface Specified By 55 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	356.32	489.62
2	366.20	488.07
3	376.10	486.67

4	386.02	485.43
5	395.96	484.35
6	405.92	483.42
7	415.89	482.64
8	425.87	482.03
9	435.86	481.57
10	445.85	481.26
11	455.85	481.11
12	465.85	481.12
13	475.85	481.28
14	485.85	481.61
15	495.83	482.08
16	505.81	482.72
17	515.78	483.50
18	525.74	484.45
19	535.68	485.55
20	545.60	486.81
21	555.50	488.22
22	565.38	489.78
23	575.23	491.50
24	585.05	493.38
25	594.84	495.40
26	604.60	497.58
27	614.33	499.91
28	624.01	502.40
29	633.66	505.03
30	643.26	507.82
31	652.82	510.75
32	662.34	513.84
33	671.80	517.07
34	681.21	520.45
35	690.57	523.98
36	699.87	527.65
37	709.11	531.47
38	718.29	535.43
39	727.41	539.54
40	736.46	543.79
41	745.45	548.18
42	754.36	552.70
43	763.21	557.37
44	771.98	562.18
45	780.67	567.12
46	789.29	572.20
47	797.82	577.41
48	806.27	582.75
49	814.64	588.23
50	822.92	593.83
51	831.11	599.57
52	839.22	605.43
53	847.22	611.42
54	855.14	617.53
55	862.73	623.58

Circle Center At X = 460.3 ; Y = 1120.5 and Radius, 639.4

*** 1.708 ***

Failure Surface Specified By 56 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.53	489.27
2	350.48	488.33
3	360.45	487.53
4	370.43	486.85
5	380.41	486.31
6	390.40	485.90
7	400.40	485.61
8	410.40	485.46
9	420.40	485.44
10	430.40	485.56
11	440.40	485.80
12	450.39	486.17
13	460.38	486.68

14	470.36	487.32
15	480.33	488.08
16	490.29	488.98
17	500.23	490.01
18	510.16	491.17
19	520.08	492.46
20	529.98	493.88
21	539.86	495.43
22	549.72	497.11
23	559.55	498.92
24	569.36	500.86
25	579.15	502.92
26	588.90	505.12
27	598.63	507.44
28	608.32	509.89
29	617.99	512.47
30	627.61	515.17
31	637.21	518.00
32	646.76	520.96
33	656.27	524.04
34	665.75	527.24
35	675.17	530.57
36	684.56	534.03
37	693.90	537.60
38	703.19	541.30
39	712.43	545.12
40	721.62	549.06
41	730.76	553.12
42	739.84	557.30
43	748.87	561.60
44	757.84	566.02
45	766.76	570.55
46	775.61	575.21
47	784.40	579.97
48	793.13	584.86
49	801.79	589.85
50	810.38	594.96
51	818.91	600.19
52	827.37	605.52
53	835.76	610.96
54	844.07	616.52
55	852.32	622.18
56	857.00	625.49

Circle Center At X = 416.9 ; Y = 1247.0 and Radius, 761.6

*** 1.709 ***

Failure Surface Specified By 54 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	345.79	489.27
2	355.62	487.41
3	365.47	485.73
4	375.36	484.22
5	385.27	482.89
6	395.20	481.73
7	405.15	480.75
8	415.12	479.95
9	425.10	479.32
10	435.09	478.87
11	445.09	478.60
12	455.09	478.50
13	465.09	478.58
14	475.08	478.84
15	485.07	479.28
16	495.06	479.89
17	505.02	480.68
18	514.98	481.65
19	524.91	482.79
20	534.83	484.11
21	544.71	485.60
22	554.57	487.27

23	564.40	489.11
24	574.20	491.13
25	583.95	493.32
26	593.67	495.68
27	603.34	498.21
28	612.97	500.92
29	622.55	503.80
30	632.07	506.84
31	641.54	510.05
32	650.95	513.44
33	660.30	516.98
34	669.59	520.69
35	678.81	524.57
36	687.96	528.61
37	697.03	532.81
38	706.03	537.17
39	714.95	541.69
40	723.79	546.37
41	732.55	551.20
42	741.21	556.18
43	749.79	561.32
44	758.28	566.61
45	766.67	572.06
46	774.96	577.64
47	783.15	583.38
48	791.24	589.26
49	799.23	595.28
50	807.10	601.44
51	814.87	607.74
52	822.52	614.18
53	830.06	620.75
54	835.87	626.00

Circle Center At X = 455.5 ; Y = 1042.7 and Radius, 564.2

*** 1.710 ***

Failure Surface Specified By 56 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.05	489.27
2	360.83	487.16
3	370.64	485.21
4	380.48	483.44
5	390.35	481.84
6	400.25	480.41
7	410.17	479.16
8	420.11	478.08
9	430.07	477.17
10	440.04	476.44
11	450.03	475.88
12	460.02	475.50
13	470.02	475.29
14	480.02	475.25
15	490.02	475.39
16	500.01	475.70
17	510.00	476.19
18	519.98	476.85
19	529.94	477.69
20	539.89	478.70
21	549.82	479.89
22	559.73	481.24
23	569.61	482.77
24	579.46	484.47
25	589.29	486.35
26	599.08	488.39
27	608.83	490.61
28	618.54	492.99
29	628.21	495.55
30	637.83	498.27
31	647.40	501.16
32	656.92	504.22
33	666.39	507.44

34	675.80	510.83
35	685.15	514.38
36	694.43	518.10
37	703.65	521.97
38	712.80	526.01
39	721.87	530.21
40	730.88	534.56
41	739.80	539.07
42	748.65	543.73
43	757.41	548.55
44	766.09	553.52
45	774.68	558.64
46	783.18	563.91
47	791.58	569.33
48	799.89	574.90
49	808.10	580.60
50	816.21	586.45
51	824.22	592.45
52	832.12	598.58
53	839.91	604.84
54	847.59	611.25
55	855.16	617.78
56	861.94	623.84

Circle Center At X = 477.0 ; Y = 1048.0 and Radius, 572.8

*** 1.714 ***

Failure Surface Specified By 57 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	345.79	489.27
2	355.51	486.91
3	365.27	484.74
4	375.07	482.74
5	384.90	480.93
6	394.77	479.29
7	404.66	477.84
8	414.58	476.57
9	424.52	475.49
10	434.48	474.58
11	444.45	473.86
12	454.44	473.33
13	464.43	472.97
14	474.43	472.81
15	484.43	472.82
16	494.43	473.02
17	504.42	473.40
18	514.41	473.97
19	524.38	474.72
20	534.33	475.66
21	544.27	476.78
22	554.19	478.08
23	564.08	479.56
24	573.94	481.23
25	583.77	483.07
26	593.56	485.10
27	603.31	487.31
28	613.02	489.69
29	622.69	492.26
30	632.30	495.00
31	641.87	497.92
32	651.38	501.01
33	660.83	504.28
34	670.22	507.72
35	679.54	511.34
36	688.80	515.12
37	697.98	519.08
38	707.09	523.20
39	716.13	527.49
40	725.08	531.95
41	733.95	536.57
42	742.73	541.35

43	751.42	546.29
44	760.02	551.39
45	768.53	556.66
46	776.93	562.07
47	785.24	567.64
48	793.44	573.36
49	801.53	579.23
50	809.52	585.25
51	817.39	591.42
52	825.15	597.73
53	832.79	604.18
54	840.31	610.77
55	847.71	617.50
56	854.98	624.36
57	856.35	625.71

Circle Center At X = 478.6 ; Y = 1016.0 and Radius, 543.2

*** 1.716 ***

Failure Surface Specified By 58 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	335.26	489.27
2	344.96	486.83
3	354.70	484.57
4	364.48	482.48
5	374.30	480.56
6	384.14	478.81
7	394.02	477.25
8	403.92	475.85
9	413.85	474.63
10	423.79	473.59
11	433.75	472.73
12	443.73	472.04
13	453.72	471.52
14	463.71	471.19
15	473.71	471.03
16	483.71	471.05
17	493.71	471.25
18	503.70	471.62
19	513.69	472.17
20	523.66	472.90
21	533.62	473.81
22	543.56	474.89
23	553.48	476.14
24	563.38	477.58
25	573.25	479.18
26	583.09	480.96
27	592.89	482.92
28	602.67	485.05
29	612.40	487.35
30	622.09	489.83
31	631.73	492.47
32	641.32	495.29
33	650.87	498.28
34	660.36	501.43
35	669.79	504.76
36	679.16	508.24
37	688.47	511.90
38	697.71	515.72
39	706.88	519.70
40	715.98	523.84
41	725.01	528.15
42	733.96	532.61
43	742.83	537.24
44	751.61	542.01
45	760.31	546.95
46	768.92	552.04
47	777.44	557.27
48	785.86	562.66
49	794.19	568.20
50	802.41	573.88

51	810.54	579.71
52	818.56	585.68
53	826.48	591.80
54	834.28	598.05
55	841.97	604.44
56	849.55	610.96
57	857.01	617.62
58	863.26	623.40

Circle Center At X = 477.6 ; Y = 1035.2 and Radius, 564.2

*** 1.716 ***

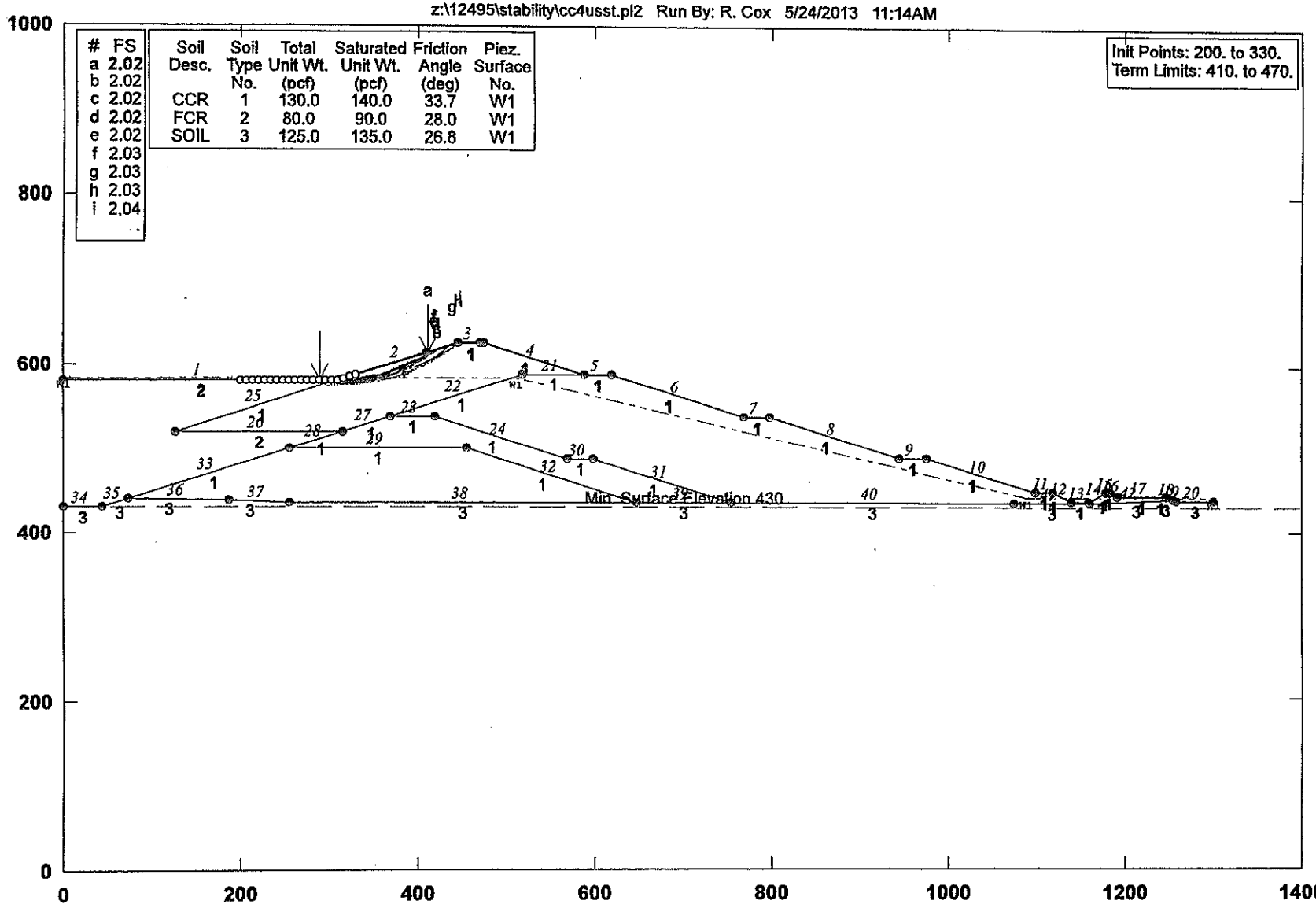
Section C-C Phase 12 Upstream Static

z:\12495\stability\cc4usst.pl2 Run By: R. Cox 5/24/2013 11:14AM

#	FS
a	2.02
b	2.02
c	2.02
d	2.02
e	2.02
f	2.03
g	2.03
h	2.03
i	2.04

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 200. to 330.
Term Limits: 410. to 470.



PCSTABL5M/si FSmin=2.02

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:14AM
Run By: R. Cox
Input Data Filename: Z:cc4usst.in
Output Filename: Z:cc4usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:cc4usst.PLT
PROBLEM DESCRIPTION Section C-C Phase 12 Upstream Static
BOUNDARY COORDINATES
20 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	581.10	309.80	581.10	2
2	309.80	581.10	444.50	626.00	1
3	444.50	626.00	474.50	626.00	1
4	474.50	626.00	588.50	588.00	1
5	588.50	588.00	618.50	588.00	1
6	618.50	588.00	768.50	538.00	1
7	768.50	538.00	798.50	538.00	1
8	798.50	538.00	944.70	489.30	1
9	944.70	489.30	974.70	489.30	1
10	974.70	489.30	1098.70	447.90	1
11	1098.70	447.90	1118.70	447.90	1
12	1118.70	447.90	1138.70	437.90	1
13	1138.70	437.90	1158.70	437.90	1
14	1158.70	437.90	1178.70	447.90	1
15	1178.70	447.90	1183.70	447.90	1
16	1183.70	447.90	1191.60	444.00	1
17	1191.60	444.00	1246.40	444.00	1
18	1246.40	444.00	1254.70	439.80	1
19	1254.70	439.80	1258.40	438.00	3
20	1258.40	438.00	1300.00	438.00	3
21	518.50	588.00	588.50	588.00	1
22	368.50	538.00	518.50	588.00	1
23	368.50	538.00	418.50	538.00	1
24	418.50	538.00	568.50	488.00	1
25	126.50	520.00	309.80	581.10	1
26	126.50	520.00	314.50	520.00	2
27	314.50	520.00	368.50	538.00	1
28	254.40	500.00	314.50	520.00	1
29	254.40	500.00	454.40	500.00	1
30	568.50	488.00	598.50	488.00	1
31	598.50	488.00	754.50	436.00	1
32	454.40	500.00	646.50	436.00	1
33	73.40	439.60	254.40	500.00	1
34	0.00	430.00	44.60	430.00	3
35	44.60	430.00	73.40	439.60	3
36	73.40	439.60	186.30	438.00	3
37	186.30	438.00	255.60	436.00	3
38	255.60	436.00	646.50	436.00	3
39	646.50	436.00	754.50	436.00	3
40	754.50	436.00	1074.80	436.00	3
41	1074.80	436.00	1159.70	436.00	3
42	1159.70	436.00	1254.70	439.80	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	585.00
2	509.50	585.00
3	1086.80	442.00
4	1300.00	442.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 200.00 ft.
and X = 330.00 ft.
Each Surface Terminates Between X = 410.00 ft.
and X = 470.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	288.95	581.10
2	298.71	578.95
3	308.62	577.58
4	318.60	577.00
5	328.60	577.20
6	338.55	578.20
7	348.39	579.97
8	358.06	582.52
9	367.50	585.82
10	376.65	589.86
11	385.45	594.60
12	393.85	600.03
13	401.80	606.10
14	409.24	612.78
15	411.29	614.93

Circle Center At X = 321.0 ; Y = 703.6 and Radius, 126.6
*** 2.017 ***
Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.8	943.8	2376.8	3103.6	0.0	0.0	0.0	0.0	0.0
2	3.3	701.2	798.6	1297.0	0.0	0.0	0.0	0.0	0.0
3	6.6	2341.3	1612.1	2904.0	0.0	0.0	0.0	0.0	0.0
4	1.2	575.1	287.1	549.5	0.0	0.0	0.0	0.0	0.0
5	8.8	6545.9	1408.7	4261.3	0.0	0.0	0.0	0.0	0.0
6	10.0	11967.1	0.0	4929.0	0.0	0.0	0.0	0.0	0.0
7	10.0	15376.2	0.0	4555.0	0.0	0.0	0.0	0.0	0.0
8	9.8	17519.8	0.0	3691.1	0.0	0.0	0.0	0.0	0.0
9	9.7	18378.3	0.0	2342.7	0.0	0.0	0.0	0.0	0.0
10	7.1	13561.9	0.0	581.8	0.0	0.0	0.0	0.0	0.0
11	2.3	4431.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	9.1	16676.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	8.8	14443.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	8.4	11362.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	7.9	7624.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	7.4	3454.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	2.0	196.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	275.26	581.10
2	285.13	579.45

7	341.67	579.09
8	351.46	581.13
9	361.09	583.82
10	370.51	587.17
11	379.68	591.15
12	388.57	595.75
13	397.11	600.94
14	405.29	606.70
15	413.05	613.00
16	417.26	616.92

Circle Center At X = 316.7 ; Y = 723.4 and Radius, 146.4

*** 2.018 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	268.42	581.10
2	278.38	580.21
3	288.37	579.77
4	298.37	579.77
5	308.36	580.22
6	318.32	581.11
7	328.23	582.44
8	338.08	584.21
9	347.83	586.41
10	357.48	589.05
11	367.00	592.11
12	376.37	595.59
13	385.58	599.49
14	394.61	603.79
15	403.44	608.49
16	412.05	613.57
17	417.10	616.87

Circle Center At X = 293.3 ; Y = 804.8 and Radius, 225.1

*** 2.028 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	268.42	581.10
2	278.15	578.78
3	287.99	577.00
4	297.91	575.78
5	307.89	575.10
6	317.89	574.98
7	327.88	575.41
8	337.83	576.40
9	347.71	577.94
10	357.49	580.02
11	367.14	582.64
12	376.63	585.80
13	385.93	589.47
14	395.01	593.66
15	403.85	598.34
16	412.41	603.51
17	420.67	609.14
18	428.61	615.23
19	436.20	621.74
20	438.58	624.03

Circle Center At X = 315.1 ; Y = 754.9 and Radius, 180.0

*** 2.030 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	268.42	581.10
2	278.18	578.90
3	288.03	577.21
4	297.96	576.04
5	307.94	575.40
6	317.94	575.27
7	327.93	575.67
8	337.89	576.60

9	347.79	578.04
10	357.59	580.00
11	367.28	582.47
12	376.83	585.45
13	386.21	588.92
14	395.39	592.87
15	404.36	597.31
16	413.08	602.20
17	421.53	607.55
18	429.69	613.33
19	437.53	619.53
20	444.88	626.00

Circle Center At X = 315.3 ; Y = 766.1 and Radius, 190.8

*** 2.031 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	275.26	581.10
2	285.22	580.20
3	295.21	579.70
4	305.21	579.60
5	315.21	579.90
6	325.18	580.61
7	335.12	581.71
8	345.01	583.21
9	354.83	585.10
10	364.56	587.39
11	374.20	590.07
12	383.72	593.13
13	393.11	596.56
14	402.35	600.38
15	411.44	604.56
16	420.35	609.10
17	429.07	613.99
18	437.58	619.23
19	445.88	624.81
20	447.51	626.00

Circle Center At X = 302.7 ; Y = 828.7 and Radius, 249.1

*** 2.036 ***

Failure Surface Specified By 18 Coordinate Points

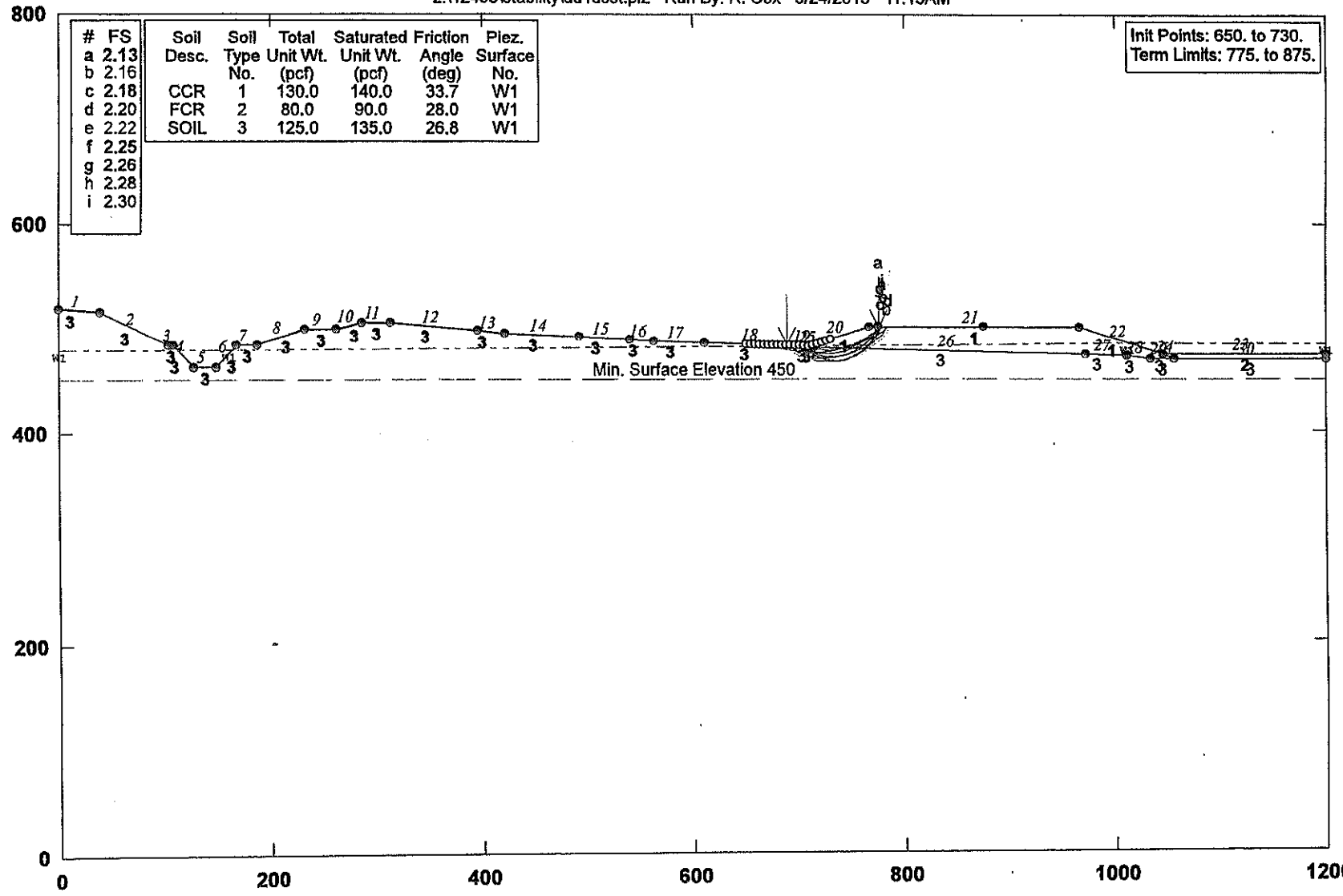
Point No.	X-Surf (ft)	Y-Surf (ft)
1	288.95	581.10
2	298.85	579.70
3	308.81	578.83
4	318.80	578.47
5	328.80	578.64
6	338.78	579.32
7	348.71	580.53
8	358.56	582.26
9	368.30	584.50
10	377.92	587.24
11	387.38	590.49
12	396.66	594.22
13	405.72	598.43
14	414.56	603.11
15	423.14	608.25
16	431.44	613.83
17	439.44	619.83
18	446.82	626.00

Circle Center At X = 320.6 ; Y = 769.7 and Radius, 191.3

*** 2.038 ***

Section D-D Phase 9 Downstream Static Deep Circle

z:\12495\stability\dd1dsst.pl2 Run By: R. Cox 5/24/2013 11:15AM



PCSTABL5M/si FSmin=2.13

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:15AM
Run By: R. Cox
Input Data Filename: Z:dd1dsst.
Output Filename: Z:dd1dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd1dsst.PLT
PROBLEM DESCRIPTION Section D-D Phase 9
Downstream Static Deep Circle

BOUNDARY COORDINATES
23 Top Boundaries
30 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	517.05	39.25	514.70	3
2	39.25	514.70	103.20	482.74	3
3	103.20	482.74	108.20	482.74	3
4	108.20	482.74	128.21	462.74	3
5	128.21	462.74	148.21	462.74	3
6	148.21	462.74	168.22	482.75	3
7	168.22	482.75	188.23	482.75	3
8	188.23	482.75	232.87	497.64	3
9	232.87	497.64	262.86	497.64	3
10	262.86	497.64	285.90	503.33	3
11	285.90	503.33	313.92	504.00	3
12	313.92	504.00	395.72	496.00	3
13	395.72	496.00	422.17	494.00	3
14	422.17	494.00	491.87	490.00	3
15	491.87	490.00	539.43	488.00	3
16	539.43	488.00	562.48	486.00	3
17	562.48	486.00	610.43	483.96	3
18	610.43	483.96	703.22	482.00	3
19	703.22	482.00	708.86	480.89	3
20	708.86	480.89	766.01	500.00	1
21	766.01	500.00	966.24	500.00	1
22	966.24	500.00	1044.86	473.80	1
23	1044.86	473.80	1200.00	473.80	2
24	1044.86	473.80	1056.27	470.00	3
25	708.86	480.89	713.40	480.00	3
26	713.40	480.00	972.01	474.00	3
27	972.01	474.00	1010.48	472.00	3
28	1010.48	472.00	1032.98	470.00	3
29	1032.98	470.00	1056.27	470.00	3
30	1056.27	470.00	1200.00	470.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	478.74
2	160.20	478.74
3	708.86	480.89
4	1011.25	485.00
5	1200.00	485.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 650.00 ft.
and X = 730.00 ft.
Each Surface Terminates Between X = 775.00 ft.
and X = 875.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	687.90	482.32
2	696.18	476.72
3	705.30	472.62
4	714.99	470.14
5	724.95	469.35
6	734.91	470.29
7	744.56	472.91
8	753.62	477.15
9	761.82	482.88
10	768.91	489.92
11	774.70	498.08
12	775.62	500.00

Circle Center At X = 724.5 ; Y = 527.3 and Radius, 58.0
*** 2.133 ***
Individual data on the 18 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.2	203.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	6.1	2731.3	0.0	939.5	0.0	0.0	0.0	0.0	0.0
3	7.0	6508.9	0.0	2754.5	0.0	0.0	0.0	0.0	0.0
4	2.1	2424.1	0.0	1107.0	0.0	0.0	0.0	0.0	0.0
5	3.6	4352.2	0.0	2000.6	0.0	0.0	0.0	0.0	0.0
6	4.5	6443.9	0.0	2864.1	0.0	0.0	0.0	0.0	0.0
7	1.6	2633.9	0.0	1084.6	0.0	0.0	0.0	0.0	0.0
8	10.0	19879.0	0.0	7047.2	0.0	0.0	0.0	0.0	0.0
9	10.0	24090.5	0.0	7085.3	0.0	0.0	0.0	0.0	0.0
10	9.6	25166.6	0.0	6058.5	0.0	0.0	0.0	0.0	0.0
11	9.1	23132.3	0.0	3997.1	0.0	0.0	0.0	0.0	0.0
12	2.7	6374.4	0.0	695.5	0.0	0.0	0.0	0.0	0.0
13	3.7	8241.7	0.0	355.5	0.0	0.0	0.0	0.0	0.0
14	1.8	3857.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	4.2	7818.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	2.9	4350.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	5.8	4515.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.9	114.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	696.32	482.15
2	704.94	477.09
3	714.28	473.50
4	724.07	471.50
5	734.07	471.12
6	743.99	472.38
7	753.57	475.25
8	762.55	479.64
9	770.69	485.44
10	777.78	492.50
11	783.17	500.00

Circle Center At X = 731.4 ; Y = 532.0 and Radius, 60.9
*** 2.157 ***
Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	708.95	480.92
2	718.66	478.53
3	728.62	477.67
4	738.60	478.36
5	748.35	480.58
6	757.63	484.28
7	766.24	489.38
8	773.95	495.75
9	777.72	500.00

Circle Center At X = 729.2 ; Y = 542.1 and Radius, 64.5

*** 2.177 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	692.11	482.23
2	701.39	478.52
3	711.07	476.00
4	720.98	474.71
5	730.98	474.69
6	740.91	475.93
7	750.60	478.40
8	759.90	482.08
9	768.66	486.90
10	776.75	492.78
11	784.03	499.63
12	784.33	500.00

Circle Center At X = 726.2 ; Y = 553.7 and Radius, 79.2

*** 2.196 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	708.95	480.92
2	718.65	478.48
3	728.60	477.51
4	738.58	478.05
5	748.38	480.06
6	757.76	483.52
7	766.52	488.34
8	774.46	494.42
9	779.85	500.00

Circle Center At X = 730.0 ; Y = 544.3 and Radius, 66.8

*** 2.218 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	692.11	482.23
2	699.55	475.55
3	708.17	470.48
4	717.62	467.22
5	727.53	465.89
6	737.51	466.56
7	747.16	469.19
8	756.09	473.67
9	763.96	479.84
10	770.45	487.45
11	775.30	496.19
12	776.51	500.00

Circle Center At X = 729.1 ; Y = 515.8 and Radius, 50.0

*** 2.248 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	700.53	482.06
2	707.95	475.36
3	716.68	470.48
4	726.28	467.68
5	736.26	467.09
6	746.13	468.74

7	755.37	472.56
8	763.53	478.34
9	770.19	485.80
10	775.02	494.55
11	776.59	500.00

Circle Center At X = 733.9 ; Y = 511.5 and Radius, 44.5

*** 2.262 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	700.53	482.06
2	707.97	475.37
3	716.69	470.48
4	726.27	467.61
5	736.24	466.91
6	746.13	468.40
7	755.45	472.01
8	763.76	477.58
9	770.65	484.83
10	775.79	493.41
11	777.96	500.00

Circle Center At X = 734.4 ; Y = 512.3 and Radius, 45.5

*** 2.278 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	675.26	482.59
2	684.61	479.04
3	694.28	476.49
4	704.16	474.96
5	714.15	474.48
6	724.14	475.05
7	734.00	476.66
8	743.65	479.30
9	752.97	482.94
10	761.85	487.53
11	770.20	493.03
12	777.93	499.38
13	778.54	500.00

Circle Center At X = 713.7 ; Y = 569.7 and Radius, 95.2

*** 2.304 ***

Failure Surface Specified By 13 Coordinate Points

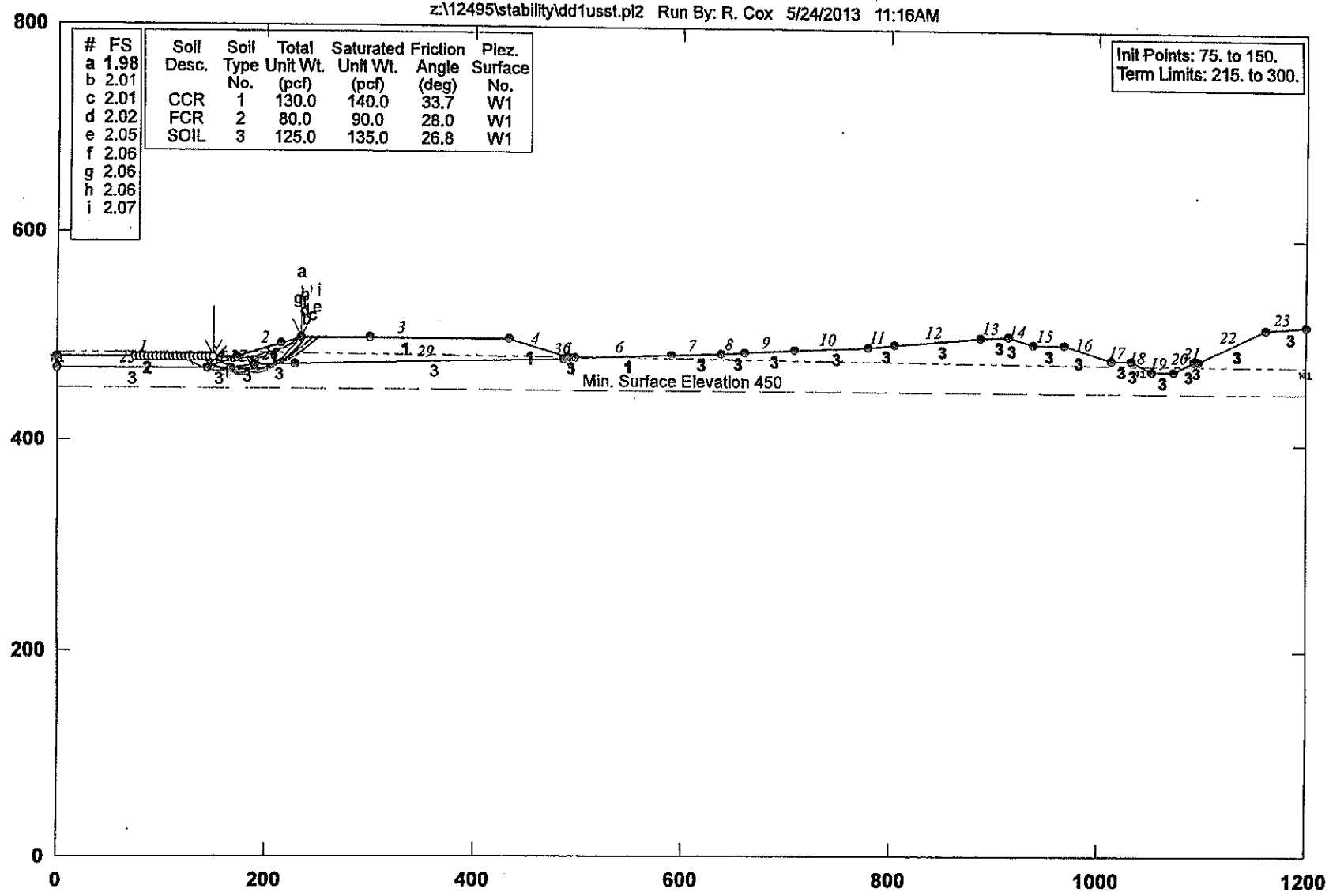
Point No.	X-Surf (ft)	Y-Surf (ft)
1	683.68	482.41
2	691.60	476.30
3	700.35	471.46
4	709.73	468.00
5	719.53	466.02
6	729.52	465.54
7	739.47	466.59
8	749.14	469.14
9	758.31	473.13
10	766.76	478.46
11	774.31	485.02
12	780.77	492.65
13	785.28	500.00

Circle Center At X = 727.6 ; Y = 531.1 and Radius, 65.6

*** 2.311 ***

Section D-D Phase 9 Upstream Static

z:\12495\stability\dd1usst.pl2 Run By: R. Cox 5/24/2013 11:16AM



PCSTABL5M/si FSmin=1.98

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:16AM
Run By: R. Cox
Input Data Filename: Z:ddlusst.in
Output Filename: Z:ddlusst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:ddlusst.PLT
PROBLEM DESCRIPTION Section D-D Phase 9 Upstream Static
BOUNDARY COORDINATES
23 Top Boundaries
30 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	479.60	172.50	479.60	2
2	172.50	479.60	233.80	500.00	1
3	233.80	500.00	434.00	500.00	1
4	434.00	500.00	491.10	480.90	1
5	491.10	480.90	496.80	482.00	1
6	496.80	482.00	589.60	484.00	1
7	589.60	484.00	637.50	486.00	3
8	637.50	486.00	660.60	488.00	3
9	660.60	488.00	708.10	490.00	3
10	708.10	490.00	777.80	494.00	3
11	777.80	494.00	804.30	496.00	3
12	804.30	496.00	886.10	504.00	3
13	886.10	504.00	914.10	505.30	3
14	914.10	505.30	937.10	497.60	3
15	937.10	497.60	967.10	497.60	3
16	967.10	497.60	1011.80	482.80	3
17	1011.80	482.80	1031.80	482.70	3
18	1031.80	482.70	1051.80	472.70	3
19	1051.80	472.70	1071.80	472.70	3
20	1071.80	472.70	1091.80	482.70	3
21	1091.80	482.70	1096.80	482.70	3
22	1096.80	482.70	1160.80	514.70	3
23	1160.80	514.70	1200.00	517.10	3
24	143.70	470.00	172.50	479.60	1
25	0.00	470.00	143.70	470.00	3
26	143.70	470.00	167.00	470.00	3
27	167.00	470.00	189.50	472.00	3
28	189.50	472.00	228.00	474.00	3
29	228.00	474.00	486.60	480.00	3
30	486.60	480.00	491.10	480.90	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	485.00
2	188.70	485.00
3	1039.80	478.70
4	1200.00	478.70

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced

Along The Ground Surface Between X = 75.00 ft.
and X = 150.00 ft.
Each Surface Terminates Between X = 215.00 ft.
and X = 300.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	150.00	479.60
2	159.92	478.30
3	169.91	477.92
4	179.89	478.46
5	189.79	479.92
6	199.50	482.29
7	208.96	485.54
8	218.08	489.65
9	226.78	494.58
10	234.56	500.00

Circle Center At X = 169.0 ; Y = 586.2 and Radius, 108.3
*** 1.976 ***
Individual data on the 14 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	579.7	3341.0	3775.0	0.0	0.0	0.0	0.0	0.0
2	7.8	1015.8	2627.2	3333.9	0.0	0.0	0.0	0.0	0.0
3	2.2	368.4	739.9	965.0	0.0	0.0	0.0	0.0	0.0
4	2.6	527.8	873.2	1135.1	0.0	0.0	0.0	0.0	0.0
5	7.4	2658.1	2027.5	3113.1	0.0	0.0	0.0	0.0	0.0
6	8.8	5440.0	853.7	3269.8	0.0	0.0	0.0	0.0	0.0
7	1.1	808.6	0.0	353.1	0.0	0.0	0.0	0.0	0.0
8	9.7	7778.9	0.0	2401.8	0.0	0.0	0.0	0.0	0.0
9	7.5	6187.3	0.0	649.8	0.0	0.0	0.0	0.0	0.0
10	2.0	1587.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	9.1	6701.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	8.7	4634.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	7.0	1647.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.8	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	150.00	479.60
2	158.69	474.65
3	168.07	471.17
4	177.88	469.24
5	187.87	468.91
6	197.79	470.20
7	207.37	473.06
8	216.36	477.43
9	224.54	483.19
10	231.68	490.19
11	237.60	498.25
12	238.50	500.00

Circle Center At X = 184.8 ; Y = 530.6 and Radius, 61.8
*** 2.006 ***
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	134.21	479.60
2	143.03	474.88
3	152.35	471.25
4	162.03	468.74
5	171.94	467.41

6	181.94	467.25
7	191.88	468.29
8	201.63	470.50
9	211.06	473.85
10	220.02	478.29
11	228.38	483.77
12	236.04	490.20
13	242.88	497.49
14	244.73	500.00

Circle Center At X = 178.2 ; Y = 551.0 and Radius, 83.9

*** 2.012 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	150.00	479.60
2	158.41	474.19
3	167.63	470.31
4	177.37	468.07
5	187.36	467.55
6	197.29	468.75
7	206.86	471.65
8	215.79	476.15
9	223.81	482.12
10	230.68	489.39
11	236.20	497.73
12	237.19	500.00

Circle Center At X = 185.3 ; Y = 525.1 and Radius, 57.6

*** 2.021 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.05	479.60
2	154.91	474.96
3	164.30	471.51
4	174.05	469.29
5	184.01	468.35
6	194.00	468.71
7	203.86	470.35
8	213.43	473.25
9	222.55	477.36
10	231.06	482.61
11	238.82	488.91
12	245.71	496.16
13	248.50	500.00

Circle Center At X = 186.3 ; Y = 545.7 and Radius, 77.4

*** 2.053 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.16	479.60
2	146.11	473.53
3	154.92	468.80
4	164.37	465.53
5	174.22	463.81
6	184.22	463.67
7	194.11	465.12
8	203.65	468.12
9	212.59	472.60
10	220.70	478.45
11	227.79	485.50
12	233.66	493.60
13	236.90	500.00

Circle Center At X = 180.1 ; Y = 526.3 and Radius, 62.8

*** 2.055 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	150.00	479.60
2	158.44	474.23
3	167.72	470.51

4	177.53	468.57
5	187.53	468.47
6	197.38	470.21
7	206.73	473.74
8	215.28	478.93
9	222.72	485.61
10	228.81	493.54
11	231.73	499.31

Circle Center At X = 183.1 ; Y = 522.3 and Radius, 54.0
*** 2.057 ***
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.16	479.60
2	147.91	477.40
3	157.83	476.09
4	167.82	475.67
5	177.81	476.15
6	187.71	477.52
7	197.46	479.76
8	206.96	482.88
9	216.15	486.83
10	224.94	491.59
11	233.28	497.11
12	236.88	500.00

Circle Center At X = 167.5 ; Y = 586.8 and Radius, 111.1
*** 2.058 ***
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	118.42	479.60
2	127.23	474.86
3	136.44	470.98
4	145.99	468.01
5	155.78	465.97
6	165.72	464.89
7	175.72	464.76
8	185.69	465.59
9	195.53	467.38
10	205.15	470.11
11	214.46	473.75
12	223.38	478.26
13	231.83	483.62
14	239.72	489.76
15	246.99	496.63
16	249.93	500.00

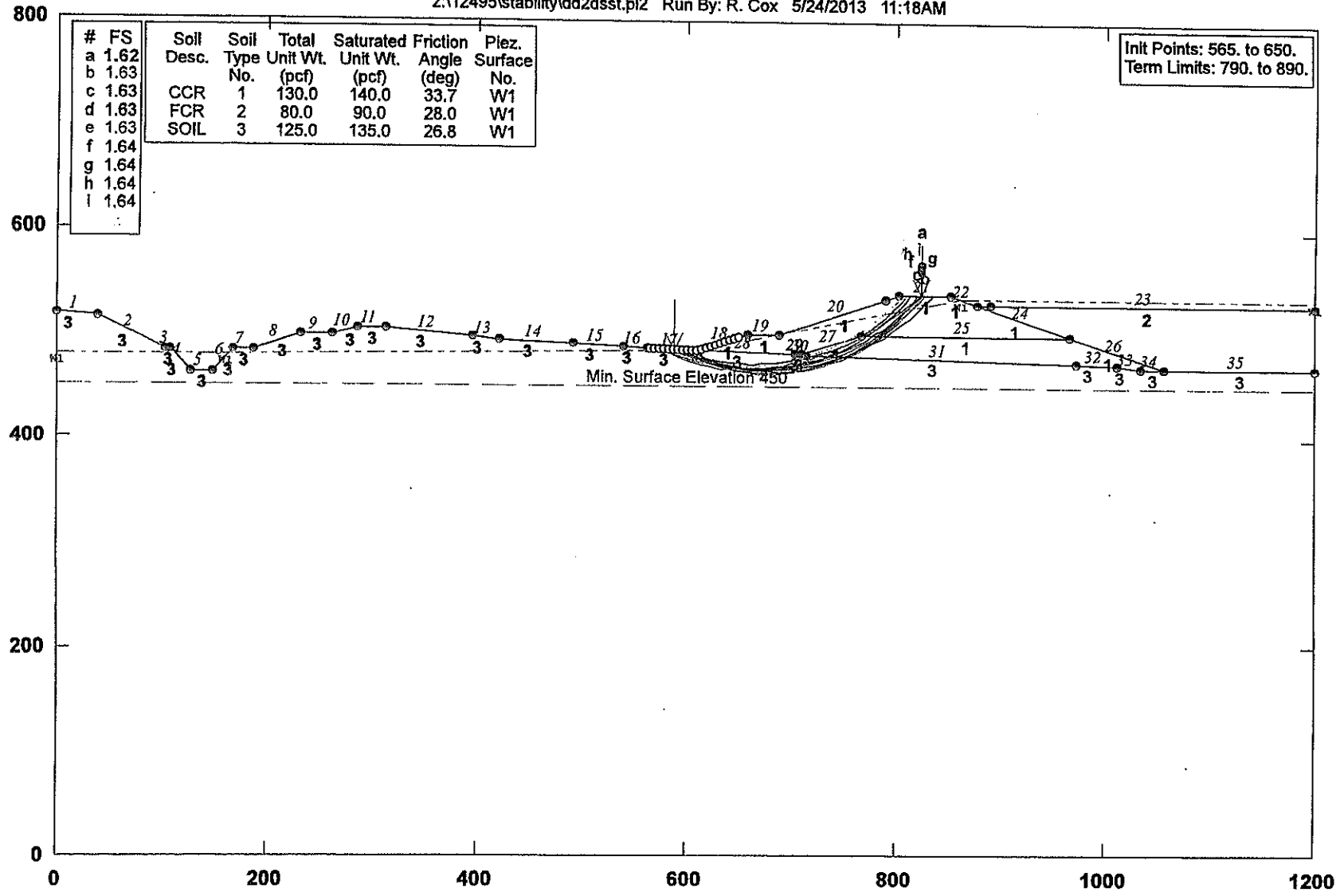
Circle Center At X = 172.0 ; Y = 568.3 and Radius, 103.7
*** 2.066 ***
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	118.42	479.60
2	126.72	474.02
3	135.61	469.43
4	144.96	465.89
5	154.66	463.45
6	164.57	462.14
7	174.57	461.98
8	184.52	462.96
9	194.29	465.08
10	203.76	468.31
11	212.79	472.60
12	221.27	477.91
13	229.08	484.15
14	236.13	491.24
15	242.31	499.10
16	242.86	500.00

Circle Center At X = 171.0 ; Y = 548.8 and Radius, 86.9
*** 2.070 ***

Section D-D Phase 10 Downstream Static Deep Circle

z:\12495\stability\dd2dsst.pl2 Run By: R. Cox 5/24/2013 11:18AM



PCSTABL5M/si FSmin=1.62

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:18AM
Run By: R. Cox
Input Data Filename: Z:dd2dsst.
Output Filename: Z:dd2dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd2dsst.PLT
PROBLEM DESCRIPTION Section D-D Phase 10
Downstream Static Deep Circle

BOUNDARY COORDINATES
23 Top Boundaries
35 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	517.05	39.25	514.70	3
2	39.25	514.70	103.20	482.74	3
3	103.20	482.74	108.20	482.74	3
4	108.20	482.74	128.21	462.74	3
5	128.21	462.74	148.21	462.74	3
6	148.21	462.74	168.22	482.75	3
7	168.22	482.75	188.23	482.75	3
8	188.23	482.75	232.87	497.64	3
9	232.87	497.64	262.86	497.64	3
10	262.86	497.64	285.90	503.33	3
11	285.90	503.33	313.92	504.00	3
12	313.92	504.00	395.72	496.00	3
13	395.72	496.00	422.17	494.00	3
14	422.17	494.00	491.87	490.00	3
15	491.87	490.00	539.43	488.00	3
16	539.43	488.00	562.48	486.00	3
17	562.48	486.00	610.43	483.96	3
18	610.43	483.96	658.57	500.00	1
19	658.57	500.00	688.57	500.00	1
20	688.57	500.00	802.59	538.00	1
21	802.59	538.00	852.60	538.00	1
22	852.60	538.00	877.14	529.80	1
23	877.14	529.80	1200.00	529.80	2
24	877.14	529.80	966.24	500.00	1
25	766.01	500.00	966.24	500.00	1
26	966.24	500.00	1056.27	470.00	1
27	708.86	480.89	766.01	500.00	1
28	610.43	483.96	703.22	482.00	3
29	703.22	482.00	708.86	480.89	3
30	708.86	480.89	713.40	480.00	3
31	713.40	480.00	972.01	474.00	3
32	972.01	474.00	1010.48	472.00	3
33	1010.48	472.00	1032.98	470.00	3
34	1032.98	470.00	1056.27	470.00	3
35	1056.27	470.00	1200.00	470.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	478.74
2	160.20	478.74

3	610.43	483.96
4	861.57	535.00
5	1200.00	535.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 565.00 ft.
and X = 650.00 ft.
Each Surface Terminates Between X = 790.00 ft.
and X = 890.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	587.37	484.94
2	596.65	481.23
3	606.11	477.97
4	615.71	475.17
5	625.43	472.84
6	635.26	470.99
7	645.17	469.62
8	655.13	468.73
9	665.12	468.32
10	675.12	468.40
11	685.10	468.97
12	695.05	470.02
13	704.93	471.55
14	714.73	473.56
15	724.41	476.04
16	733.97	478.99
17	743.37	482.40
18	752.59	486.26
19	761.62	490.57
20	770.42	495.31
21	778.99	500.47
22	787.29	506.04
23	795.32	512.01
24	803.04	518.36
25	810.45	525.07
26	817.53	532.14
27	822.84	538.00

Circle Center At X = 668.5 ; Y = 674.2 and Radius, 205.9
*** 1.621 ***
Individual data on the 38 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	3.0	205.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	6.3	1801.0	0.0	540.6	0.0	0.0	0.0	0.0	0.0
3	9.5	6013.1	0.0	2656.7	0.0	0.0	0.0	0.0	0.0
4	4.3	3912.5	0.0	1853.0	0.0	0.0	0.0	0.0	0.0
5	5.3	6339.4	0.0	2877.2	0.0	0.0	0.0	0.0	0.0
6	9.7	17526.3	0.0	7347.4	0.0	0.0	0.0	0.0	0.0
7	9.8	24839.9	0.0	9840.6	0.0	0.0	0.0	0.0	0.0
8	9.9	31628.8	0.0	12053.1	0.0	0.0	0.0	0.0	0.0
9	10.0	37816.3	0.0	13979.8	0.0	0.0	0.0	0.0	0.0
10	3.4	14359.1	0.0	5212.8	0.0	0.0	0.0	0.0	0.0
11	6.5	28047.0	0.0	10403.1	0.0	0.0	0.0	0.0	0.0
12	10.0	43125.8	0.0	16958.1	0.0	0.0	0.0	0.0	0.0
13	10.0	42833.0	0.0	18002.7	0.0	0.0	0.0	0.0	0.0
14	3.5	14707.8	0.0	6469.4	0.0	0.0	0.0	0.0	0.0
15	6.5	27991.2	0.0	12277.9	0.0	0.0	0.0	0.0	0.0

16	8.2	36964.3	0.0	15850.4	0.0	0.0	0.0	0.0	0.0
17	1.7	7939.0	0.0	3340.1	0.0	0.0	0.0	0.0	0.0
18	3.9	18487.0	0.0	7757.9	0.0	0.0	0.0	0.0	0.0
19	4.5	21711.4	0.0	8958.3	0.0	0.0	0.0	0.0	0.0
20	1.3	6410.0	0.0	2614.8	0.0	0.0	0.0	0.0	0.0
21	9.7	47474.9	0.0	19168.3	0.0	0.0	0.0	0.0	0.0
22	9.6	47507.1	0.0	18703.2	0.0	0.0	0.0	0.0	0.0
23	1.4	6870.4	0.0	2685.5	0.0	0.0	0.0	0.0	0.0
24	8.0	39825.1	0.0	15251.0	0.0	0.0	0.0	0.0	0.0
25	9.2	45023.6	0.0	16870.1	0.0	0.0	0.0	0.0	0.0
26	9.0	42634.1	0.0	15506.4	0.0	0.0	0.0	0.0	0.0
27	4.4	20035.6	0.0	7133.0	0.0	0.0	0.0	0.0	0.0
28	4.4	19551.6	0.0	6715.7	0.0	0.0	0.0	0.0	0.0
29	7.8	32803.9	0.0	10906.7	0.0	0.0	0.0	0.0	0.0
30	0.8	3146.8	0.0	994.4	0.0	0.0	0.0	0.0	0.0
31	8.3	31801.7	0.0	9667.9	0.0	0.0	0.0	0.0	0.0
32	8.0	27226.1	0.0	7154.5	0.0	0.0	0.0	0.0	0.0
33	7.3	21120.5	0.0	4191.0	0.0	0.0	0.0	0.0	0.0
34	0.5	1192.1	0.0	175.8	0.0	0.0	0.0	0.0	0.0
35	6.8	14712.7	0.0	1323.9	0.0	0.0	0.0	0.0	0.0
36	0.7	1128.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	7.1	8636.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	5.3	2025.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	582.90	485.13
2	592.10	481.23
3	601.49	477.77
4	611.02	474.76
5	620.69	472.22
6	630.47	470.13
7	640.34	468.52
8	650.28	467.38
9	660.26	466.72
10	670.25	466.53
11	680.25	466.82
12	690.22	467.59
13	700.14	468.83
14	709.99	470.55
15	719.75	472.73
16	729.40	475.38
17	738.90	478.49
18	748.25	482.04
19	757.41	486.04
20	766.38	490.47
21	775.12	495.33
22	783.62	500.59
23	791.86	506.26
24	799.82	512.31
25	807.48	518.74
26	814.83	525.52
27	821.84	532.65
28	826.62	538.00

Circle Center At X = 669.1 ; Y = 675.7 and Radius, 209.2

*** 1.626 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	596.32	484.56
2	605.20	479.97
3	614.34	475.91
4	623.70	472.40
5	633.26	469.45
6	642.97	467.06
7	652.80	465.25
8	662.73	464.01
9	672.71	463.37
10	682.71	463.31
11	692.69	463.85

12	702.63	464.96
13	712.48	466.67
14	722.22	468.94
15	731.81	471.79
16	741.21	475.20
17	750.39	479.15
18	759.33	483.64
19	767.99	488.65
20	776.33	494.15
21	784.34	500.14
22	791.98	506.59
23	799.23	513.48
24	806.07	520.78
25	812.46	528.47
26	818.38	536.53
27	819.34	538.00

Circle Center At X = 678.7 ; Y = 633.1 and Radius, 169.9

*** 1.630 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	591.84	484.75
2	600.71	480.14
3	609.83	476.03
4	619.16	472.44
5	628.69	469.38
6	638.36	466.86
7	648.17	464.89
8	658.07	463.48
9	668.03	462.62
10	678.03	462.33
11	688.02	462.60
12	697.99	463.44
13	707.89	464.83
14	717.70	466.78
15	727.38	469.27
16	736.91	472.31
17	746.25	475.88
18	755.38	479.97
19	764.26	484.57
20	772.87	489.66
21	781.17	495.22
22	789.15	501.25
23	796.78	507.71
24	804.04	514.59
25	810.89	521.88
26	817.33	529.53
27	823.32	537.54
28	823.63	538.00

Circle Center At X = 678.2 ; Y = 639.9 and Radius, 177.6

*** 1.631 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	600.79	484.37
2	609.80	480.03
3	619.04	476.20
4	628.48	472.91
5	638.10	470.17
6	647.85	467.97
7	657.72	466.34
8	667.66	465.27
9	677.65	464.76
10	687.65	464.83
11	697.63	465.47
12	707.55	466.67
13	717.40	468.44
14	727.12	470.77
15	736.70	473.65
16	746.10	477.06

17	755.29	481.01
18	764.23	485.47
19	772.91	490.44
20	781.29	495.90
21	789.35	501.82
22	797.06	508.19
23	804.39	514.99
24	811.32	522.20
25	817.83	529.79
26	823.90	537.74
27	824.08	538.00

Circle Center At X = 681.5 ; Y = 640.2 and Radius, 175.4

*** 1.634 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	573.95	485.51
2	583.00	481.26
3	592.25	477.47
4	601.69	474.17
5	611.29	471.35
6	621.01	469.03
7	630.85	467.21
8	640.76	465.90
9	650.73	465.10
10	660.72	464.81
11	670.72	465.04
12	680.69	465.78
13	690.62	467.03
14	700.46	468.79
15	710.20	471.05
16	719.81	473.81
17	729.27	477.06
18	738.55	480.79
19	747.62	484.99
20	756.47	489.65
21	765.07	494.76
22	773.39	500.30
23	781.42	506.27
24	789.13	512.63
25	796.50	519.39
26	803.52	526.51
27	810.16	533.99
28	813.37	538.00

Circle Center At X = 661.3 ; Y = 659.4 and Radius, 194.6

*** 1.635 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	587.37	484.94
2	596.55	480.98
3	605.91	477.45
4	615.42	474.37
5	625.07	471.75
6	634.83	469.59
7	644.69	467.89
8	654.61	466.66
9	664.59	465.91
10	674.58	465.63
11	684.58	465.82
12	694.56	466.49
13	704.49	467.62
14	714.36	469.23
15	724.14	471.31
16	733.82	473.85
17	743.36	476.84
18	752.75	480.28
19	761.96	484.17
20	770.98	488.48
21	779.79	493.22

22	788.36	498.37
23	796.68	503.92
24	804.72	509.87
25	812.47	516.18
26	819.92	522.86
27	827.04	529.88
28	833.82	537.23
29	834.46	538.00

Circle Center At X = 675.5 ; Y = 676.4 and Radius, 210.8

*** 1.637 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	573.95	485.51
2	583.14	481.58
3	592.52	478.12
4	602.06	475.12
5	611.74	472.60
6	621.53	470.57
7	631.41	469.03
8	641.36	467.98
9	651.34	467.42
10	661.34	467.37
11	671.33	467.81
12	681.29	468.75
13	691.19	470.18
14	701.00	472.10
15	710.70	474.51
16	720.28	477.40
17	729.70	480.76
18	738.94	484.59
19	747.97	488.87
20	756.79	493.59
21	765.35	498.75
22	773.65	504.33
23	781.66	510.31
24	789.37	516.69
25	796.75	523.44
26	803.78	530.55
27	810.45	538.00
28	810.45	538.00

Circle Center At X = 657.5 ; Y = 668.2 and Radius, 200.9

*** 1.637 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	582.90	485.13
2	592.38	481.95
3	601.99	479.19
4	611.71	476.85
5	621.53	474.94
6	631.42	473.46
7	641.36	472.42
8	651.34	471.82
9	661.34	471.66
10	671.34	471.93
11	681.31	472.65
12	691.25	473.80
13	701.12	475.38
14	710.91	477.40
15	720.61	479.85
16	730.19	482.72
17	739.63	486.01
18	748.92	489.70
19	758.04	493.81
20	766.97	498.31
21	775.70	503.20
22	784.20	508.46
23	792.46	514.10
24	800.47	520.09

25	808.20	526.43
26	815.65	533.10
27	820.67	538.00

Circle Center At X = 660.1 ; Y = 699.3 and Radius, 227.7

*** 1.638 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	578.42	485.32
2	587.73	481.68
3	597.22	478.50
4	606.85	475.81
5	616.60	473.61
6	626.46	471.90
7	636.38	470.70
8	646.36	469.99
9	656.36	469.79
10	666.35	470.09
11	676.32	470.89
12	686.23	472.20
13	696.07	474.00
14	705.80	476.30
15	715.41	479.08
16	724.86	482.35
17	734.13	486.09
18	743.21	490.29
19	752.06	494.94
20	760.67	500.03
21	769.01	505.55
22	777.06	511.48
23	784.80	517.81
24	792.21	524.53
25	799.27	531.60
26	805.04	538.00

Circle Center At X = 655.4 ; Y = 668.1 and Radius, 198.3

*** 1.640 ***

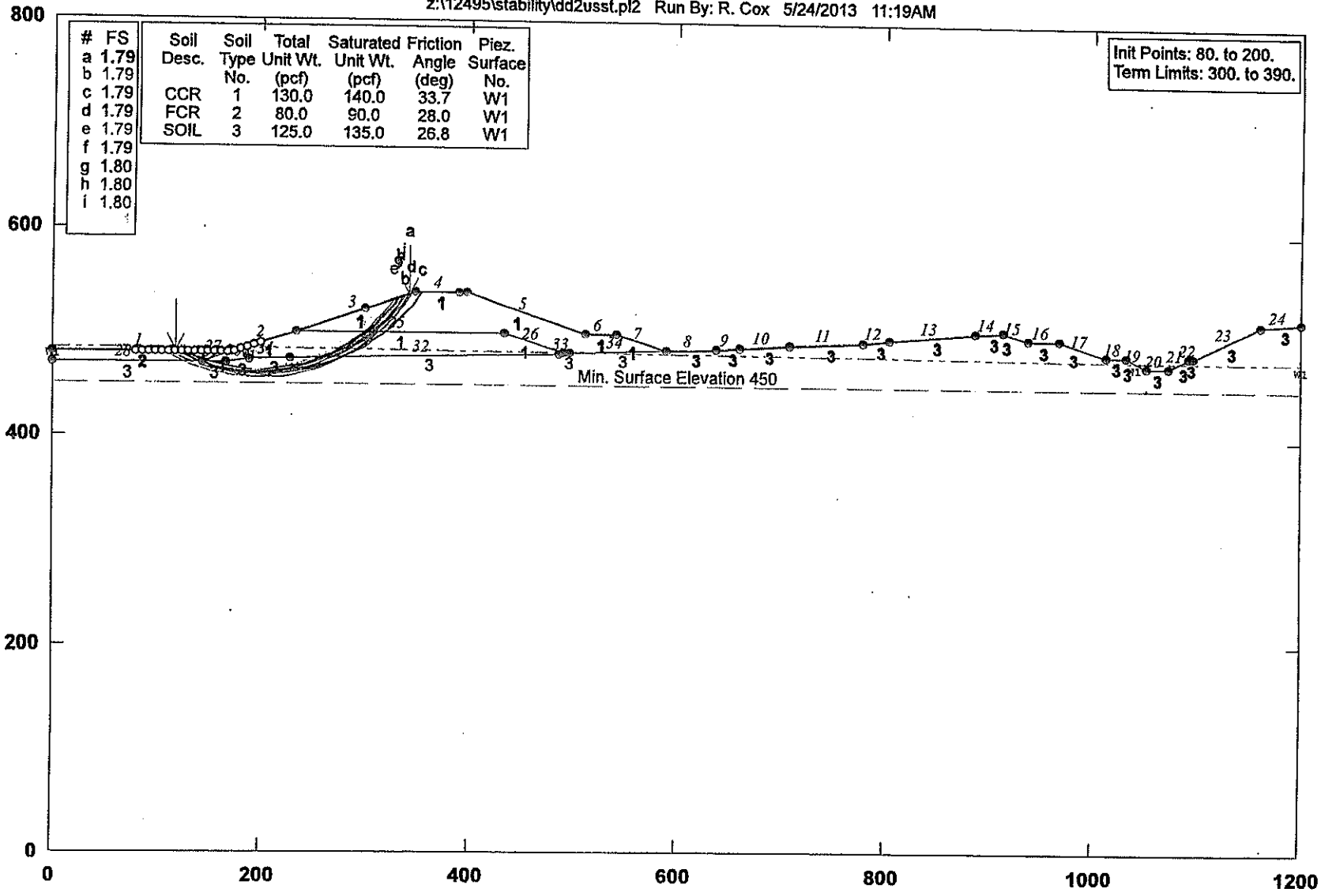
Section D-D Phase 10 Upstream Static

z:\12495\stability\dd2usst.pl2 Run By: R. Cox 5/24/2013 11:19AM

#	FS
a	1.79
b	1.79
c	1.79
d	1.79
e	1.79
f	1.79
g	1.80
h	1.80
i	1.80

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 80. to 200.
Term Limits: 300. to 390.



PCSTABL5M/si FSmin=1.79

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:19AM
Run By: R. Cox
Input Data Filename: Z:dd2usst.in
Output Filename: Z:dd2usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd2usst.PLT
PROBLEM DESCRIPTION Section D-D Phase 10 Upstream Static
BOUNDARY COORDINATES
24 Top Boundaries
34 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	479.60	172.50	479.60	2
2	172.50	479.60	233.80	500.00	1
3	233.80	500.00	347.40	538.00	1
4	347.40	538.00	397.40	538.00	1
5	397.40	538.00	511.40	500.00	1
6	511.40	500.00	541.40	500.00	1
7	541.40	500.00	589.60	484.00	1
8	589.60	484.00	637.50	486.00	3
9	637.50	486.00	660.60	488.00	3
10	660.60	488.00	708.10	490.00	3
11	708.10	490.00	777.80	494.00	3
12	777.80	494.00	804.30	496.00	3
13	804.30	496.00	886.10	504.00	3
14	886.10	504.00	914.10	505.30	3
15	914.10	505.30	937.10	497.60	3
16	937.10	497.60	967.10	497.60	3
17	967.10	497.60	1011.80	482.80	3
18	1011.80	482.80	1031.80	482.70	3
19	1031.80	482.70	1051.80	472.70	3
20	1051.80	472.70	1071.80	472.70	3
21	1071.80	472.70	1091.80	482.70	3
22	1091.80	482.70	1096.80	482.70	3
23	1096.80	482.70	1160.80	514.70	3
24	1160.80	514.70	1200.00	517.10	3
25	233.80	500.00	434.00	500.00	1
26	434.00	500.00	491.14	480.90	1
27	143.70	470.00	172.50	479.60	1
28	0.00	470.00	143.70	470.00	3
29	143.70	470.00	167.00	470.00	3
30	167.00	470.00	189.50	472.00	3
31	189.50	472.00	228.00	474.00	3
32	228.00	474.00	486.60	480.00	3
33	486.60	480.00	496.80	482.00	3
34	496.80	482.00	589.60	484.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	485.00
2	188.70	485.00
3	1039.80	478.70
4	1200.00	478.70

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 80.00 ft.
and X = 200.00 ft.
Each Surface Terminates Between X = 300.00 ft.
and X = 390.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.90	479.60
2	126.86	475.16
3	136.06	471.25
4	145.47	467.88
5	155.07	465.06
6	164.81	462.81
7	174.67	461.12
8	184.61	460.02
9	194.59	459.49
10	204.59	459.54
11	214.57	460.18
12	224.50	461.40
13	234.34	463.19
14	244.05	465.55
15	253.62	468.47
16	263.00	471.94
17	272.15	475.95
18	281.07	480.49
19	289.70	485.54
20	298.02	491.09
21	306.01	497.10
22	313.63	503.58
23	320.86	510.48
24	327.68	517.79
25	334.07	525.49
26	339.99	533.55
27	341.63	536.07

Circle Center At X = 198.7 ; Y = 631.3 and Radius, 171.8
*** 1.788 ***
Individual data on the 37 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.0	1790.5	3019.1	4755.1	0.0	0.0	0.0	0.0	0.0
2	9.2	5298.3	3101.0	7361.2	0.0	0.0	0.0	0.0	0.0
3	3.5	2814.6	1173.9	3319.5	0.0	0.0	0.0	0.0	0.0
4	4.2	4010.3	1401.1	4338.8	0.0	0.0	0.0	0.0	0.0
5	1.8	1990.4	597.5	1974.9	0.0	0.0	0.0	0.0	0.0
6	9.6	13915.4	3233.2	11563.6	0.0	0.0	0.0	0.0	0.0
7	9.7	19034.1	3282.9	13145.7	0.0	0.0	0.0	0.0	0.0
8	2.2	4882.8	737.6	3101.5	0.0	0.0	0.0	0.0	0.0
9	5.5	13100.8	1853.3	8020.8	0.0	0.0	0.0	0.0	0.0
10	2.2	5561.4	718.5	3251.8	0.0	0.0	0.0	0.0	0.0
11	9.9	29259.4	1977.0	15244.6	0.0	0.0	0.0	0.0	0.0
12	4.1	13741.5	185.7	6417.9	0.0	0.0	0.0	0.0	0.0
13	0.8	2788.9	0.0	1260.6	0.0	0.0	0.0	0.0	0.0
14	5.1	18505.1	0.0	8067.6	0.0	0.0	0.0	0.0	0.0
15	10.0	39719.0	0.0	15851.1	0.0	0.0	0.0	0.0	0.0
16	10.0	43453.4	0.0	15589.3	0.0	0.0	0.0	0.0	0.0
17	9.9	46218.6	0.0	14965.5	0.0	0.0	0.0	0.0	0.0
18	3.5	16876.9	0.0	5109.9	0.0	0.0	0.0	0.0	0.0

19	5.8	28450.7	0.0	8139.4	0.0	0.0	0.0	0.0	0.0
20	0.5	2663.2	0.0	732.5	0.0	0.0	0.0	0.0	0.0
21	9.7	48781.6	0.0	12641.3	0.0	0.0	0.0	0.0	0.0
22	9.6	48591.8	0.0	10948.8	0.0	0.0	0.0	0.0	0.0
23	9.4	47443.3	0.0	8910.0	0.0	0.0	0.0	0.0	0.0
24	6.9	34400.9	0.0	5168.2	0.0	0.0	0.0	0.0	0.0
25	2.2	10982.3	0.0	1363.5	0.0	0.0	0.0	0.0	0.0
26	8.9	42359.5	0.0	3822.1	0.0	0.0	0.0	0.0	0.0
27	6.5	29074.9	0.0	891.8	0.0	0.0	0.0	0.0	0.0
28	2.2	9465.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	8.3	34382.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	8.0	29822.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	3.4	11609.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	4.2	13254.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	7.2	19641.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	6.8	14298.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	6.4	8986.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	5.9	3859.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	1.6	210.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.90	479.60
2	126.80	475.05
3	135.96	471.04
4	145.35	467.59
5	154.92	464.71
6	164.66	462.42
7	174.51	460.71
8	184.45	459.60
9	194.43	459.09
10	204.43	459.18
11	214.41	459.87
12	224.33	461.16
13	234.15	463.05
14	243.84	465.52
15	253.36	468.58
16	262.68	472.20
17	271.77	476.37
18	280.59	481.08
19	289.11	486.32
20	297.30	492.06
21	305.13	498.28
22	312.57	504.96
23	319.59	512.08
24	326.17	519.61
25	332.29	527.52
26	337.09	534.55

Circle Center At X = 197.9 ; Y = 625.1 and Radius, 166.0

*** 1.789 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.90	479.60
2	126.91	475.27
3	136.14	471.43
4	145.57	468.10
5	155.17	465.28
6	164.90	462.99
7	174.74	461.22
8	184.67	459.98
9	194.64	459.28
10	204.64	459.13
11	214.63	459.51
12	224.59	460.43
13	234.48	461.88
14	244.28	463.87
15	253.96	466.38
16	263.49	469.41
17	272.85	472.95

18	281.99	477.00
19	290.91	481.52
20	299.57	486.53
21	307.94	491.99
22	316.01	497.90
23	323.75	504.23
24	331.14	510.97
25	338.15	518.10
26	344.76	525.60
27	350.97	533.44
28	354.19	538.00

Circle Center At X = 202.6 ; Y = 644.3 and Radius, 185.1

*** 1.791 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	124.21	479.60
2	133.01	474.86
3	142.10	470.67
4	151.42	467.05
5	160.95	464.02
6	170.65	461.58
7	180.48	459.75
8	190.40	458.53
9	200.38	457.93
10	210.38	457.94
11	220.36	458.58
12	230.28	459.83
13	240.11	461.70
14	249.80	464.17
15	259.32	467.23
16	268.63	470.88
17	277.70	475.10
18	286.48	479.87
19	294.96	485.18
20	303.09	491.00
21	310.84	497.31
22	318.19	504.09
23	325.11	511.32
24	331.56	518.96
25	337.53	526.98
26	342.99	535.36
27	343.80	536.80

Circle Center At X = 205.1 ; Y = 619.2 and Radius, 161.4

*** 1.792 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.90	479.60
2	126.87	475.19
3	136.10	471.34
4	145.55	468.07
5	155.19	465.39
6	164.97	463.31
7	174.86	461.84
8	184.82	460.98
9	194.82	460.74
10	204.81	461.12
11	214.76	462.11
12	224.63	463.71
13	234.38	465.92
14	243.98	468.73
15	253.39	472.12
16	262.57	476.09
17	271.48	480.62
18	280.10	485.69
19	288.39	491.29
20	296.32	497.38
21	303.86	503.95
22	310.97	510.98

23	317.65	518.43
24	323.84	526.27
25	327.32	531.28

Circle Center At X = 193.7 ; Y = 622.6 and Radius, 161.9

*** 1.793 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.58	479.60
2	120.54	475.16
3	129.75	471.25
4	139.16	467.89
5	148.76	465.09
6	158.51	462.86
7	168.37	461.19
8	178.31	460.11
9	188.30	459.62
10	198.30	459.71
11	208.28	460.38
12	218.20	461.64
13	228.03	463.47
14	237.73	465.88
15	247.28	468.86
16	256.64	472.38
17	265.77	476.45
18	274.65	481.05
19	283.25	486.16
20	291.53	491.77
21	299.47	497.85
22	307.04	504.38
23	314.21	511.35
24	320.97	518.72
25	327.28	526.48
26	331.82	532.79

Circle Center At X = 191.8 ; Y = 630.1 and Radius, 170.6

*** 1.794 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	124.21	479.60
2	133.31	475.45
3	142.65	471.87
4	152.18	468.85
5	161.88	466.42
6	171.71	464.58
7	181.63	463.35
8	191.61	462.71
9	201.61	462.68
10	211.60	463.26
11	221.53	464.44
12	231.37	466.22
13	241.08	468.60
14	250.63	471.55
15	259.99	475.09
16	269.11	479.18
17	277.97	483.82
18	286.53	488.99
19	294.77	494.66
20	302.64	500.83
21	310.12	507.46
22	317.19	514.53
23	323.82	522.02
24	329.98	529.90
25	332.02	532.86

Circle Center At X = 197.1 ; Y = 627.5 and Radius, 164.9

*** 1.798 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.26	479.60

2	114.04	474.81
3	123.08	470.54
4	132.36	466.81
5	141.85	463.64
6	151.50	461.03
7	161.29	458.99
8	171.18	457.54
9	181.15	456.67
10	191.14	456.38
11	201.14	456.69
12	211.10	457.59
13	220.99	459.07
14	230.77	461.13
15	240.42	463.76
16	249.89	466.96
17	259.16	470.71
18	268.20	475.00
19	276.96	479.81
20	285.43	485.14
21	293.57	490.95
22	301.35	497.23
23	308.75	503.96
24	315.73	511.11
25	322.29	518.66
26	328.39	526.59
27	332.83	533.13

Circle Center At X = 190.9 ; Y = 626.1 and Radius, 169.7

*** 1.803 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	124.21	479.60
2	132.79	474.46
3	141.69	469.91
4	150.88	465.96
5	160.31	462.64
6	169.95	459.96
7	179.74	457.94
8	189.65	456.58
9	199.62	455.88
10	209.62	455.86
11	219.60	456.51
12	229.52	457.82
13	239.32	459.80
14	248.96	462.43
15	258.41	465.71
16	267.62	469.61
17	276.54	474.12
18	285.15	479.22
19	293.39	484.89
20	301.23	491.10
21	308.63	497.82
22	315.57	505.02
23	322.01	512.67
24	327.92	520.74
25	333.27	529.18
26	335.99	534.18

Circle Center At X = 204.9 ; Y = 604.5 and Radius, 148.7

*** 1.804 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.58	479.60
2	120.63	475.34
3	129.91	471.63
4	139.41	468.50
5	149.08	465.96
6	158.89	464.00
7	168.80	462.65
8	178.77	461.90

9	188.77	461.76
10	198.76	462.23
11	208.70	463.31
12	218.56	464.99
13	228.29	467.27
14	237.87	470.13
15	247.26	473.58
16	256.42	477.59
17	265.32	482.15
18	273.93	487.24
19	282.21	492.85
20	290.13	498.95
21	297.67	505.52
22	304.79	512.54
23	311.47	519.98
24	317.69	527.81
25	317.92	528.14

Circle Center At X = 186.0 ; Y = 625.9 and Radius, 164.2

*** 1.805 ***

Section D-D Phase 11 Downstream Static Deep Circle

z:\12495\stability\dd3dsst.pl2 Run By: R. Cox 5/24/2013 11:20AM

#	FS
a	1.52
b	1.52
c	1.52
d	1.52
e	1.52
f	1.52
g	1.52
h	1.52
i	1.53

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 130. to 225.
Term Limits: 530. to 630.

Min. Surface Elevation 450

800
600
400
200
0

0 200 400 600 800 1000 1200

PCSTABL5M/si FSmin=1.52
Safety Factors Are Calculated By The Modified Bishop Method

STED

268

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:20AM
Run By: R. Cox
Input Data Filename: Z:dd3dsst.
Output Filename: Z:dd3dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd3dsst.PLT
PROBLEM DESCRIPTION Section D-D Phase 11
Downstream Static Deep Circle

BOUNDARY COORDINATES
16 Top Boundaries
41 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	517.05	39.25	514.70	3
2	39.25	514.70	103.20	482.74	3
3	103.20	482.74	108.20	482.74	3
4	108.20	482.74	128.21	462.74	3
5	128.21	462.74	148.21	462.74	3
6	148.21	462.74	168.22	482.75	3
7	168.22	482.75	188.23	482.75	3
8	188.23	482.75	232.87	497.64	3
9	232.87	497.64	262.86	497.64	3
10	262.86	497.64	285.90	503.33	3
11	285.90	503.33	383.76	538.00	1
12	383.76	538.00	413.77	538.00	1
13	413.77	538.00	563.77	588.00	1
14	563.77	588.00	702.20	588.00	1
15	702.20	588.00	728.66	579.20	1
16	728.66	579.20	1200.00	579.20	2
17	728.66	579.20	802.59	538.00	1
18	802.59	538.00	852.60	538.00	1
19	852.60	538.00	906.43	520.00	1
20	906.43	520.00	966.24	500.00	1
21	688.57	500.00	802.59	538.00	1
22	658.57	500.00	688.57	500.00	1
23	766.01	500.00	966.24	500.00	1
24	966.24	500.00	1056.27	470.00	1
25	610.43	483.96	658.57	500.00	1
26	708.86	480.89	766.01	500.00	1
27	285.90	503.33	313.92	504.00	3
28	313.92	504.00	395.72	496.00	3
29	395.72	496.00	422.17	494.00	3
30	422.17	494.00	491.87	490.00	3
31	491.87	490.00	539.43	488.00	3
32	539.43	488.00	562.48	486.00	3
33	562.48	486.00	610.43	483.96	3
34	610.43	483.96	703.22	482.00	3
35	703.22	482.00	708.86	480.89	3
36	708.86	480.89	713.40	480.00	3
37	713.40	480.00	972.01	474.00	3
38	972.01	474.00	1010.48	472.00	3
39	1010.48	472.00	1032.98	470.00	3
40	1032.98	470.00	1056.27	470.00	3
41	1056.27	470.00	1200.00	470.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	478.74
2	200.00	478.74
3	711.23	585.00
4	1200.00	585.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 130.00 ft.
and X = 225.00 ft.
Each Surface Terminates Between X = 530.00 ft.
and X = 630.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.75	460.50
3	149.54	458.48
4	159.38	456.68
5	169.25	455.10
6	179.16	453.74
7	189.09	452.61
8	199.05	451.70
9	209.03	451.01
10	219.02	450.55
11	229.02	450.31
12	239.02	450.30
13	249.01	450.51
14	259.00	450.94
15	268.98	451.60
16	278.94	452.48
17	288.88	453.59
18	298.79	454.92
19	308.67	456.47
20	318.51	458.24
21	328.31	460.24
22	338.06	462.45
23	347.76	464.88
24	357.41	467.53
25	366.99	470.39
26	376.50	473.47
27	385.95	476.76
28	395.31	480.27
29	404.60	483.98
30	413.80	487.90
31	422.91	492.02
32	431.92	496.35
33	440.84	500.88
34	449.65	505.61
35	458.35	510.54
36	466.94	515.66
37	475.41	520.97
38	483.77	526.47
39	491.99	532.15
40	500.09	538.02
41	508.05	544.07
42	515.87	550.30
43	523.56	556.70
44	531.09	563.27

45 538.48 570.01
46 545.72 576.92
47 552.79 583.98
48 553.30 584.51

Circle Center At X = 234.6 ; Y = 895.6 and Radius, 445.4

*** 1.521 ***

Individual data on the 62 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	1473.6	9730.3	10682.9	0.0	0.0	0.0	0.0	0.0
2	8.5	3557.1	8450.1	10306.9	0.0	0.0	0.0	0.0	0.0
3	1.3	859.9	1800.0	1705.4	0.0	0.0	0.0	0.0	0.0
4	9.8	15150.9	8464.9	13204.4	0.0	0.0	0.0	0.0	0.0
5	8.8	26690.2	321.2	12723.6	0.0	0.0	0.0	0.0	0.0
6	1.0	3796.6	0.0	1535.2	0.0	0.0	0.0	0.0	0.0
7	9.9	37492.5	0.0	15174.8	0.0	0.0	0.0	0.0	0.0
8	9.1	35792.6	0.0	14536.3	0.0	0.0	0.0	0.0	0.0
9	0.9	3491.9	0.0	1415.7	0.0	0.0	0.0	0.0	0.0
10	10.0	43160.5	0.0	16590.0	0.0	0.0	0.0	0.0	0.0
11	0.9	4383.5	0.0	1604.2	0.0	0.0	0.0	0.0	0.0
12	9.0	44108.5	0.0	15682.6	0.0	0.0	0.0	0.0	0.0
13	10.0	53683.5	0.0	18867.2	0.0	0.0	0.0	0.0	0.0
14	10.0	58567.1	0.0	20350.7	0.0	0.0	0.0	0.0	0.0
15	3.9	23811.8	0.0	8211.9	0.0	0.0	0.0	0.0	0.0
16	6.1	38527.0	0.0	13485.8	0.0	0.0	0.0	0.0	0.0
17	10.0	62705.7	0.0	22907.7	0.0	0.0	0.0	0.0	0.0
18	10.0	62428.7	0.0	23979.8	0.0	0.0	0.0	0.0	0.0
19	3.9	23971.5	0.0	9525.6	0.0	0.0	0.0	0.0	0.0
20	6.1	38425.9	0.0	15388.1	0.0	0.0	0.0	0.0	0.0
21	10.0	64292.4	0.0	25708.7	0.0	0.0	0.0	0.0	0.0
22	7.0	46062.9	0.0	18393.6	0.0	0.0	0.0	0.0	0.0
23	3.0	20073.6	0.0	7971.0	0.0	0.0	0.0	0.0	0.0
24	9.9	68682.9	0.0	26881.0	0.0	0.0	0.0	0.0	0.0
25	9.9	71230.1	0.0	27257.6	0.0	0.0	0.0	0.0	0.0
26	5.2	38862.5	0.0	14641.1	0.0	0.0	0.0	0.0	0.0
27	4.6	34555.1	0.0	12853.1	0.0	0.0	0.0	0.0	0.0
28	0.6	4406.3	0.0	1634.9	0.0	0.0	0.0	0.0	0.0
29	9.2	70875.5	0.0	25955.9	0.0	0.0	0.0	0.0	0.0
30	9.8	76785.6	0.0	27547.3	0.0	0.0	0.0	0.0	0.0
31	9.7	77922.2	0.0	27363.7	0.0	0.0	0.0	0.0	0.0
32	9.6	78693.5	0.0	27040.0	0.0	0.0	0.0	0.0	0.0
33	9.6	79102.6	0.0	26576.5	0.0	0.0	0.0	0.0	0.0
34	9.5	79153.9	0.0	25973.3	0.0	0.0	0.0	0.0	0.0
35	7.3	60588.8	0.0	19463.1	0.0	0.0	0.0	0.0	0.0
36	2.2	18154.3	0.0	5767.8	0.0	0.0	0.0	0.0	0.0
37	9.4	75243.3	0.0	24349.5	0.0	0.0	0.0	0.0	0.0
38	0.4	3180.5	0.0	1047.5	0.0	0.0	0.0	0.0	0.0
39	8.9	67111.3	0.0	22282.0	0.0	0.0	0.0	0.0	0.0
40	9.2	64929.2	0.0	22107.5	0.0	0.0	0.0	0.0	0.0
41	0.0	187.5	0.0	64.4	0.0	0.0	0.0	0.0	0.0
42	8.4	56616.2	0.0	19238.3	0.0	0.0	0.0	0.0	0.0
43	0.7	4932.1	0.0	1638.2	0.0	0.0	0.0	0.0	0.0
44	3.6	23929.5	0.0	7938.8	0.0	0.0	0.0	0.0	0.0
45	5.4	35534.8	0.0	11505.8	0.0	0.0	0.0	0.0	0.0
46	8.9	56931.3	0.0	17876.6	0.0	0.0	0.0	0.0	0.0
47	8.8	54108.3	0.0	16173.4	0.0	0.0	0.0	0.0	0.0
48	8.7	51027.4	0.0	14335.8	0.0	0.0	0.0	0.0	0.0
49	8.6	47704.4	0.0	12364.7	0.0	0.0	0.0	0.0	0.0
50	8.5	44156.1	0.0	10261.3	0.0	0.0	0.0	0.0	0.0
51	8.4	40399.8	0.0	8026.4	0.0	0.0	0.0	0.0	0.0
52	8.2	36453.8	0.0	5661.3	0.0	0.0	0.0	0.0	0.0
53	8.1	32337.1	0.0	3167.1	0.0	0.0	0.0	0.0	0.0
54	5.6	20134.0	0.0	663.5	0.0	0.0	0.0	0.0	0.0
55	2.4	7950.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	7.8	23947.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	7.7	19788.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	7.5	15543.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	7.4	11231.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

60	7.2	6875.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	7.1	2494.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	0.5	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.74	460.47
3	149.53	458.43
4	159.36	456.61
5	169.23	455.01
6	179.14	453.64
7	189.07	452.50
8	199.03	451.58
9	209.01	450.89
10	219.00	450.42
11	228.99	450.19
12	238.99	450.18
13	248.99	450.40
14	258.98	450.85
15	268.96	451.52
16	278.92	452.43
17	288.85	453.55
18	298.76	454.91
19	308.64	456.49
20	318.47	458.30
21	328.26	460.32
22	338.01	462.58
23	347.70	465.05
24	357.33	467.74
25	366.89	470.65
26	376.39	473.78
27	385.82	477.13
28	395.16	480.68
29	404.42	484.45
30	413.60	488.43
31	422.68	492.62
32	431.66	497.02
33	440.54	501.62
34	449.31	506.41
35	457.98	511.41
36	466.52	516.61
37	474.95	521.99
38	483.25	527.57
39	491.42	533.34
40	499.45	539.29
41	507.35	545.42
42	515.11	551.73
43	522.72	558.21
44	530.19	564.87
45	537.50	571.69
46	544.65	578.68
47	548.91	583.05

Circle Center At X = 234.3 ; Y = 889.0 and Radius, 438.8

*** 1.521 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.76	460.55
3	149.56	458.57
4	159.40	456.82
5	169.29	455.28
6	179.20	453.96
7	189.14	452.86
8	199.10	451.99
9	209.08	451.33
10	219.07	450.90
11	229.07	450.69
12	239.07	450.70

13	249.06	450.93
14	259.05	451.39
15	269.03	452.07
16	278.99	452.97
17	288.93	454.09
18	298.84	455.43
19	308.71	456.99
20	318.55	458.76
21	328.35	460.76
22	338.11	462.98
23	347.81	465.41
24	357.45	468.05
25	367.03	470.91
26	376.55	473.98
27	385.99	477.27
28	395.37	480.76
29	404.66	484.45
30	413.86	488.36
31	422.98	492.47
32	432.00	496.77
33	440.93	501.28
34	449.75	505.99
35	458.47	510.89
36	467.08	515.98
37	475.57	521.26
38	483.94	526.73
39	492.19	532.39
40	500.31	538.22
41	508.30	544.24
42	516.15	550.43
43	523.86	556.80
44	531.43	563.33
45	538.86	570.03
46	546.13	576.89
47	553.25	583.92
48	554.07	584.77

Circle Center At X = 233.6 ; Y = 900.7 and Radius, 450.1

*** 1.521 ***

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.00	462.74
2	144.76	460.54
3	154.55	458.55
4	164.39	456.76
5	174.27	455.19
6	184.18	453.83
7	194.11	452.69
8	204.07	451.75
9	214.04	451.03
10	224.03	450.52
11	234.02	450.23
12	244.02	450.14
13	254.02	450.28
14	264.02	450.62
15	274.00	451.19
16	283.97	451.96
17	293.92	452.95
18	303.85	454.15
19	313.75	455.56
20	323.62	457.18
21	333.45	459.01
22	343.24	461.06
23	352.98	463.31
24	362.67	465.77
25	372.31	468.44
26	381.89	471.31
27	391.40	474.38
28	400.85	477.66
29	410.23	481.14

30	419.52	484.82
31	428.74	488.70
32	437.87	492.78
33	446.92	497.05
34	455.87	501.51
35	464.72	506.16
36	473.47	511.00
37	482.12	516.02
38	490.65	521.23
39	499.07	526.62
40	507.38	532.19
41	515.56	537.94
42	523.62	543.86
43	531.55	549.95
44	539.35	556.21
45	547.02	562.63
46	554.54	569.22
47	561.92	575.97
48	569.16	582.87
49	574.31	588.00

Circle Center At X = 242.8 ; Y = 917.7 and Radius, 467.6

*** 1.522 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.78	460.64
3	149.59	458.73
4	159.45	457.03
5	169.33	455.52
6	179.25	454.21
7	189.19	453.10
8	199.14	452.20
9	209.12	451.49
10	219.11	450.99
11	229.10	450.68
12	239.10	450.58
13	249.10	450.68
14	259.10	450.98
15	269.08	451.48
16	279.06	452.19
17	289.02	453.09
18	298.96	454.20
19	308.87	455.50
20	318.76	457.01
21	328.61	458.71
22	338.43	460.61
23	348.21	462.71
24	357.94	465.01
25	367.62	467.50
26	377.26	470.19
27	386.83	473.07
28	396.35	476.14
29	405.80	479.40
30	415.18	482.86
31	424.50	486.50
32	433.74	490.33
33	442.89	494.34
34	451.97	498.54
35	460.96	502.92
36	469.86	507.48
37	478.66	512.22
38	487.37	517.14
39	495.98	522.23
40	504.48	527.49
41	512.88	532.93
42	521.16	538.53
43	529.33	544.30
44	537.38	550.23
45	545.31	556.32

46	553.12	562.57
47	560.80	568.98
48	568.34	575.54
49	575.76	582.25
50	581.86	588.00

Circle Center At X = 239.2 ; Y = 946.6 and Radius, 496.0

*** 1.523 ***

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	462.74
2	149.76	460.54
3	159.56	458.55
4	169.40	456.78
5	179.27	455.22
6	189.18	453.87
7	199.12	452.73
8	209.08	451.81
9	219.05	451.11
10	229.04	450.62
11	239.04	450.34
12	249.04	450.29
13	259.03	450.44
14	269.03	450.82
15	279.01	451.41
16	288.98	452.21
17	298.93	453.23
18	308.85	454.46
19	318.74	455.91
20	328.60	457.57
21	338.43	459.45
22	348.21	461.53
23	357.94	463.83
24	367.62	466.33
25	377.25	469.04
26	386.81	471.96
27	396.31	475.09
28	405.74	478.42
29	415.09	481.95
30	424.37	485.69
31	433.56	489.62
32	442.67	493.75
33	451.69	498.08
34	460.61	502.60
35	469.43	507.31
36	478.14	512.21
37	486.75	517.30
38	495.25	522.57
39	503.63	528.03
40	511.89	533.66
41	520.03	539.47
42	528.04	545.46
43	535.92	551.62
44	543.67	557.94
45	551.27	564.43
46	558.74	571.09
47	566.06	577.90
48	573.23	584.87
49	576.31	588.00

Circle Center At X = 246.7 ; Y = 913.6 and Radius, 463.3

*** 1.523 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	462.74
2	149.76	460.54
3	159.56	458.57
4	169.40	456.81
5	179.28	455.27
6	189.20	453.95

7	199.14	452.85
8	209.10	451.97
9	219.08	451.32
10	229.07	450.89
11	239.06	450.68
12	249.06	450.69
13	259.06	450.93
14	269.05	451.38
15	279.03	452.06
16	288.99	452.97
17	298.92	454.09
18	308.83	455.43
19	318.71	457.00
20	328.55	458.78
21	338.35	460.78
22	348.10	463.00
23	357.80	465.44
24	367.44	468.09
25	377.02	470.96
26	386.53	474.04
27	395.98	477.33
28	405.34	480.83
29	414.63	484.53
30	423.84	488.44
31	432.95	492.56
32	441.97	496.88
33	450.89	501.40
34	459.71	506.11
35	468.42	511.02
36	477.02	516.12
37	485.50	521.42
38	493.87	526.90
39	502.11	532.56
40	510.22	538.41
41	518.20	544.44
42	526.04	550.64
43	533.75	557.02
44	541.31	563.56
45	548.72	570.27
46	555.98	577.15
47	563.09	584.19
48	566.77	588.00

Circle Center At X = 243.5 ; Y = 899.8 and Radius, 449.1

*** 1.523 ***

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	462.74
2	149.77	460.58
3	159.57	458.64
4	169.42	456.91
5	179.31	455.39
6	189.22	454.09
7	199.16	453.00
8	209.12	452.13
9	219.10	451.47
10	229.09	451.03
11	239.09	450.81
12	249.09	450.80
13	259.09	451.01
14	269.08	451.44
15	279.06	452.08
16	289.02	452.94
17	298.96	454.02
18	308.88	455.31
19	318.77	456.82
20	328.62	458.53
21	338.43	460.47
22	348.20	462.61
23	357.92	464.97

24	367.58	467.53
25	377.19	470.31
26	386.73	473.29
27	396.21	476.48
28	405.62	479.87
29	414.95	483.46
30	424.20	487.26
31	433.37	491.26
32	442.45	495.45
33	451.43	499.84
34	460.32	504.43
35	469.10	509.20
36	477.78	514.17
37	486.36	519.32
38	494.81	524.65
39	503.15	530.17
40	511.37	535.87
41	519.46	541.74
42	527.43	547.79
43	535.26	554.01
44	542.95	560.40
45	550.50	566.95
46	557.91	573.67
47	565.18	580.54
48	572.29	587.57
49	572.71	588.00

Circle Center At X = 244.4 ; Y = 912.2 and Radius, 461.4

*** 1.523 ***

Failure Surface Specified By 51 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.77	460.62
3	149.59	458.69
4	159.44	456.96
5	169.32	455.43
6	179.23	454.09
7	189.16	452.95
8	199.12	452.01
9	209.09	451.26
10	219.07	450.71
11	229.07	450.37
12	239.07	450.22
13	249.07	450.26
14	259.06	450.51
15	269.05	450.96
16	279.03	451.60
17	289.00	452.44
18	298.94	453.48
19	308.87	454.72
20	318.76	456.15
21	328.63	457.78
22	338.46	459.61
23	348.25	461.63
24	358.01	463.85
25	367.71	466.25
26	377.37	468.85
27	386.97	471.65
28	396.52	474.63
29	406.00	477.80
30	415.42	481.16
31	424.77	484.70
32	434.05	488.43
33	443.25	492.35
34	452.37	496.44
35	461.41	500.72
36	470.36	505.17
37	479.23	509.81
38	488.00	514.61
39	496.67	519.59

40	505.24	524.74
41	513.71	530.07
42	522.07	535.55
43	530.31	541.21
44	538.45	547.02
45	546.47	553.00
46	554.37	559.13
47	562.14	565.42
48	569.79	571.86
49	577.31	578.46
50	584.69	585.20
51	587.64	588.00

Circle Center At X = 241.6 ; Y = 953.6 and Radius, 503.4

*** 1.525 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	462.74
2	149.73	460.44
3	159.51	458.36
4	169.34	456.52
5	179.21	454.91
6	189.12	453.53
7	199.05	452.38
8	209.01	451.47
9	218.99	450.79
10	228.98	450.35
11	238.97	450.14
12	248.97	450.16
13	258.97	450.42
14	268.96	450.91
15	278.93	451.64
16	288.89	452.60
17	298.81	453.80
18	308.71	455.23
19	318.57	456.89
20	328.39	458.78
21	338.16	460.90
22	347.88	463.25
23	357.55	465.83
24	367.15	468.63
25	376.68	471.66
26	386.13	474.91
27	395.51	478.38
28	404.80	482.07
29	414.01	485.98
30	423.12	490.10
31	432.13	494.44
32	441.04	498.99
33	449.83	503.74
34	458.52	508.70
35	467.08	513.86
36	475.52	519.22
37	483.84	524.78
38	492.02	530.53
39	500.06	536.47
40	507.96	542.60
41	515.72	548.92
42	523.32	555.41
43	530.77	562.08
44	538.06	568.92
45	545.19	575.94
46	552.16	583.11
47	553.51	584.58

Circle Center At X = 242.9 ; Y = 876.1 and Radius, 426.0

*** 1.525 ***

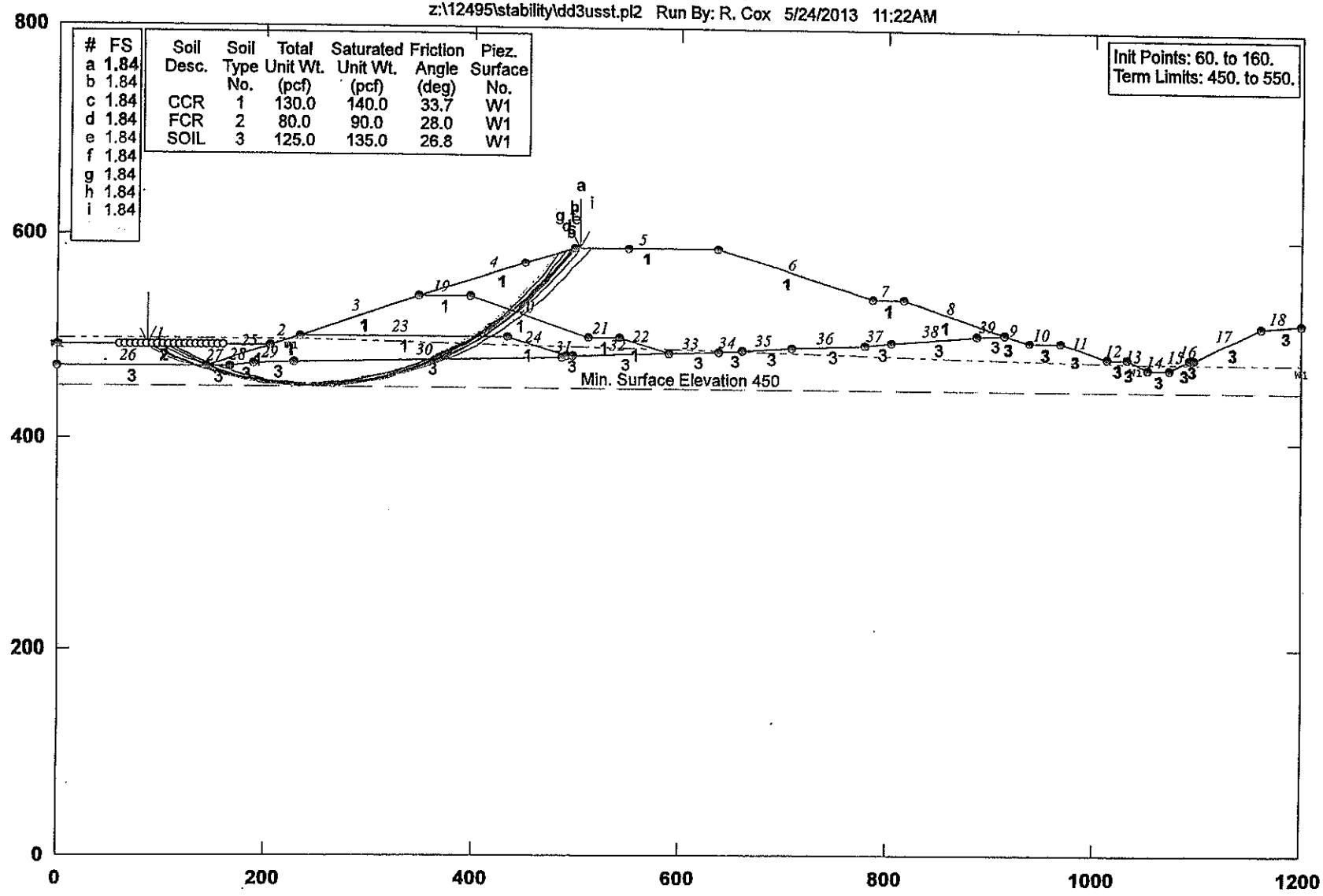
Section D-D Phase 11 Upstream Static

z:\12495\stability\dd3usst.pl2 Run By: R. Cox 5/24/2013 11:22AM

#	FS
a	1.84
b	1.84
c	1.84
d	1.84
e	1.84
f	1.84
g	1.84
h	1.84
i	1.84

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 60. to 160.
Term Limits: 450. to 550.



PCSTABL5M/si FSmin=1.84

Safety Factors Are Calculated By The Modified Bishop Method

STED

R10279

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:22AM
Run By: R. Cox
Input Data Filename: Z:dd3usst.in
Output Filename: Z:dd3usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd3usst.PLT
PROBLEM DESCRIPTION Section D-D Phase 11 Upstream Static
BOUNDARY COORDINATES
18 Top Boundaries
39 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.50	205.20	490.50	2
2	205.20	490.50	233.80	500.00	1
3	233.80	500.00	347.40	538.00	1
4	347.40	538.00	497.80	588.00	1
5	497.80	588.00	636.20	588.00	1
6	636.20	588.00	786.20	538.00	1
7	786.20	538.00	816.20	538.00	1
8	816.20	538.00	914.10	505.30	1
9	914.10	505.30	937.10	497.60	3
10	937.10	497.60	967.10	497.60	3
11	967.10	497.60	1011.80	482.80	3
12	1011.80	482.80	1031.80	482.70	3
13	1031.80	482.70	1051.80	472.70	3
14	1051.80	472.70	1071.80	472.70	3
15	1071.80	472.70	1091.80	482.70	3
16	1091.80	482.70	1096.80	482.70	3
17	1096.80	482.70	1160.80	514.70	3
18	1160.80	514.70	1200.00	517.10	3
19	347.40	538.00	397.40	538.00	1
20	397.40	538.00	511.40	500.00	1
21	511.40	500.00	541.40	500.00	1
22	541.40	500.00	589.60	484.00	1
23	233.80	500.00	434.00	500.00	1
24	434.00	500.00	491.14	480.90	1
25	143.70	470.00	233.80	500.00	1
26	0.00	470.00	143.70	470.00	3
27	143.70	470.00	167.00	470.00	3
28	167.00	470.00	189.50	472.00	3
29	189.50	472.00	228.00	474.00	3
30	228.00	474.00	486.60	480.00	3
31	486.60	480.00	496.80	482.00	3
32	496.80	482.00	589.60	484.00	3
33	589.60	484.00	637.50	486.00	3
34	637.50	486.00	660.60	488.00	3
35	660.60	488.00	708.10	490.00	3
36	708.10	490.00	777.80	494.00	3
37	777.80	494.00	804.30	496.00	3
38	804.30	496.00	886.10	504.00	3
39	886.10	504.00	914.10	505.30	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point	X-Water	Y-Water

No.	(ft)	(ft)
1	0.00	497.00
2	224.80	497.00
3	1039.80	478.70
4	1200.00	478.70

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 60.00 ft.
and X = 160.00 ft.
Each Surface Terminates Between X = 450.00 ft.
and X = 550.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.32	490.50
2	95.15	485.82
3	104.13	481.42
4	113.25	477.30
5	122.48	473.47
6	131.83	469.93
7	141.29	466.68
8	150.85	463.73
9	160.49	461.08
10	170.21	458.73
11	180.00	456.69
12	189.85	454.95
13	199.74	453.52
14	209.68	452.41
15	219.65	451.60
16	229.64	451.11
17	239.64	450.92
18	249.63	451.05
19	259.62	451.50
20	269.60	452.25
21	279.54	453.32
22	289.44	454.69
23	299.30	456.38
24	309.10	458.37
25	318.83	460.67
26	328.49	463.27
27	338.06	466.17
28	347.53	469.37
29	356.90	472.86
30	366.16	476.65
31	375.29	480.72
32	384.30	485.07
33	393.16	489.71
34	401.87	494.62
35	410.42	499.79
36	418.81	505.24
37	427.03	510.94
38	435.06	516.90
39	442.90	523.10
40	450.54	529.55
41	457.98	536.23
42	465.21	543.14
43	472.22	550.28
44	479.00	557.63
45	485.55	565.19
46	491.85	572.95
47	497.92	580.90

48 502.99 588.00
Circle Center At X = 240.5 ; Y = 770.9 and Radius, 319.9
*** 1.835 ***
Individual data on the 63 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.8	1861.1	3584.4	5516.2	0.0	0.0	0.0	0.0	0.0
2	9.0	5560.6	3642.0	8349.6	0.0	0.0	0.0	0.0	0.0
3	9.1	9136.8	3696.0	11007.9	0.0	0.0	0.0	0.0	0.0
4	9.2	12566.2	3746.4	13488.6	0.0	0.0	0.0	0.0	0.0
5	9.2	15465.2	3713.9	15436.9	0.0	0.0	0.0	0.0	0.0
6	0.2	361.2	79.2	352.2	0.0	0.0	0.0	0.0	0.0
7	9.5	19617.7	3836.2	17907.4	0.0	0.0	0.0	0.0	0.0
8	2.4	5644.2	976.8	4827.5	0.0	0.0	0.0	0.0	0.0
9	7.1	18596.9	2898.6	15013.6	0.0	0.0	0.0	0.0	0.0
10	9.6	29600.7	3910.9	21588.6	0.0	0.0	0.0	0.0	0.0
11	6.5	22719.8	2640.9	15343.4	0.0	0.0	0.0	0.0	0.0
12	3.2	11964.6	1301.7	7804.7	0.0	0.0	0.0	0.0	0.0
13	9.8	39387.3	3970.5	24518.0	0.0	0.0	0.0	0.0	0.0
14	9.5	42099.7	3853.8	24774.1	0.0	0.0	0.0	0.0	0.0
15	0.3	1604.1	140.6	922.8	0.0	0.0	0.0	0.0	0.0
16	9.9	47629.6	4014.5	26683.9	0.0	0.0	0.0	0.0	0.0
17	5.5	27692.5	2212.9	14999.5	0.0	0.0	0.0	0.0	0.0
18	4.5	23755.6	1696.1	12478.4	0.0	0.0	0.0	0.0	0.0
19	10.0	57046.0	2199.4	28078.2	0.0	0.0	0.0	0.0	0.0
20	5.1	31587.1	286.2	14623.0	0.0	0.0	0.0	0.0	0.0
21	0.0	62.8	0.0	28.5	0.0	0.0	0.0	0.0	0.0
22	3.2	20350.5	0.0	9133.9	0.0	0.0	0.0	0.0	0.0
23	1.6	10604.9	0.0	4678.7	0.0	0.0	0.0	0.0	0.0
24	4.2	27535.1	0.0	11891.2	0.0	0.0	0.0	0.0	0.0
25	5.0	39919.7	0.0	16650.9	0.0	0.0	0.0	0.0	0.0
26	10.0	71806.1	0.0	28426.1	0.0	0.0	0.0	0.0	0.0
27	10.0	75663.3	0.0	28107.4	0.0	0.0	0.0	0.0	0.0
28	10.0	79009.3	0.0	27593.9	0.0	0.0	0.0	0.0	0.0
29	9.9	81833.6	0.0	26886.6	0.0	0.0	0.0	0.0	0.0
30	9.9	84127.5	0.0	25985.7	0.0	0.0	0.0	0.0	0.0
31	9.9	85886.5	0.0	24892.4	0.0	0.0	0.0	0.0	0.0
32	9.8	87108.9	0.0	23607.7	0.0	0.0	0.0	0.0	0.0
33	9.7	87795.7	0.0	22132.9	0.0	0.0	0.0	0.0	0.0
34	9.7	87951.6	0.0	20469.3	0.0	0.0	0.0	0.0	0.0
35	9.6	87584.0	0.0	18618.6	0.0	0.0	0.0	0.0	0.0
36	9.3	85484.0	0.0	16363.9	0.0	0.0	0.0	0.0	0.0
37	0.1	1219.2	0.0	218.7	0.0	0.0	0.0	0.0	0.0
38	9.4	85310.9	0.0	14363.3	0.0	0.0	0.0	0.0	0.0
39	9.3	83424.8	0.0	11962.9	0.0	0.0	0.0	0.0	0.0
40	1.3	11846.7	0.0	1526.2	0.0	0.0	0.0	0.0	0.0
41	7.8	69165.0	0.0	7857.5	0.0	0.0	0.0	0.0	0.0
42	9.0	78045.0	0.0	6628.2	0.0	0.0	0.0	0.0	0.0
43	8.9	74653.8	0.0	3699.1	0.0	0.0	0.0	0.0	0.0
44	4.2	34858.4	0.0	689.7	0.0	0.0	0.0	0.0	0.0
45	1.8	14205.3	0.0	64.4	0.0	0.0	0.0	0.0	0.0
46	2.7	21826.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	8.6	67086.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.3	2433.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	8.1	60630.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	8.2	58750.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	8.0	54179.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	7.6	47931.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.2	1456.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	7.6	44414.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	7.4	39297.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	7.2	34079.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	7.0	28802.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	6.8	23508.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	6.5	18241.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	6.3	13045.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	5.9	7857.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	0.1	109.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

63 5.1 2340.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.84	490.50
2	105.65	485.76
3	114.61	481.32
4	123.71	477.17
5	132.94	473.34
6	142.30	469.81
7	151.77	466.60
8	161.34	463.70
9	171.00	461.13
10	180.75	458.88
11	190.56	456.95
12	200.43	455.36
13	210.35	454.09
14	220.31	453.16
15	230.29	452.56
16	240.29	452.29
17	250.29	452.36
18	260.28	452.76
19	270.25	453.49
20	280.20	454.56
21	290.10	455.95
22	299.95	457.68
23	309.73	459.73
24	319.45	462.11
25	329.08	464.81
26	338.61	467.83
27	348.03	471.17
28	357.34	474.82
29	366.53	478.78
30	375.57	483.04
31	384.47	487.60
32	393.21	492.46
33	401.79	497.61
34	410.19	503.04
35	418.40	508.74
36	426.42	514.72
37	434.23	520.96
38	441.83	527.46
39	449.21	534.21
40	456.36	541.20
41	463.27	548.42
42	469.94	555.87
43	476.36	563.54
44	482.52	571.42
45	488.41	579.50
46	493.12	586.44

Circle Center At X = 243.3 ; Y = 751.9 and Radius, 299.7

*** 1.837 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.11	490.50
2	110.80	485.55
3	119.65	480.91
4	128.67	476.58
5	137.82	472.56
6	147.12	468.87
7	156.53	465.49
8	166.06	462.45
9	175.68	459.74
10	185.39	457.36
11	195.18	455.32
12	205.04	453.62
13	214.95	452.27
14	224.90	451.26
15	234.87	450.59

16	244.87	450.27
17	254.87	450.30
18	264.86	450.68
19	274.84	451.40
20	284.78	452.47
21	294.68	453.88
22	304.52	455.63
23	314.30	457.72
24	324.00	460.15
25	333.61	462.92
26	343.12	466.02
27	352.52	469.44
28	361.79	473.19
29	370.92	477.26
30	379.91	481.64
31	388.74	486.33
32	397.40	491.33
33	405.89	496.62
34	414.18	502.21
35	422.28	508.07
36	430.17	514.22
37	437.84	520.63
38	445.29	527.31
39	452.49	534.24
40	459.46	541.42
41	466.17	548.83
42	472.62	556.47
43	478.80	564.34
44	484.70	572.41
45	490.32	580.68
46	494.18	586.80

Circle Center At X = 249.0 ; Y = 738.5 and Radius, 288.3

*** 1.837 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.58	490.50
2	100.29	485.60
3	109.17	480.99
4	118.20	476.69
5	127.36	472.69
6	136.66	469.01
7	146.08	465.64
8	155.60	462.60
9	165.23	459.88
10	174.94	457.48
11	184.72	455.42
12	194.57	453.69
13	204.47	452.29
14	214.41	451.23
15	224.39	450.50
16	234.38	450.12
17	244.38	450.07
18	254.38	450.36
19	264.36	450.99
20	274.31	451.95
21	284.22	453.26
22	294.09	454.89
23	303.89	456.86
24	313.63	459.16
25	323.27	461.79
26	332.83	464.75
27	342.28	468.02
28	351.61	471.61
29	360.81	475.52
30	369.88	479.74
31	378.80	484.26
32	387.56	489.08
33	396.16	494.19
34	404.57	499.59

35	412.80	505.27
36	420.83	511.23
37	428.66	517.46
38	436.27	523.95
39	443.65	530.69
40	450.81	537.68
41	457.72	544.90
42	464.38	552.36
43	470.79	560.04
44	476.94	567.93
45	482.81	576.02
46	488.41	584.31
47	488.86	585.03

Circle Center At X = 240.8 ; Y = 745.5 and Radius, 295.5

*** 1.837 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.32	490.50
2	95.23	485.96
3	104.28	481.70
4	113.45	477.73
5	122.75	474.04
6	132.15	470.65
7	141.66	467.54
8	151.26	464.74
9	160.94	462.23
10	170.69	460.03
11	180.51	458.13
12	190.38	456.54
13	200.30	455.26
14	210.25	454.28
15	220.23	453.62
16	230.22	453.26
17	240.22	453.22
18	250.22	453.49
19	260.20	454.07
20	270.16	454.95
21	280.09	456.15
22	289.98	457.66
23	299.81	459.47
24	309.59	461.59
25	319.29	464.01
26	328.91	466.74
27	338.44	469.76
28	347.88	473.07
29	357.20	476.68
30	366.41	480.57
31	375.50	484.75
32	384.45	489.22
33	393.26	493.95
34	401.91	498.96
35	410.41	504.24
36	418.73	509.77
37	426.88	515.57
38	434.85	521.61
39	442.63	527.90
40	450.20	534.43
41	457.57	541.19
42	464.72	548.18
43	471.66	555.38
44	478.36	562.80
45	484.84	570.42
46	491.07	578.24
47	497.05	586.25
48	498.28	588.00

Circle Center At X = 236.6 ; Y = 774.6 and Radius, 321.4

*** 1.838 ***

Failure Surface Specified By 46 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	107.37	490.50
2	116.13	485.68
3	125.05	481.17
4	134.13	476.97
5	143.35	473.08
6	152.69	469.52
7	162.15	466.29
8	171.72	463.38
9	181.38	460.81
10	191.13	458.57
11	200.95	456.68
12	210.83	455.12
13	220.75	453.91
14	230.72	453.04
15	240.70	452.52
16	250.70	452.35
17	260.70	452.52
18	270.69	453.04
19	280.65	453.91
20	290.58	455.12
21	300.45	456.67
22	310.27	458.56
23	320.02	460.80
24	329.68	463.37
25	339.25	466.27
26	348.72	469.51
27	358.06	473.07
28	367.28	476.95
29	376.35	481.15
30	385.28	485.66
31	394.04	490.48
32	402.63	495.60
33	411.04	501.01
34	419.25	506.71
35	427.27	512.69
36	435.07	518.95
37	442.65	525.47
38	449.99	532.26
39	457.10	539.29
40	463.96	546.57
41	470.57	554.08
42	476.91	561.81
43	482.97	569.76
44	488.76	577.91
45	494.27	586.26
46	494.70	586.97

Circle Center At X = 250.7 ; Y = 740.7 and Radius, 288.4

*** 1.840 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.11	490.50
2	110.77	485.52
3	119.62	480.84
4	128.62	476.49
5	137.78	472.47
6	147.07	468.77
7	156.49	465.42
8	166.02	462.40
9	175.66	459.72
10	185.38	457.39
11	195.18	455.41
12	205.05	453.79
13	214.97	452.52
14	224.93	451.60
15	234.91	451.05
16	244.91	450.85
17	254.91	451.01
18	264.89	451.53

19	274.86	452.40
20	284.78	453.64
21	294.65	455.22
22	304.46	457.16
23	314.20	459.45
24	323.84	462.09
25	333.39	465.07
26	342.82	468.40
27	352.13	472.06
28	361.30	476.05
29	370.32	480.36
30	379.18	485.00
31	387.87	489.95
32	396.37	495.21
33	404.68	500.77
34	412.79	506.62
35	420.68	512.77
36	428.35	519.19
37	435.78	525.88
38	442.96	532.83
39	449.90	540.04
40	456.57	547.49
41	462.96	555.18
42	469.08	563.09
43	474.91	571.21
44	480.45	579.54
45	482.53	582.92

Circle Center At X = 245.4 ; Y = 729.8 and Radius, 278.9

*** 1.840 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.05	490.50
2	89.96	485.95
3	99.00	481.67
4	108.16	477.68
5	117.45	473.96
6	126.84	470.54
7	136.34	467.41
8	145.93	464.57
9	155.60	462.02
10	165.35	459.78
11	175.15	457.84
12	185.02	456.19
13	194.93	454.86
14	204.88	453.83
15	214.85	453.10
16	224.84	452.68
17	234.84	452.57
18	244.84	452.77
19	254.83	453.28
20	264.79	454.09
21	274.73	455.21
22	284.63	456.63
23	294.48	458.36
24	304.27	460.39
25	313.99	462.72
26	323.64	465.35
27	333.21	468.28
28	342.67	471.49
29	352.04	475.00
30	361.29	478.79
31	370.42	482.87
32	379.42	487.22
33	388.29	491.85
34	397.00	496.76
35	405.57	501.92
36	413.96	507.35
37	422.19	513.03
38	430.24	518.97

39	438.10	525.15
40	445.77	531.56
41	453.24	538.22
42	460.50	545.09
43	467.54	552.19
44	474.37	559.50
45	480.96	567.02
46	487.32	574.74
47	493.44	582.64
48	497.18	587.79

Circle Center At X = 233.4 ; Y = 777.5 and Radius, 324.9

*** 1.840 ***

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.32	490.50
2	95.19	485.88
3	104.19	481.54
4	113.33	477.46
5	122.58	473.67
6	131.94	470.15
7	141.40	466.92
8	150.96	463.97
9	160.60	461.31
10	170.31	458.95
11	180.10	456.88
12	189.94	455.10
13	199.83	453.62
14	209.76	452.44
15	219.72	451.56
16	229.70	450.99
17	239.70	450.71
18	249.70	450.73
19	259.69	451.05
20	269.67	451.68
21	279.63	452.61
22	289.56	453.83
23	299.44	455.36
24	309.27	457.18
25	319.05	459.29
26	328.75	461.70
27	338.38	464.40
28	347.92	467.39
29	357.37	470.67
30	366.71	474.23
31	375.95	478.07
32	385.06	482.19
33	394.05	486.57
34	402.90	491.23
35	411.60	496.15
36	420.15	501.34
37	428.55	506.77
38	436.77	512.46
39	444.82	518.39
40	452.69	524.57
41	460.37	530.97
42	467.85	537.61
43	475.13	544.47
44	482.19	551.54
45	489.05	558.82
46	495.67	566.31
47	502.08	573.99
48	508.24	581.87
49	512.75	588.00

Circle Center At X = 243.9 ; Y = 782.5 and Radius, 331.9

*** 1.840 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.58	490.50

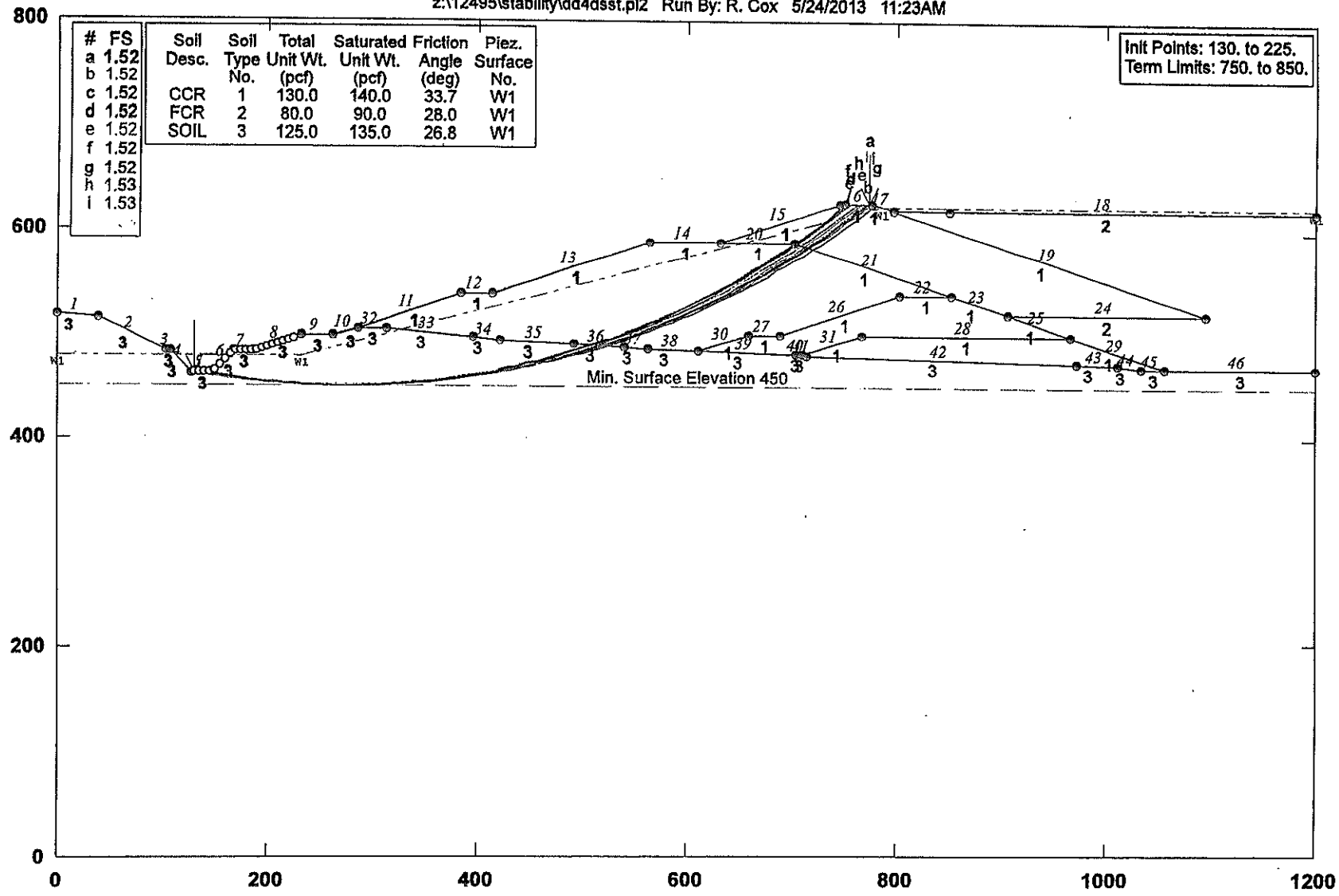
2	100.27	485.55
3	109.12	480.91
4	118.14	476.57
5	127.30	472.56
6	136.59	468.86
7	146.00	465.50
8	155.53	462.46
9	165.16	459.76
10	174.88	457.39
11	184.67	455.37
12	194.53	453.68
13	204.44	452.35
14	214.39	451.35
15	224.37	450.71
16	234.36	450.41
17	244.36	450.47
18	254.35	450.87
19	264.33	451.62
20	274.27	452.72
21	284.16	454.16
22	294.00	455.95
23	303.77	458.08
24	313.46	460.54
25	323.06	463.35
26	332.55	466.49
27	341.93	469.96
28	351.19	473.75
29	360.30	477.86
30	369.27	482.29
31	378.07	487.03
32	386.71	492.07
33	395.17	497.41
34	403.43	503.04
35	411.49	508.96
36	419.34	515.15
37	426.97	521.61
38	434.37	528.34
39	441.53	535.32
40	448.45	542.54
41	455.10	550.01
42	461.50	557.70
43	467.62	565.60
44	473.46	573.72
45	478.77	581.67

Circle Center At X = 237.8 ; Y = 737.1 and Radius, 286.7

*** 1.840 ***

Section D-D Phase 12 Downstream Static Deep Circle

z:\12495\stability\dd4dsst.pl2 Run By: R. Cox 5/24/2013 11:23AM



PCSTABL5M/si FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:23AM
Run By: R. Cox
Input Data Filename: Z:dd4dsst.
Output Filename: Z:dd4dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd4dsst.PLT
PROBLEM DESCRIPTION Section D-D Phase 12
Downstream Static Deep Circle

BOUNDARY COORDINATES
18 Top Boundaries
46 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	517.05	39.25	514.70	3
2	39.25	514.70	103.20	482.74	3
3	103.20	482.74	108.20	482.74	3
4	108.20	482.74	128.21	462.74	3
5	128.21	462.74	148.21	462.74	3
6	148.21	462.74	168.22	482.75	3
7	168.22	482.75	188.23	482.75	3
8	188.23	482.75	232.87	497.64	3
9	232.87	497.64	262.86	497.64	3
10	262.86	497.64	285.90	503.33	3
11	285.90	503.33	383.76	538.00	1
12	383.76	538.00	413.77	538.00	1
13	413.77	538.00	563.77	588.00	1
14	563.77	588.00	631.34	588.00	1
15	631.34	588.00	746.21	626.00	1
16	746.21	626.00	776.22	626.00	1
17	776.22	626.00	796.62	619.20	1
18	796.62	619.20	1200.00	619.20	2
19	796.62	619.20	1094.27	520.00	1
20	631.34	588.00	702.20	588.00	1
21	702.20	588.00	852.60	538.00	1
22	802.59	538.00	852.60	538.00	1
23	852.60	538.00	906.43	520.00	1
24	906.43	520.00	1094.27	520.00	2
25	906.43	520.00	966.24	500.00	1
26	688.57	500.00	802.59	538.00	1
27	658.57	500.00	688.57	500.00	1
28	766.01	500.00	966.24	500.00	1
29	966.24	500.00	1056.27	470.00	1
30	610.43	483.96	658.57	500.00	1
31	708.86	480.89	766.01	500.00	1
32	285.90	503.33	313.92	504.00	3
33	313.92	504.00	395.72	496.00	3
34	395.72	496.00	422.17	494.00	3
35	422.17	494.00	491.87	490.00	3
36	491.87	490.00	539.43	488.00	3
37	539.43	488.00	562.48	486.00	3
38	562.48	486.00	610.43	483.96	3
39	610.43	483.96	703.22	482.00	3
40	703.22	482.00	708.86	480.89	3
41	708.86	480.89	713.40	480.00	3
42	713.40	480.00	972.01	474.00	3
43	972.01	474.00	1010.48	472.00	3
44	1010.48	472.00	1032.98	470.00	3
45	1032.98	470.00	1056.27	470.00	3
46	1056.27	470.00	1200.00	470.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	478.74
2	232.86	478.74
3	785.22	623.00
4	1200.00	623.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 130.00 ft.
and X = 225.00 ft.
Each Surface Terminates Between X = 750.00 ft.
and X = 850.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.85	461.04
3	149.73	459.46
4	159.62	458.01
5	169.53	456.67
6	179.46	455.47
7	189.40	454.38
8	199.36	453.42
9	209.32	452.58
10	219.30	451.87
11	229.28	451.28
12	239.27	450.82
13	249.26	450.48
14	259.26	450.27
15	269.26	450.18
16	279.26	450.21
17	289.26	450.37
18	299.25	450.65
19	309.24	451.06
20	319.23	451.59
21	329.21	452.25
22	339.18	453.03
23	349.14	453.94
24	359.08	454.97
25	369.02	456.12
26	378.94	457.40
27	388.84	458.80
28	398.72	460.32
29	408.58	461.97
30	418.43	463.73
31	428.25	465.63
32	438.04	467.64
33	447.81	469.77
34	457.55	472.03
35	467.27	474.41
36	476.95	476.91
37	486.60	479.53
38	496.22	482.27
39	505.80	485.12

40	515.35	488.10
41	524.85	491.20
42	534.32	494.41
43	543.75	497.75
44	553.14	501.20
45	562.48	504.76
46	571.78	508.44
47	581.03	512.24
48	590.23	516.15
49	599.39	520.18
50	608.49	524.32
51	617.54	528.58
52	626.53	532.94
53	635.48	537.42
54	644.36	542.01
55	653.19	546.71
56	661.96	551.52
57	670.66	556.43
58	679.31	561.46
59	687.89	566.59
60	696.41	571.83
61	704.86	577.18
62	713.24	582.63
63	721.56	588.18
64	729.81	593.84
65	737.98	599.60
66	746.08	605.46
67	754.11	611.42
68	762.07	617.48
69	769.94	623.64
70	772.89	626.00

Circle Center At X = 271.5 ; Y = 1253.0 and Radius, 802.8

*** 1.521 ***

Individual data on the 91 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	1131.4	9838.5	10514.7	0.0	0.0	0.0	0.0	0.0
2	8.4	2671.7	8341.8	9698.3	0.0	0.0	0.0	0.0	0.0
3	1.5	803.6	2043.6	1839.5	0.0	0.0	0.0	0.0	0.0
4	9.9	13987.9	8323.7	12484.1	0.0	0.0	0.0	0.0	0.0
5	8.6	24399.1	218.9	11535.3	0.0	0.0	0.0	0.0	0.0
6	1.3	4557.2	0.0	1818.2	0.0	0.0	0.0	0.0	0.0
7	9.9	35355.7	0.0	14145.9	0.0	0.0	0.0	0.0	0.0
8	8.8	32514.4	0.0	13074.2	0.0	0.0	0.0	0.0	0.0
9	1.2	4459.2	0.0	1786.9	0.0	0.0	0.0	0.0	0.0
10	10.0	40917.9	0.0	15499.2	0.0	0.0	0.0	0.0	0.0
11	10.0	46310.6	0.0	16059.8	0.0	0.0	0.0	0.0	0.0
12	10.0	51544.5	0.0	16543.0	0.0	0.0	0.0	0.0	0.0
13	10.0	56615.7	0.0	16948.6	0.0	0.0	0.0	0.0	0.0
14	3.6	21511.2	0.0	6162.2	0.0	0.0	0.0	0.0	0.0
15	0.0	60.9	0.0	16.7	0.0	0.0	0.0	0.0	0.0
16	6.4	39090.9	0.0	11067.1	0.0	0.0	0.0	0.0	0.0
17	10.0	61707.5	0.0	18766.8	0.0	0.0	0.0	0.0	0.0
18	10.0	62354.4	0.0	20511.1	0.0	0.0	0.0	0.0	0.0
19	3.6	22580.5	0.0	7799.4	0.0	0.0	0.0	0.0	0.0
20	6.4	40875.7	0.0	14381.2	0.0	0.0	0.0	0.0	0.0
21	10.0	66635.3	0.0	23775.0	0.0	0.0	0.0	0.0	0.0
22	6.6	46038.6	0.0	16635.8	0.0	0.0	0.0	0.0	0.0
23	3.4	23882.7	0.0	8658.4	0.0	0.0	0.0	0.0	0.0
24	10.0	74115.1	0.0	26737.7	0.0	0.0	0.0	0.0	0.0
25	10.0	78457.3	0.0	28105.6	0.0	0.0	0.0	0.0	0.0
26	4.7	38164.2	0.0	13606.8	0.0	0.0	0.0	0.0	0.0
27	5.3	44457.5	0.0	15790.6	0.0	0.0	0.0	0.0	0.0
28	6.1	52330.3	0.0	18517.8	0.0	0.0	0.0	0.0	0.0
29	3.9	34312.7	0.0	12095.3	0.0	0.0	0.0	0.0	0.0
30	10.0	90479.5	0.0	31752.4	0.0	0.0	0.0	0.0	0.0
31	10.0	94123.3	0.0	32815.2	0.0	0.0	0.0	0.0	0.0
32	9.9	97572.1	0.0	33801.2	0.0	0.0	0.0	0.0	0.0

33	9.9	100824.9	0.0	34710.4	0.0	0.0	0.0	0.0	0.0
34	9.9	103879.8	0.0	35542.6	0.0	0.0	0.0	0.0	0.0
35	4.8	51633.8	0.0	17594.7	0.0	0.0	0.0	0.0	0.0
36	5.1	54508.5	0.0	18703.0	0.0	0.0	0.0	0.0	0.0
37	6.9	73185.1	0.0	25681.2	0.0	0.0	0.0	0.0	0.0
38	3.0	31646.2	0.0	11294.4	0.0	0.0	0.0	0.0	0.0
39	9.9	102802.5	0.0	37576.0	0.0	0.0	0.0	0.0	0.0
40	5.2	53259.4	0.0	20012.7	0.0	0.0	0.0	0.0	0.0
41	4.7	47809.7	0.0	18086.3	0.0	0.0	0.0	0.0	0.0
42	3.7	38765.4	0.0	14645.4	0.0	0.0	0.0	0.0	0.0
43	6.1	63530.1	0.0	23899.1	0.0	0.0	0.0	0.0	0.0
44	9.8	103900.4	0.0	38912.4	0.0	0.0	0.0	0.0	0.0
45	9.8	105307.5	0.0	39202.7	0.0	0.0	0.0	0.0	0.0
46	9.7	106517.0	0.0	39415.2	0.0	0.0	0.0	0.0	0.0
47	9.7	107530.6	0.0	39550.1	0.0	0.0	0.0	0.0	0.0
48	9.7	108347.8	0.0	39607.0	0.0	0.0	0.0	0.0	0.0
49	9.7	108970.6	0.0	39586.4	0.0	0.0	0.0	0.0	0.0
50	5.3	59860.3	0.0	21655.9	0.0	0.0	0.0	0.0	0.0
51	4.3	49538.6	0.0	17832.1	0.0	0.0	0.0	0.0	0.0
52	9.6	109629.3	0.0	39311.7	0.0	0.0	0.0	0.0	0.0
53	9.5	109668.0	0.0	39057.8	0.0	0.0	0.0	0.0	0.0
54	2.5	28499.2	0.0	10120.0	0.0	0.0	0.0	0.0	0.0
55	7.0	80972.9	0.0	28606.2	0.0	0.0	0.0	0.0	0.0
56	9.5	108972.1	0.0	38317.0	0.0	0.0	0.0	0.0	0.0
57	9.4	108277.4	0.0	37830.2	0.0	0.0	0.0	0.0	0.0
58	9.4	107396.0	0.0	37266.0	0.0	0.0	0.0	0.0	0.0
59	9.3	106330.7	0.0	36624.3	0.0	0.0	0.0	0.0	0.0
60	1.3	14618.6	0.0	5023.5	0.0	0.0	0.0	0.0	0.0
61	8.0	89076.4	0.0	30882.0	0.0	0.0	0.0	0.0	0.0
62	9.3	98595.6	0.0	35109.4	0.0	0.0	0.0	0.0	0.0
63	9.2	93342.6	0.0	34236.1	0.0	0.0	0.0	0.0	0.0
64	9.2	87977.8	0.0	33286.0	0.0	0.0	0.0	0.0	0.0
65	9.1	82506.3	0.0	32259.0	0.0	0.0	0.0	0.0	0.0
66	9.1	76934.5	0.0	31155.6	0.0	0.0	0.0	0.0	0.0
67	9.0	71267.1	0.0	29975.5	0.0	0.0	0.0	0.0	0.0
68	4.8	35880.1	0.0	15596.6	0.0	0.0	0.0	0.0	0.0
69	4.1	29998.6	0.0	13122.7	0.0	0.0	0.0	0.0	0.0
70	8.9	62949.0	0.0	27387.0	0.0	0.0	0.0	0.0	0.0
71	6.8	47026.8	0.0	20277.8	0.0	0.0	0.0	0.0	0.0
72	2.0	13345.8	0.0	5701.1	0.0	0.0	0.0	0.0	0.0
73	8.8	57657.6	0.0	24495.0	0.0	0.0	0.0	0.0	0.0
74	8.7	54808.4	0.0	22935.7	0.0	0.0	0.0	0.0	0.0
75	8.6	51830.6	0.0	21301.3	0.0	0.0	0.0	0.0	0.0
76	8.6	48728.4	0.0	19591.9	0.0	0.0	0.0	0.0	0.0
77	8.5	45507.4	0.0	17808.0	0.0	0.0	0.0	0.0	0.0
78	5.8	29232.1	0.0	11135.2	0.0	0.0	0.0	0.0	0.0
79	2.7	12940.5	0.0	4814.4	0.0	0.0	0.0	0.0	0.0
80	8.4	38729.8	0.0	14017.2	0.0	0.0	0.0	0.0	0.0
81	1.7	7461.8	0.0	2621.7	0.0	0.0	0.0	0.0	0.0
82	6.6	27722.3	0.0	9389.2	0.0	0.0	0.0	0.0	0.0
83	8.2	31541.4	0.0	9931.2	0.0	0.0	0.0	0.0	0.0
84	8.2	27807.4	0.0	7778.3	0.0	0.0	0.0	0.0	0.0
85	8.1	23988.2	0.0	5552.6	0.0	0.0	0.0	0.0	0.0
86	0.1	346.5	0.0	69.6	0.0	0.0	0.0	0.0	0.0
87	7.9	18400.7	0.0	3184.9	0.0	0.0	0.0	0.0	0.0
88	6.9	10834.6	0.0	905.2	0.0	0.0	0.0	0.0	0.0
89	1.1	1223.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	7.9	5570.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	2.9	451.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.86	461.05
3	149.73	459.47
4	159.63	458.03
5	169.54	456.70
6	179.47	455.50
7	189.41	454.42
8	199.36	453.47

9	209.33	452.64
10	219.30	451.94
11	229.29	451.36
12	239.28	450.90
13	249.27	450.57
14	259.27	450.37
15	269.27	450.28
16	279.27	450.33
17	289.27	450.50
18	299.26	450.79
19	309.25	451.21
20	319.24	451.75
21	329.22	452.42
22	339.18	453.21
23	349.14	454.12
24	359.09	455.16
25	369.02	456.33
26	378.94	457.61
27	388.84	459.03
28	398.72	460.56
29	408.58	462.22
30	418.42	464.00
31	428.24	465.90
32	438.03	467.93
33	447.80	470.08
34	457.54	472.34
35	467.25	474.73
36	476.93	477.25
37	486.57	479.88
38	496.19	482.63
39	505.77	485.50
40	515.31	488.49
41	524.81	491.60
42	534.28	494.83
43	543.70	498.18
44	553.08	501.64
45	562.42	505.22
46	571.71	508.92
47	580.96	512.73
48	590.15	516.66
49	599.30	520.70
50	608.39	524.85
51	617.44	529.12
52	626.43	533.50
53	635.36	538.00
54	644.24	542.60
55	653.06	547.31
56	661.82	552.14
57	670.52	557.07
58	679.15	562.11
59	687.73	567.26
60	696.23	572.51
61	704.68	577.87
62	713.05	583.34
63	721.36	588.91
64	729.59	594.58
65	737.75	600.36
66	745.85	606.23
67	753.86	612.21
68	761.81	618.29
69	769.67	624.46
70	771.58	626.00

Circle Center At X = 270.8 ; Y = 1251.8 and Radius, 801.5

*** 1.522 ***

Failure Surface Specified By 68 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.85	460.99
3	149.71	459.37

1	140.00	462.74
2	149.84	460.95
3	159.70	459.30
4	169.59	457.78
5	179.49	456.40
6	189.41	455.15
7	199.35	454.04
8	209.30	453.06
9	219.27	452.22
10	229.24	451.51
11	239.22	450.93
12	249.22	450.50
13	259.21	450.20
14	269.21	450.03
15	279.21	450.00
16	289.21	450.11
17	299.21	450.35
18	309.20	450.73
19	319.19	451.24
20	329.16	451.89
21	339.13	452.67
22	349.09	453.59
23	359.04	454.64
24	368.96	455.83
25	378.88	457.16
26	388.77	458.62
27	398.64	460.21
28	408.49	461.94
29	418.32	463.80
30	428.12	465.79
31	437.89	467.92
32	447.63	470.18
33	457.34	472.57
34	467.02	475.09
35	476.66	477.74
36	486.26	480.53
37	495.83	483.44
38	505.35	486.49
39	514.84	489.66
40	524.27	492.96
41	533.67	496.39
42	543.01	499.95
43	552.31	503.63
44	561.56	507.44
45	570.75	511.38
46	579.89	515.44
47	588.97	519.62
48	598.00	523.92
49	606.96	528.35
50	615.87	532.90
51	624.71	537.57
52	633.49	542.36
53	642.20	547.27
54	650.85	552.30
55	659.42	557.44
56	667.93	562.70
57	676.36	568.07
58	684.72	573.56
59	693.01	579.16
60	701.21	584.87
61	709.34	590.70
62	717.39	596.63
63	725.36	602.67
64	733.25	608.82
65	741.05	615.08
66	748.76	621.44
67	754.14	626.00

Circle Center At X = 276.4 ; Y = 1186.4 and Radius, 736.4

*** 1.523 ***

Failure Surface Specified By 68 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	145.00	462.74
2	154.84	460.98
3	164.71	459.34
4	174.60	457.84
5	184.50	456.47
6	194.43	455.24
7	204.36	454.13
8	214.32	453.16
9	224.28	452.32
10	234.26	451.62
11	244.24	451.04
12	254.23	450.61
13	264.23	450.30
14	274.22	450.13
15	284.22	450.09
16	294.22	450.18
17	304.22	450.41
18	314.21	450.77
19	324.20	451.26
20	334.18	451.89
21	344.15	452.65
22	354.11	453.54
23	364.06	454.56
24	373.99	455.72
25	383.91	457.01
26	393.81	458.43
27	403.69	459.99
28	413.54	461.67
29	423.38	463.49
30	433.19	465.44
31	442.97	467.51
32	452.72	469.72
33	462.44	472.06
34	472.14	474.53
35	481.79	477.12
36	491.41	479.85
37	501.00	482.70
38	510.54	485.68
39	520.05	488.79
40	529.51	492.03
41	538.93	495.39
42	548.30	498.87
43	557.63	502.48
44	566.90	506.21
45	576.13	510.07
46	585.30	514.05
47	594.42	518.15
48	603.49	522.38
49	612.50	526.72
50	621.45	531.18
51	630.33	535.77
52	639.16	540.47
53	647.92	545.28
54	656.62	550.22
55	665.25	555.27
56	673.82	560.43
57	682.31	565.71
58	690.73	571.10
59	699.08	576.60
60	707.36	582.22
61	715.56	587.94
62	723.68	593.77
63	731.73	599.71
64	739.69	605.76
65	747.58	611.91
66	755.38	618.17
67	763.09	624.53
68	764.83	626.00

Circle Center At X = 282.2 ; Y = 1200.1 and Radius, 750.0
*** 1.524 ***
Failure Surface Specified By 67 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.00	462.74
2	144.84	460.96
3	154.71	459.32
4	164.59	457.81
5	174.50	456.43
6	184.42	455.19
7	194.36	454.08
8	204.31	453.11
9	214.27	452.27
10	224.25	451.56
11	234.23	450.99
12	244.22	450.55
13	254.22	450.25
14	264.22	450.08
15	274.22	450.05
16	284.22	450.15
17	294.21	450.39
18	304.21	450.76
19	314.19	451.27
20	324.17	451.91
21	334.14	452.69
22	344.10	453.60
23	354.05	454.64
24	363.98	455.82
25	373.89	457.14
26	383.78	458.58
27	393.66	460.16
28	403.51	461.88
29	413.34	463.72
30	423.14	465.70
31	432.92	467.81
32	442.66	470.05
33	452.38	472.42
34	462.06	474.93
35	471.70	477.56
36	481.32	480.33
37	490.89	483.22
38	500.42	486.24
39	509.91	489.39
40	519.36	492.67
41	528.76	496.08
42	538.12	499.61
43	547.42	503.27
44	556.68	507.05
45	565.88	510.96
46	575.04	514.99
47	584.13	519.14
48	593.17	523.42
49	602.15	527.82
50	611.07	532.34
51	619.93	536.98
52	628.73	541.74
53	637.46	546.61
54	646.12	551.61
55	654.72	556.72
56	663.24	561.94
57	671.70	567.28
58	680.08	572.74
59	688.39	578.30
60	696.62	583.98
61	704.77	589.77
62	712.85	595.67
63	720.84	601.67
64	728.76	607.78
65	736.59	614.00

66	744.33	620.33
67	751.09	626.00

Circle Center At X = 271.6 ; Y = 1191.4 and Radius, 741.3

*** 1.524 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.00	462.74
2	144.86	461.06
3	154.74	459.50
4	164.63	458.07
5	174.55	456.75
6	184.48	455.56
7	194.42	454.49
8	204.37	453.55
9	214.34	452.72
10	224.31	452.02
11	234.30	451.45
12	244.29	450.99
13	254.28	450.66
14	264.28	450.45
15	274.28	450.36
16	284.28	450.40
17	294.28	450.56
18	304.27	450.85
19	314.27	451.25
20	324.25	451.78
21	334.23	452.44
22	344.20	453.21
23	354.16	454.11
24	364.11	455.13
25	374.04	456.27
26	383.96	457.54
27	393.86	458.93
28	403.75	460.44
29	413.62	462.07
30	423.46	463.82
31	433.28	465.69
32	443.08	467.69
33	452.86	469.80
34	462.60	472.04
35	472.32	474.40
36	482.01	476.87
37	491.67	479.46
38	501.29	482.18
39	510.89	485.01
40	520.44	487.96
41	529.96	491.02
42	539.44	494.21
43	548.88	497.51
44	558.28	500.92
45	567.63	504.45
46	576.94	508.10
47	586.21	511.86
48	595.43	515.74
49	604.60	519.72
50	613.72	523.82
51	622.79	528.04
52	631.81	532.36
53	640.77	536.80
54	649.68	541.34
55	658.53	545.99
56	667.32	550.76
57	676.05	555.63
58	684.73	560.61
59	693.34	565.69
60	701.89	570.88
61	710.37	576.17
62	718.79	581.57
63	727.14	587.08

64	735.42	592.68
65	743.63	598.39
66	751.77	604.19
67	759.84	610.10
68	767.84	616.11
69	775.76	622.21
70	779.27	624.98

Circle Center At X = 276.2 ; Y = 1262.2 and Radius, 811.8

*** 1.524 ***

Failure Surface Specified By 68 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.00	462.74
2	144.85	461.04
3	154.73	459.46
4	164.62	458.01
5	174.54	456.69
6	184.46	455.50
7	194.41	454.44
8	204.36	453.50
9	214.33	452.70
10	224.31	452.02
11	234.29	451.47
12	244.29	451.06
13	254.28	450.77
14	264.28	450.61
15	274.28	450.58
16	284.28	450.68
17	294.28	450.91
18	304.27	451.27
19	314.26	451.76
20	324.24	452.37
21	334.21	453.12
22	344.17	454.00
23	354.12	455.00
24	364.06	456.14
25	373.98	457.40
26	383.88	458.79
27	393.77	460.31
28	403.63	461.95
29	413.47	463.73
30	423.29	465.63
31	433.08	467.66
32	442.84	469.81
33	452.58	472.09
34	462.29	474.50
35	471.96	477.03
36	481.60	479.69
37	491.21	482.47
38	500.78	485.37
39	510.31	488.40
40	519.80	491.56
41	529.24	494.83
42	538.65	498.23
43	548.01	501.75
44	557.32	505.39
45	566.59	509.15
46	575.81	513.03
47	584.97	517.03
48	594.09	521.14
49	603.14	525.38
50	612.15	529.73
51	621.09	534.20
52	629.98	538.78
53	638.81	543.48
54	647.58	548.29
55	656.28	553.22
56	664.92	558.25
57	673.49	563.40
58	682.00	568.66

59	690.43	574.03
60	698.80	579.51
61	707.09	585.09
62	715.32	590.79
63	723.46	596.58
64	731.53	602.49
65	739.53	608.50
66	747.44	614.61
67	755.28	620.82
68	761.65	626.00

Circle Center At X = 271.5 ; Y = 1222.9 and Radius, 772.3

*** 1.525 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.00	462.74
2	144.86	461.07
3	154.74	459.52
4	164.64	458.09
5	174.55	456.79
6	184.48	455.61
7	194.43	454.55
8	204.38	453.62
9	214.35	452.81
10	224.33	452.13
11	234.31	451.57
12	244.30	451.14
13	254.30	450.83
14	264.29	450.64
15	274.29	450.58
16	284.29	450.64
17	294.29	450.83
18	304.29	451.14
19	314.28	451.58
20	324.26	452.14
21	334.24	452.82
22	344.21	453.63
23	354.16	454.57
24	364.11	455.63
25	374.04	456.81
26	383.95	458.11
27	393.85	459.54
28	403.73	461.09
29	413.59	462.77
30	423.42	464.56
31	433.24	466.48
32	443.03	468.52
33	452.79	470.69
34	462.52	472.97
35	472.23	475.38
36	481.91	477.91
37	491.55	480.55
38	501.16	483.32
39	510.73	486.20
40	520.27	489.21
41	529.77	492.33
42	539.23	495.58
43	548.65	498.94
44	558.03	502.41
45	567.36	506.00
46	576.65	509.71
47	585.89	513.54
48	595.08	517.48
49	604.22	521.53
50	613.31	525.70
51	622.35	529.98
52	631.33	534.37
53	640.26	538.87
54	649.13	543.49
55	657.94	548.21

56	666.70	553.04
57	675.39	557.99
58	684.02	563.04
59	692.59	568.20
60	701.09	573.46
61	709.53	578.83
62	717.90	584.30
63	726.20	589.88
64	734.43	595.56
65	742.59	601.34
66	750.67	607.23
67	758.68	613.21
68	766.62	619.29
69	774.48	625.48
70	775.13	626.00

Circle Center At X = 274.2 ; Y = 1253.5 and Radius, 802.9

*** 1.525 ***

Failure Surface Specified By 70 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	462.74
2	139.86	461.09
3	149.75	459.57
4	159.65	458.17
5	169.57	456.89
6	179.50	455.73
7	189.45	454.70
8	199.40	453.79
9	209.37	453.00
10	219.35	452.34
11	229.34	451.80
12	239.33	451.39
13	249.32	451.10
14	259.32	450.93
15	269.32	450.89
16	279.32	450.97
17	289.32	451.17
18	299.31	451.50
19	309.30	451.95
20	319.29	452.53
21	329.26	453.23
22	339.23	454.06
23	349.18	455.00
24	359.13	456.07
25	369.05	457.27
26	378.97	458.59
27	388.86	460.03
28	398.74	461.59
29	408.60	463.27
30	418.43	465.08
31	428.25	467.01
32	438.03	469.06
33	447.79	471.23
34	457.53	473.52
35	467.23	475.94
36	476.91	478.47
37	486.55	481.12
38	496.16	483.90
39	505.73	486.79
40	515.26	489.80
41	524.76	492.93
42	534.22	496.17
43	543.64	499.53
44	553.02	503.01
45	562.35	506.61
46	571.63	510.32
47	580.87	514.14
48	590.06	518.08
49	599.21	522.13
50	608.30	526.30

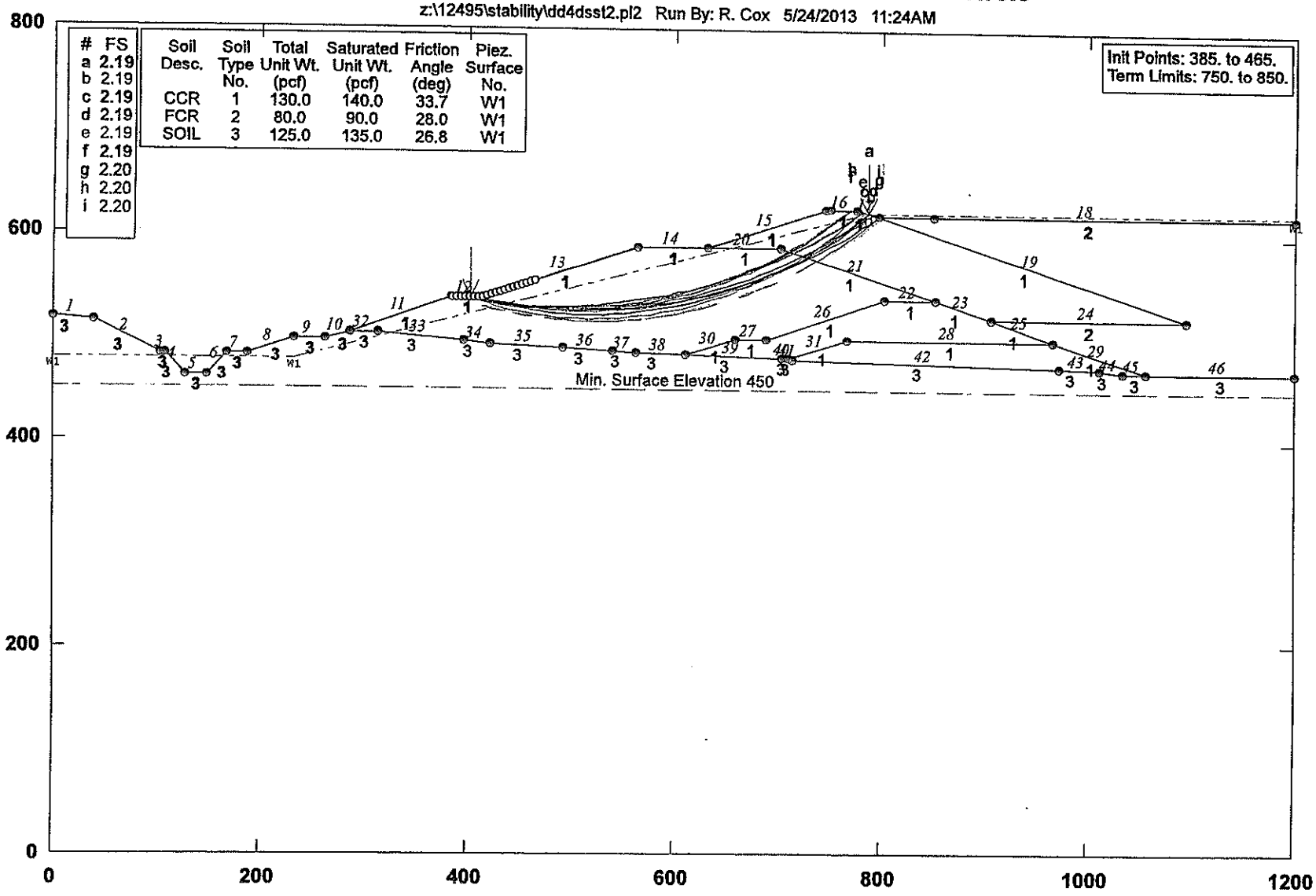
51	617.34	530.58
52	626.32	534.97
53	635.25	539.47
54	644.12	544.08
55	652.94	548.80
56	661.69	553.63
57	670.39	558.57
58	679.02	563.62
59	687.59	568.77
60	696.10	574.03
61	704.54	579.39
62	712.91	584.86
63	721.22	590.43
64	729.45	596.10
65	737.62	601.88
66	745.71	607.76
67	753.72	613.73
68	761.67	619.81
69	769.54	625.98
70	769.56	626.00

Circle Center At X = 267.8 ; Y = 1257.4 and Radius, 806.5

*** 1.525 ***

Section D-D Phase 12 Downstream Static Shallow Circle

z:\12495\stability\dd4dsst2.pl2 Run By: R. Cox 5/24/2013 11:24AM



PCSTABL5M/si FSmin=2.19

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:24AM
Run By: R. Cox
Input Data Filename: Z:dd4dsst2.
Output Filename: Z:dd4dsst2.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd4dsst2.PLT
PROBLEM DESCRIPTION Section D-D Phase 12
Downstream Static Shallow Circle

BOUNDARY COORDINATES
18 Top Boundaries
46 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	517.05	39.25	514.70	3
2	39.25	514.70	103.20	482.74	3
3	103.20	482.74	108.20	482.74	3
4	108.20	482.74	128.21	462.74	3
5	128.21	462.74	148.21	462.74	3
6	148.21	462.74	168.22	482.75	3
7	168.22	482.75	188.23	482.75	3
8	188.23	482.75	232.87	497.64	3
9	232.87	497.64	262.86	497.64	3
10	262.86	497.64	285.90	503.33	3
11	285.90	503.33	383.76	538.00	1
12	383.76	538.00	413.77	538.00	1
13	413.77	538.00	563.77	588.00	1
14	563.77	588.00	631.34	588.00	1
15	631.34	588.00	746.21	626.00	1
16	746.21	626.00	776.22	626.00	1
17	776.22	626.00	796.62	619.20	1
18	796.62	619.20	1200.00	619.20	2
19	796.62	619.20	1094.27	520.00	1
20	631.34	588.00	702.20	588.00	1
21	702.20	588.00	852.60	538.00	1
22	802.59	538.00	852.60	538.00	1
23	852.60	538.00	906.43	520.00	1
24	906.43	520.00	1094.27	520.00	2
25	906.43	520.00	966.24	500.00	1
26	688.57	500.00	802.59	538.00	1
27	658.57	500.00	688.57	500.00	1
28	766.01	500.00	966.24	500.00	1
29	966.24	500.00	1056.27	470.00	1
30	610.43	483.96	658.57	500.00	1
31	708.86	480.89	766.01	500.00	1
32	285.90	503.33	313.92	504.00	3
33	313.92	504.00	395.72	496.00	3
34	395.72	496.00	422.17	494.00	3
35	422.17	494.00	491.87	490.00	3
36	491.87	490.00	539.43	488.00	3
37	539.43	488.00	562.48	486.00	3
38	562.48	486.00	610.43	483.96	3
39	610.43	483.96	703.22	482.00	3
40	703.22	482.00	708.86	480.89	3
41	708.86	480.89	713.40	480.00	3
42	713.40	480.00	972.01	474.00	3
43	972.01	474.00	1010.48	472.00	3
44	1010.48	472.00	1032.98	470.00	3
45	1032.98	470.00	1056.27	470.00	3
46	1056.27	470.00	1200.00	470.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	478.74
2	232.86	478.74
3	785.22	623.00
4	1200.00	623.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 385.00 ft.
and X = 465.00 ft.
Each Surface Terminates Between X = 750.00 ft.
and X = 850.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	401.84	538.00
2	411.50	535.40
3	421.22	533.04
4	430.99	530.91
5	440.81	529.02
6	450.67	527.36
7	460.57	525.93
8	470.49	524.74
9	480.45	523.80
10	490.42	523.09
11	500.41	522.62
12	510.41	522.38
13	520.41	522.39
14	530.41	522.64
15	540.40	523.12
16	550.37	523.85
17	560.32	524.81
18	570.25	526.01
19	580.15	527.45
20	590.01	529.13
21	599.82	531.04
22	609.59	533.18
23	619.30	535.56
24	628.95	538.17
25	638.54	541.01
26	648.06	544.08
27	657.50	547.38
28	666.86	550.90
29	676.13	554.64
30	685.31	558.60
31	694.40	562.79
32	703.38	567.19
33	712.25	571.80
34	721.01	576.62
35	729.65	581.66
36	738.17	586.89
37	746.56	592.33
38	754.82	597.97
39	762.94	603.81

40	770.92	609.84
41	778.75	616.05
42	786.43	622.46
43	786.55	622.56

Circle Center At X = 515.1 ; Y = 940.2 and Radius, 417.8

*** 2.188 ***

Individual data on the 52 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	1629.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2.3	847.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	7.4	5125.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	9.8	12872.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.9	1594.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	8.9	18251.2	0.0	1102.0	0.0	0.0	0.0	0.0	0.0
7	9.9	26829.1	0.0	3716.1	0.0	0.0	0.0	0.0	0.0
8	9.9	33546.4	0.0	6206.3	0.0	0.0	0.0	0.0	0.0
9	9.9	39977.0	0.0	8558.8	0.0	0.0	0.0	0.0	0.0
10	10.0	46103.2	0.0	10772.1	0.0	0.0	0.0	0.0	0.0
11	10.0	51908.9	0.0	12845.2	0.0	0.0	0.0	0.0	0.0
12	10.0	57379.1	0.0	14776.7	0.0	0.0	0.0	0.0	0.0
13	10.0	62499.9	0.0	16565.5	0.0	0.0	0.0	0.0	0.0
14	10.0	67258.9	0.0	18210.7	0.0	0.0	0.0	0.0	0.0
15	10.0	71644.9	0.0	19711.3	0.0	0.0	0.0	0.0	0.0
16	10.0	75648.1	0.0	21066.5	0.0	0.0	0.0	0.0	0.0
17	10.0	79260.3	0.0	22275.4	0.0	0.0	0.0	0.0	0.0
18	10.0	82474.3	0.0	23337.4	0.0	0.0	0.0	0.0	0.0
19	3.4	29290.9	0.0	8326.0	0.0	0.0	0.0	0.0	0.0
20	6.5	55083.6	0.0	15925.8	0.0	0.0	0.0	0.0	0.0
21	9.9	82786.3	0.0	25018.2	0.0	0.0	0.0	0.0	0.0
22	9.9	80576.7	0.0	25636.1	0.0	0.0	0.0	0.0	0.0
23	9.8	78012.1	0.0	26105.1	0.0	0.0	0.0	0.0	0.0
24	9.8	75101.8	0.0	26425.0	0.0	0.0	0.0	0.0	0.0
25	9.7	71856.7	0.0	26595.6	0.0	0.0	0.0	0.0	0.0
26	9.7	68288.7	0.0	26616.8	0.0	0.0	0.0	0.0	0.0
27	2.4	16357.6	0.0	6608.7	0.0	0.0	0.0	0.0	0.0
28	7.2	49168.8	0.0	19879.8	0.0	0.0	0.0	0.0	0.0
29	9.5	65134.2	0.0	26211.0	0.0	0.0	0.0	0.0	0.0
30	3.1	21531.5	0.0	8651.4	0.0	0.0	0.0	0.0	0.0
31	6.3	42960.0	0.0	17132.9	0.0	0.0	0.0	0.0	0.0
32	9.4	63484.7	0.0	25208.5	0.0	0.0	0.0	0.0	0.0
33	9.3	62124.3	0.0	24484.3	0.0	0.0	0.0	0.0	0.0
34	9.2	60420.7	0.0	23611.7	0.0	0.0	0.0	0.0	0.0
35	9.1	58387.4	0.0	22591.6	0.0	0.0	0.0	0.0	0.0
36	7.8	48790.6	0.0	18684.2	0.0	0.0	0.0	0.0	0.0
37	1.2	7246.9	0.0	2740.2	0.0	0.0	0.0	0.0	0.0
38	8.9	53386.2	0.0	20110.6	0.0	0.0	0.0	0.0	0.0
39	8.8	50449.6	0.0	18651.2	0.0	0.0	0.0	0.0	0.0
40	5.6	30926.4	0.0	11239.9	0.0	0.0	0.0	0.0	0.0
41	3.0	16318.9	0.0	5807.0	0.0	0.0	0.0	0.0	0.0
42	8.5	43791.4	0.0	15298.7	0.0	0.0	0.0	0.0	0.0
43	8.0	38491.4	0.0	12885.4	0.0	0.0	0.0	0.0	0.0
44	0.4	1613.3	0.0	522.1	0.0	0.0	0.0	0.0	0.0
45	8.3	34622.8	0.0	11374.5	0.0	0.0	0.0	0.0	0.0
46	8.1	27707.1	0.0	9200.8	0.0	0.0	0.0	0.0	0.0
47	8.0	20774.3	0.0	6887.7	0.0	0.0	0.0	0.0	0.0
48	5.3	10100.3	0.0	3277.9	0.0	0.0	0.0	0.0	0.0
49	2.5	3611.8	0.0	1158.6	0.0	0.0	0.0	0.0	0.0
50	6.5	4694.9	0.0	1733.1	0.0	0.0	0.0	0.0	0.0
51	1.2	144.1	16.1	103.6	0.0	0.0	0.0	0.0	0.0
52	0.1	1.1	3.2	4.8	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	406.05	538.00
2	415.85	536.01
3	425.69	534.22
4	435.57	532.65

5	445.47	531.29
6	455.41	530.14
7	465.36	529.20
8	475.34	528.47
9	485.32	527.96
10	495.32	527.66
11	505.32	527.57
12	515.32	527.70
13	525.31	528.03
14	535.30	528.59
15	545.27	529.35
16	555.22	530.33
17	565.15	531.52
18	575.05	532.92
19	584.92	534.53
20	594.75	536.35
21	604.54	538.38
22	614.29	540.62
23	623.99	543.06
24	633.63	545.72
25	643.21	548.57
26	652.73	551.63
27	662.19	554.89
28	671.57	558.36
29	680.87	562.02
30	690.10	565.88
31	699.24	569.94
32	708.29	574.19
33	717.25	578.63
34	726.11	583.26
35	734.87	588.08
36	743.53	593.09
37	752.08	598.27
38	760.51	603.64
39	768.83	609.19
40	777.03	614.92
41	785.11	620.82
42	787.13	622.36

Circle Center At X = 504.4 ; Y = 996.5 and Radius, 469.0

*** 2.190 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	385.00	538.00
2	394.86	536.31
3	404.74	534.80
4	414.65	533.48
5	424.59	532.34
6	434.54	531.40
7	444.52	530.64
8	454.50	530.07
9	464.49	529.70
10	474.49	529.51
11	484.49	529.51
12	494.49	529.69
13	504.48	530.07
14	514.47	530.64
15	524.44	531.39
16	534.39	532.34
17	544.33	533.47
18	554.24	534.79
19	564.13	536.30
20	573.98	537.99
21	583.80	539.87
22	593.59	541.94
23	603.33	544.19
24	613.03	546.62
25	622.68	549.24
26	632.28	552.03
27	641.83	555.01

28	651.32	558.17
29	660.74	561.51
30	670.10	565.03
31	679.40	568.72
32	688.62	572.59
33	697.77	576.63
34	706.83	580.85
35	715.82	585.23
36	724.72	589.79
37	733.54	594.51
38	742.26	599.39
39	750.89	604.45
40	759.43	609.66
41	767.86	615.03
42	776.19	620.57
43	781.50	624.24

Circle Center At X = 479.5 ; Y = 1058.2 and Radius, 528.7

*** 2.191 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	406.05	538.00
2	415.80	535.76
3	425.59	533.74
4	435.43	531.93
5	445.30	530.34
6	455.21	528.98
7	465.14	527.83
8	475.10	526.90
9	485.07	526.20
10	495.06	525.71
11	505.06	525.45
12	515.06	525.41
13	525.06	525.59
14	535.05	525.99
15	545.03	526.62
16	554.99	527.46
17	564.94	528.53
18	574.85	529.82
19	584.74	531.32
20	594.59	533.05
21	604.40	534.99
22	614.16	537.15
23	623.88	539.53
24	633.53	542.12
25	643.13	544.92
26	652.67	547.94
27	662.13	551.17
28	671.52	554.61
29	680.83	558.25
30	690.06	562.10
31	699.20	566.15
32	708.25	570.41
33	717.21	574.86
34	726.06	579.52
35	734.80	584.37
36	743.44	589.41
37	751.96	594.64
38	760.37	600.06
39	768.65	605.66
40	776.81	611.45
41	784.83	617.41
42	789.97	621.42

Circle Center At X = 511.9 ; Y = 976.1 and Radius, 450.7

*** 2.193 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	397.63	538.00
2	407.15	534.92

3	416.74	532.09
4	426.40	529.53
5	436.13	527.22
6	445.92	525.17
7	455.76	523.38
8	465.64	521.86
9	475.56	520.61
10	485.52	519.61
11	495.49	518.89
12	505.48	518.43
13	515.48	518.24
14	525.48	518.32
15	535.47	518.66
16	545.45	519.27
17	555.41	520.15
18	565.35	521.29
19	575.25	522.70
20	585.11	524.37
21	594.92	526.30
22	604.67	528.50
23	614.37	530.96
24	623.99	533.67
25	633.54	536.64
26	643.01	539.87
27	652.38	543.35
28	661.66	547.07
29	670.84	551.05
30	679.91	555.26
31	688.86	559.72
32	697.69	564.42
33	706.39	569.35
34	714.95	574.51
35	723.38	579.90
36	731.65	585.51
37	739.78	591.34
38	747.74	597.38
39	755.55	603.64
40	763.18	610.10
41	770.63	616.76
42	777.91	623.63
43	779.27	624.98

Circle Center At X = 517.6 ; Y = 892.3 and Radius, 374.1

*** 2.193 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	397.63	538.00
2	407.39	535.81
3	417.19	533.85
4	427.04	532.11
5	436.93	530.62
6	446.85	529.35
7	456.80	528.32
8	466.77	527.52
9	476.75	526.96
10	486.74	526.64
11	496.74	526.55
12	506.74	526.69
13	516.74	527.07
14	526.72	527.68
15	536.68	528.53
16	546.62	529.62
17	556.53	530.94
18	566.41	532.49
19	576.25	534.27
20	586.05	536.29
21	595.79	538.53
22	605.48	541.00
23	615.11	543.70
24	624.67	546.63

25	634.16	549.78
26	643.58	553.16
27	652.91	556.75
28	662.15	560.56
29	671.31	564.59
30	680.36	568.84
31	689.31	573.29
32	698.16	577.96
33	706.89	582.83
34	715.51	587.91
35	724.00	593.19
36	732.37	598.66
37	740.60	604.34
38	748.70	610.20
39	756.66	616.25
40	764.47	622.49
41	768.66	626.00

Circle Center At X = 495.6 ; Y = 951.2 and Radius, 424.7

*** 2.193 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	397.63	538.00
2	407.40	535.88
3	417.22	533.96
4	427.07	532.24
5	436.95	530.71
6	446.86	529.39
7	456.80	528.27
8	466.76	527.36
9	476.73	526.64
10	486.72	526.13
11	496.72	525.82
12	506.72	525.71
13	516.72	525.80
14	526.71	526.10
15	536.70	526.60
16	546.67	527.31
17	556.63	528.21
18	566.57	529.32
19	576.48	530.63
20	586.37	532.14
21	596.22	533.85
22	606.04	535.76
23	615.81	537.86
24	625.54	540.17
25	635.23	542.67
26	644.86	545.37
27	654.43	548.26
28	663.94	551.35
29	673.39	554.63
30	682.76	558.10
31	692.07	561.76
32	701.30	565.61
33	710.45	569.64
34	719.52	573.86
35	728.50	578.26
36	737.38	582.85
37	746.18	587.61
38	754.87	592.55
39	763.46	597.67
40	771.95	602.96
41	780.33	608.42
42	788.59	614.04
43	796.09	619.38

Circle Center At X = 507.0 ; Y = 1018.6 and Radius, 492.9

*** 2.196 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	397.63	538.00
2	407.43	536.01
3	417.28	534.25
4	427.16	532.70
5	437.07	531.38
6	447.01	530.28
7	456.97	529.41
8	466.95	528.76
9	476.94	528.33
10	486.94	528.13
11	496.94	528.16
12	506.93	528.41
13	516.92	528.88
14	526.90	529.58
15	536.86	530.50
16	546.79	531.65
17	556.70	533.02
18	566.57	534.61
19	576.40	536.42
20	586.19	538.46
21	595.94	540.71
22	605.63	543.18
23	615.26	545.87
24	624.83	548.78
25	634.33	551.90
26	643.75	555.23
27	653.11	558.78
28	662.37	562.53
29	671.56	566.49
30	680.65	570.66
31	689.64	575.03
32	698.54	579.60
33	707.33	584.37
34	716.00	589.33
35	724.57	594.49
36	733.02	599.84
37	741.34	605.39
38	749.54	611.11
39	757.61	617.02
40	765.54	623.11
41	769.14	626.00

Circle Center At X = 490.9 ; Y = 972.7 and Radius, 444.6

*** 2.197 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	385.00	538.00
2	394.51	534.91
3	404.10	532.06
4	413.74	529.43
5	423.45	527.03
6	433.21	524.86
7	443.02	522.92
8	452.88	521.22
9	462.77	519.76
10	472.70	518.53
11	482.65	517.54
12	492.62	516.78
13	502.60	516.26
14	512.60	515.98
15	522.60	515.94
16	532.60	516.14
17	542.59	516.57
18	552.57	517.25
19	562.52	518.16
20	572.46	519.30
21	582.36	520.68
22	592.23	522.30
23	602.06	524.15
24	611.84	526.24

25	621.57	528.56
26	631.23	531.11
27	640.84	533.89
28	650.38	536.89
29	659.84	540.13
30	669.22	543.58
31	678.52	547.26
32	687.73	551.16
33	696.84	555.28
34	705.86	559.62
35	714.76	564.16
36	723.56	568.92
37	732.24	573.89
38	740.80	579.06
39	749.23	584.43
40	757.53	590.01
41	765.70	595.77
42	773.73	601.74
43	781.61	607.89
44	789.35	614.22
45	795.55	619.56

Circle Center At X = 519.4 ; Y = 935.9 and Radius, 420.0

*** 2.201 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	385.00	538.00
2	394.56	535.06
3	404.18	532.34
4	413.86	529.84
5	423.60	527.56
6	433.39	525.50
7	443.22	523.67
8	453.09	522.06
9	462.99	520.68
10	472.92	519.53
11	482.88	518.60
12	492.86	517.90
13	502.85	517.43
14	512.84	517.18
15	522.84	517.17
16	532.84	517.38
17	542.83	517.82
18	552.81	518.49
19	562.77	519.39
20	572.70	520.51
21	582.61	521.86
22	592.49	523.44
23	602.32	525.24
24	612.12	527.27
25	621.86	529.52
26	631.55	531.99
27	641.18	534.68
28	650.75	537.59
29	660.25	540.72
30	669.67	544.07
31	679.01	547.63
32	688.28	551.40
33	697.45	555.38
34	706.53	559.57
35	715.51	563.97
36	724.39	568.57
37	733.16	573.37
38	741.82	578.38
39	750.36	583.57
40	758.78	588.97
41	767.08	594.55
42	775.24	600.32
43	783.28	606.28
44	791.17	612.41

```
   45        798.92      618.73
   46        799.47      619.20
Circle Center At X =  518.5 ; Y =  954.9  and Radius,  437.8
     ***     2.204   ***
```

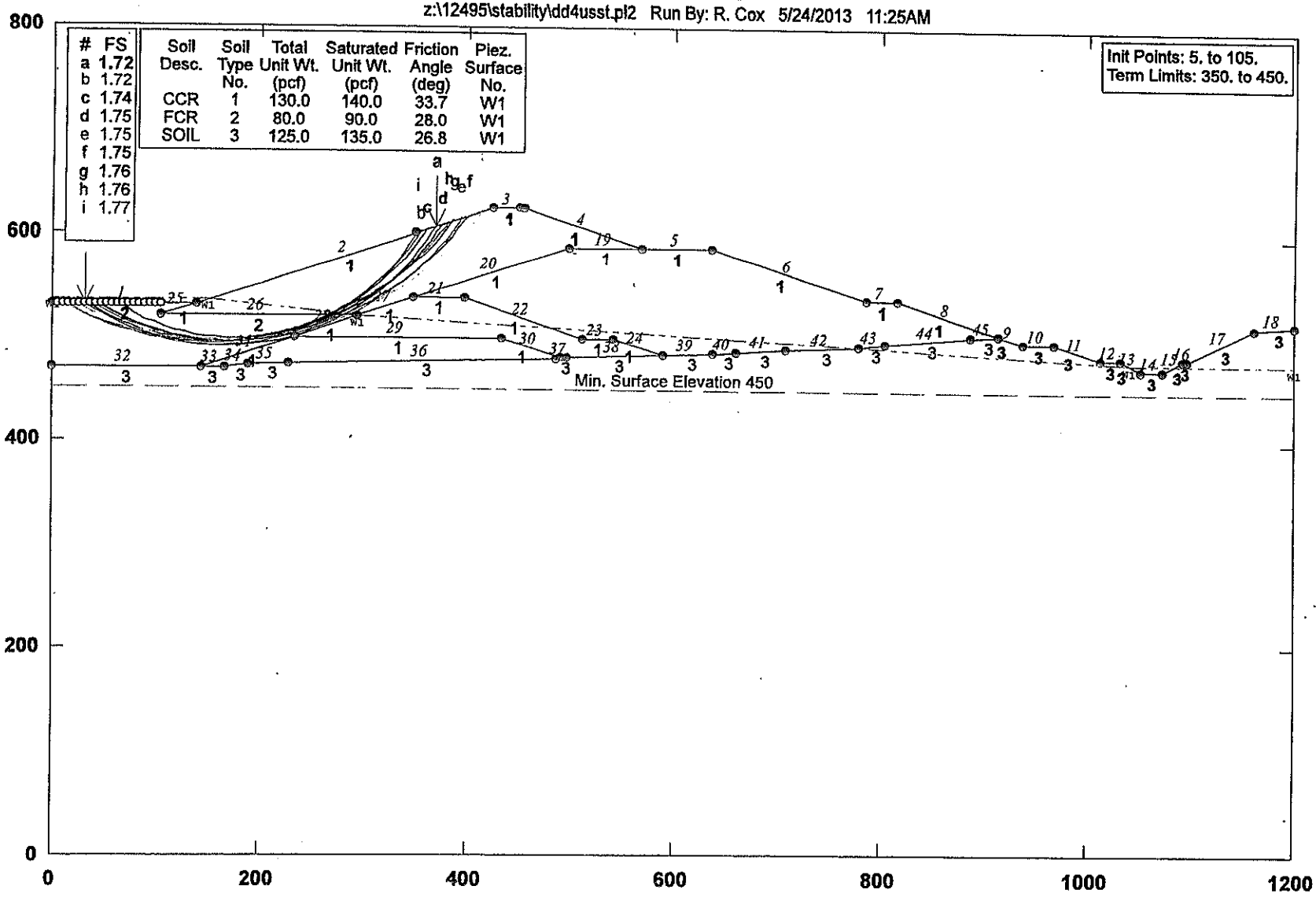
Section D-D Phase 12 Upstream Static

z:\12495\stability\dd4usst.pl2 Run By: R. Cox 5/24/2013 11:25AM

#	FS
a	1.72
b	1.72
c	1.74
d	1.75
e	1.75
f	1.75
g	1.76
h	1.76
i	1.77

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

Init Points: 5. to 105.
Term Limits: 350. to 450.



PCSTABL5M/si FSmin=1.72

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:25AM
Run By: R. Cox
Input Data Filename: Z:dd4usst.in
Output Filename: Z:dd4usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:dd4usst.PLT
PROBLEM DESCRIPTION Section D-D Phase 12 Upstream Static
BOUNDARY COORDINATES
18 Top Boundaries
45 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	531.20	139.30	531.20	2
2	139.30	531.20	423.80	626.00	1
3	423.80	626.00	453.80	626.00	1
4	453.80	626.00	568.70	588.00	1
5	568.70	588.00	636.20	588.00	1
6	636.20	588.00	786.20	538.00	1
7	786.20	538.00	816.20	538.00	1
8	816.20	538.00	914.10	505.30	1
9	914.10	505.30	937.10	497.60	3
10	937.10	497.60	967.10	497.60	3
11	967.10	497.60	1011.80	482.80	3
12	1011.80	482.80	1031.80	482.70	3
13	1031.80	482.70	1051.80	472.70	3
14	1051.80	472.70	1071.80	472.70	3
15	1071.80	472.70	1091.80	482.70	3
16	1091.80	482.70	1096.80	482.70	3
17	1096.80	482.70	1160.80	514.70	3
18	1160.80	514.70	1200.00	517.10	3
19	497.80	588.00	568.70	588.00	1
20	347.40	538.00	497.80	588.00	1
21	347.40	538.00	397.40	538.00	1
22	397.40	538.00	511.40	500.00	1
23	511.40	500.00	541.40	500.00	1
24	541.40	500.00	589.60	484.00	1
25	105.70	520.00	139.30	531.20	1
26	105.70	520.00	293.60	520.00	2
27	293.60	520.00	347.40	538.00	1
28	233.80	500.00	293.60	520.00	1
29	233.80	500.00	434.00	500.00	1
30	434.00	500.00	491.14	480.90	1
31	143.70	470.00	233.80	500.00	1
32	0.00	470.00	143.70	470.00	3
33	143.70	470.00	167.00	470.00	3
34	167.00	470.00	189.50	472.00	3
35	189.50	472.00	228.00	474.00	3
36	228.00	474.00	486.60	480.00	3
37	486.60	480.00	496.80	482.00	3
38	496.80	482.00	589.60	484.00	3
39	589.60	484.00	637.50	486.00	3
40	637.50	486.00	660.60	488.00	3
41	660.60	488.00	708.10	490.00	3
42	708.10	490.00	777.80	494.00	3
43	777.80	494.00	804.30	496.00	3
44	804.30	496.00	886.10	504.00	3
45	886.10	504.00	914.10	505.30	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1

2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	535.00
2	150.70	535.00
3	293.60	520.00
4	1039.80	478.70
5	1200.00	478.70

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 5.00 ft.
and X = 105.00 ft.
Each Surface Terminates Between X = 350.00 ft.
and X = 450.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =450.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.32	531.20
2	39.69	525.73
3	48.28	520.62
4	57.08	515.87
5	66.08	511.51
6	75.25	507.53
7	84.59	503.94
8	94.07	500.75
9	103.67	497.97
10	113.39	495.59
11	123.19	493.64
12	133.07	492.09
13	143.01	490.97
14	152.99	490.27
15	162.98	490.00
16	172.98	490.15
17	182.96	490.72
18	192.91	491.72
19	202.81	493.14
20	212.64	494.98
21	222.39	497.23
22	232.03	499.89
23	241.54	502.96
24	250.92	506.43
25	260.14	510.30
26	269.19	514.55
27	278.06	519.18
28	286.71	524.19
29	295.15	529.56
30	303.35	535.28
31	311.30	541.34
32	318.99	547.74
33	326.40	554.45
34	333.52	561.48
35	340.33	568.80
36	346.83	576.40
37	353.00	584.27
38	358.83	592.39
39	364.31	600.76
40	368.33	607.52

Circle Center At X = 164.4 ; Y = 725.6 and Radius, 235.6

*** 1.718 ***

Individual data on the 44 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.4	2061.2	1984.6	4078.6	0.0	0.0	0.0	0.0	0.0
2	8.6	6210.2	2037.9	7381.1	0.0	0.0	0.0	0.0	0.0
3	8.8	10265.7	2087.5	10456.1	0.0	0.0	0.0	0.0	0.0
4	9.0	14178.8	2133.3	13298.1	0.0	0.0	0.0	0.0	0.0
5	9.2	17903.2	2175.3	15901.9	0.0	0.0	0.0	0.0	0.0
6	9.3	21395.2	2213.4	18263.0	0.0	0.0	0.0	0.0	0.0
7	9.5	24614.6	2247.5	20376.9	0.0	0.0	0.0	0.0	0.0
8	9.6	27524.5	2277.5	22239.9	0.0	0.0	0.0	0.0	0.0
9	2.0	6111.1	480.9	4856.7	0.0	0.0	0.0	0.0	0.0
10	7.7	24473.4	1822.5	18992.0	0.0	0.0	0.0	0.0	0.0
11	9.8	34346.3	2325.2	25200.4	0.0	0.0	0.0	0.0	0.0
12	9.9	37783.7	2342.9	26292.5	0.0	0.0	0.0	0.0	0.0
13	6.2	25277.2	1476.6	16914.9	0.0	0.0	0.0	0.0	0.0
14	3.7	15760.3	776.4	10208.1	0.0	0.0	0.0	0.0	0.0
15	7.7	35044.1	648.7	21307.8	0.0	0.0	0.0	0.0	0.0
16	2.3	11002.1	0.0	6331.0	0.0	0.0	0.0	0.0	0.0
17	10.0	50909.8	0.0	27367.0	0.0	0.0	0.0	0.0	0.0
18	10.0	55205.2	0.0	26754.4	0.0	0.0	0.0	0.0	0.0
19	10.0	59012.2	0.0	25879.0	0.0	0.0	0.0	0.0	0.0
20	10.0	62304.8	0.0	24742.3	0.0	0.0	0.0	0.0	0.0
21	9.9	65061.9	0.0	23346.5	0.0	0.0	0.0	0.0	0.0
22	9.8	67268.3	0.0	21693.9	0.0	0.0	0.0	0.0	0.0
23	9.7	68914.0	0.0	19787.7	0.0	0.0	0.0	0.0	0.0
24	9.6	69994.4	0.0	17631.2	0.0	0.0	0.0	0.0	0.0
25	9.5	70510.7	0.0	15228.3	0.0	0.0	0.0	0.0	0.0
26	9.4	70469.5	0.0	12583.3	0.0	0.0	0.0	0.0	0.0
27	9.2	69883.3	0.0	9701.1	0.0	0.0	0.0	0.0	0.0
28	9.1	68769.1	0.0	6586.7	0.0	0.0	0.0	0.0	0.0
29	8.9	67149.8	0.0	3245.8	0.0	0.0	0.0	0.0	0.0
30	1.4	10665.0	0.0	199.1	0.0	0.0	0.0	0.0	0.0
31	2.2	16288.2	0.0	115.5	0.0	0.0	0.0	0.0	0.0
32	5.1	37429.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	8.4	60166.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	8.2	55532.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	8.0	50530.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	7.7	45229.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	7.4	39700.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	7.1	34021.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	6.8	28270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	6.5	22527.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	6.2	16877.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	5.8	11402.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	5.5	6187.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	4.0	1418.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.32	531.20
2	39.66	525.69
3	48.24	520.55
4	57.04	515.80
5	66.04	511.45
6	75.23	507.49
7	84.58	503.95
8	94.08	500.83
9	103.71	498.14
10	113.45	495.87
11	123.28	494.04
12	133.18	492.65
13	143.14	491.70
14	153.13	491.19
15	163.13	491.13
16	173.12	491.51

17	183.08	492.33
18	193.00	493.59
19	202.86	495.30
20	212.63	497.44
21	222.29	500.01
22	231.83	503.01
23	241.23	506.42
24	250.46	510.26
25	259.52	514.49
26	268.38	519.13
27	277.03	524.16
28	285.44	529.56
29	293.61	535.33
30	301.51	541.46
31	309.13	547.94
32	316.45	554.74
33	323.47	561.87
34	330.17	569.30
35	336.52	577.02
36	342.53	585.01
37	348.18	593.27
38	353.45	601.76
39	354.00	602.74

Circle Center At X = 159.6 ; Y = 716.3 and Radius, 225.2

*** 1.720 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.32	531.20
2	39.92	526.11
3	48.74	521.38
4	57.74	517.03
5	66.91	513.05
6	76.24	509.45
7	85.71	506.24
8	95.31	503.43
9	105.01	501.02
10	114.81	499.01
11	124.68	497.41
12	134.61	496.22
13	144.58	495.44
14	154.57	495.08
15	164.57	495.13
16	174.56	495.60
17	184.52	496.48
18	194.44	497.77
19	204.29	499.47
20	214.07	501.58
21	223.75	504.09
22	233.32	507.00
23	242.75	510.31
24	252.05	514.00
25	261.18	518.08
26	270.13	522.53
27	278.90	527.35
28	287.45	532.53
29	295.78	538.05
30	303.88	543.92
31	311.73	550.12
32	319.31	556.64
33	326.62	563.47
34	333.64	570.59
35	340.35	578.00
36	346.76	585.68
37	352.84	593.62
38	358.58	601.81
39	360.59	604.94

Circle Center At X = 158.3 ; Y = 736.3 and Radius, 241.2

*** 1.742 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	41.84	531.20
2	50.48	526.16
3	59.31	521.47
4	68.34	517.16
5	77.53	513.22
6	86.87	509.66
7	96.35	506.49
8	105.96	503.71
9	115.67	501.33
10	125.47	499.35
11	135.35	497.77
12	145.28	496.60
13	155.25	495.85
14	165.25	495.50
15	175.25	495.56
16	185.24	496.04
17	195.20	496.92
18	205.11	498.22
19	214.97	499.92
20	224.74	502.02
21	234.42	504.53
22	243.99	507.43
23	253.44	510.72
24	262.73	514.40
25	271.87	518.46
26	280.84	522.89
27	289.61	527.69
28	298.18	532.84
29	306.54	538.34
30	314.65	544.18
31	322.52	550.35
32	330.14	556.83
33	337.47	563.63
34	344.52	570.72
35	351.28	578.09
36	357.72	585.74
37	363.85	593.64
38	369.64	601.79
39	374.76	609.66

Circle Center At X = 168.7 ; Y = 738.5 and Radius, 243.1

*** 1.749 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.58	531.20
2	45.30	526.30
3	54.20	521.74
4	63.26	517.51
5	72.48	513.63
6	81.83	510.10
7	91.31	506.92
8	100.91	504.11
9	110.60	501.65
10	120.38	499.56
11	130.23	497.85
12	140.14	496.50
13	150.10	495.53
14	160.08	494.94
15	170.07	494.72
16	180.07	494.88
17	190.06	495.41
18	200.02	496.32
19	209.93	497.61
20	219.80	499.26
21	229.59	501.29
22	239.30	503.69
23	248.91	506.45
24	258.41	509.57

25	267.79	513.04
26	277.03	516.87
27	286.11	521.04
28	295.04	525.55
29	303.79	530.39
30	312.35	535.56
31	320.71	541.05
32	328.85	546.85
33	336.78	552.95
34	344.46	559.35
35	351.90	566.03
36	359.09	572.99
37	366.00	580.21
38	372.64	587.69
39	379.00	595.41
40	385.05	603.37
41	390.81	611.54
42	393.67	615.96

Circle Center At X = 170.9 ; Y = 760.1 and Radius, 265.3

*** 1.750 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.26	531.20
2	19.11	526.54
3	28.11	522.17
4	37.24	518.10
5	46.51	514.34
6	55.89	510.88
7	65.38	507.74
8	74.98	504.91
9	84.66	502.40
10	94.41	500.21
11	104.24	498.35
12	114.12	496.81
13	124.04	495.60
14	134.01	494.72
15	143.99	494.16
16	153.99	493.94
17	163.99	494.05
18	173.98	494.49
19	183.95	495.25
20	193.89	496.35
21	203.79	497.77
22	213.63	499.53
23	223.41	501.60
24	233.12	504.00
25	242.75	506.71
26	252.27	509.75
27	261.70	513.09
28	271.01	516.75
29	280.19	520.71
30	289.23	524.98
31	298.13	529.54
32	306.88	534.39
33	315.46	539.52
34	323.86	544.94
35	332.08	550.64
36	340.11	556.60
37	347.94	562.82
38	355.56	569.30
39	362.96	576.03
40	370.13	582.99
41	377.07	590.20
42	383.76	597.62
43	390.21	605.27
44	396.40	613.12
45	400.06	618.09

Circle Center At X = 155.7 ; Y = 796.5 and Radius, 302.6

*** 1.754 ***

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.26	531.20
2	19.08	526.49
3	28.06	522.08
4	37.18	517.98
5	46.44	514.20
6	55.82	510.74
7	65.32	507.61
8	74.92	504.80
9	84.61	502.33
10	94.37	500.19
11	104.21	498.39
12	114.10	496.92
13	124.04	495.80
14	134.01	495.02
15	144.00	494.58
16	154.00	494.49
17	164.00	494.74
18	173.98	495.33
19	183.93	496.27
20	193.85	497.55
21	203.72	499.17
22	213.53	501.13
23	223.26	503.42
24	232.91	506.05
25	242.46	509.00
26	251.91	512.29
27	261.23	515.89
28	270.43	519.82
29	279.49	524.06
30	288.39	528.61
31	297.14	533.46
32	305.71	538.61
33	314.10	544.05
34	322.30	549.77
35	330.30	555.78
36	338.08	562.05
37	345.65	568.59
38	352.98	575.39
39	360.08	582.44
40	366.93	589.72
41	373.53	597.24
42	379.86	604.97
43	385.93	612.92
44	386.35	613.52

Circle Center At X = 151.7 ; Y = 785.2 and Radius, 290.8

*** 1.755 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.26	531.20
2	19.10	526.51
3	28.09	522.14
4	37.23	518.07
5	46.50	514.33
6	55.90	510.91
7	65.41	507.82
8	75.02	505.06
9	84.72	502.63
10	94.50	500.54
11	104.34	498.79
12	114.24	497.38
13	124.19	496.32
14	134.16	495.60
15	144.15	495.23
16	154.15	495.20
17	164.15	495.52
18	174.13	496.19

19	184.08	497.20
20	193.98	498.56
21	203.84	500.26
22	213.63	502.30
23	223.34	504.67
24	232.97	507.39
25	242.49	510.43
26	251.91	513.80
27	261.20	517.50
28	270.36	521.51
29	279.37	525.84
30	288.23	530.48
31	296.92	535.43
32	305.44	540.67
33	313.76	546.21
34	321.90	552.03
35	329.82	558.12
36	337.53	564.49
37	345.02	571.13
38	352.27	578.01
39	359.27	585.15
40	366.03	592.52
41	372.52	600.12
42	378.75	607.95
43	381.75	611.99

Circle Center At X = 149.9 ; Y = 783.8 and Radius, 288.6

*** 1.760 ***

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.90	531.20
2	71.39	525.93
3	80.14	521.08
4	89.11	516.67
5	98.30	512.71
6	107.66	509.21
7	117.19	506.17
8	126.86	503.61
9	136.64	501.54
10	146.51	499.94
11	156.45	498.84
12	166.43	498.23
13	176.43	498.11
14	186.43	498.49
15	196.39	499.36
16	206.29	500.72
17	216.12	502.57
18	225.85	504.90
19	235.44	507.71
20	244.89	510.99
21	254.16	514.73
22	263.24	518.93
23	272.10	523.57
24	280.72	528.64
25	289.07	534.14
26	297.15	540.03
27	304.92	546.32
28	312.38	552.99
29	319.49	560.02
30	326.25	567.39
31	332.64	575.08
32	338.64	583.08
33	344.23	591.37
34	349.41	599.92
35	350.26	601.50

Circle Center At X = 173.8 ; Y = 700.4 and Radius, 202.3

*** 1.770 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

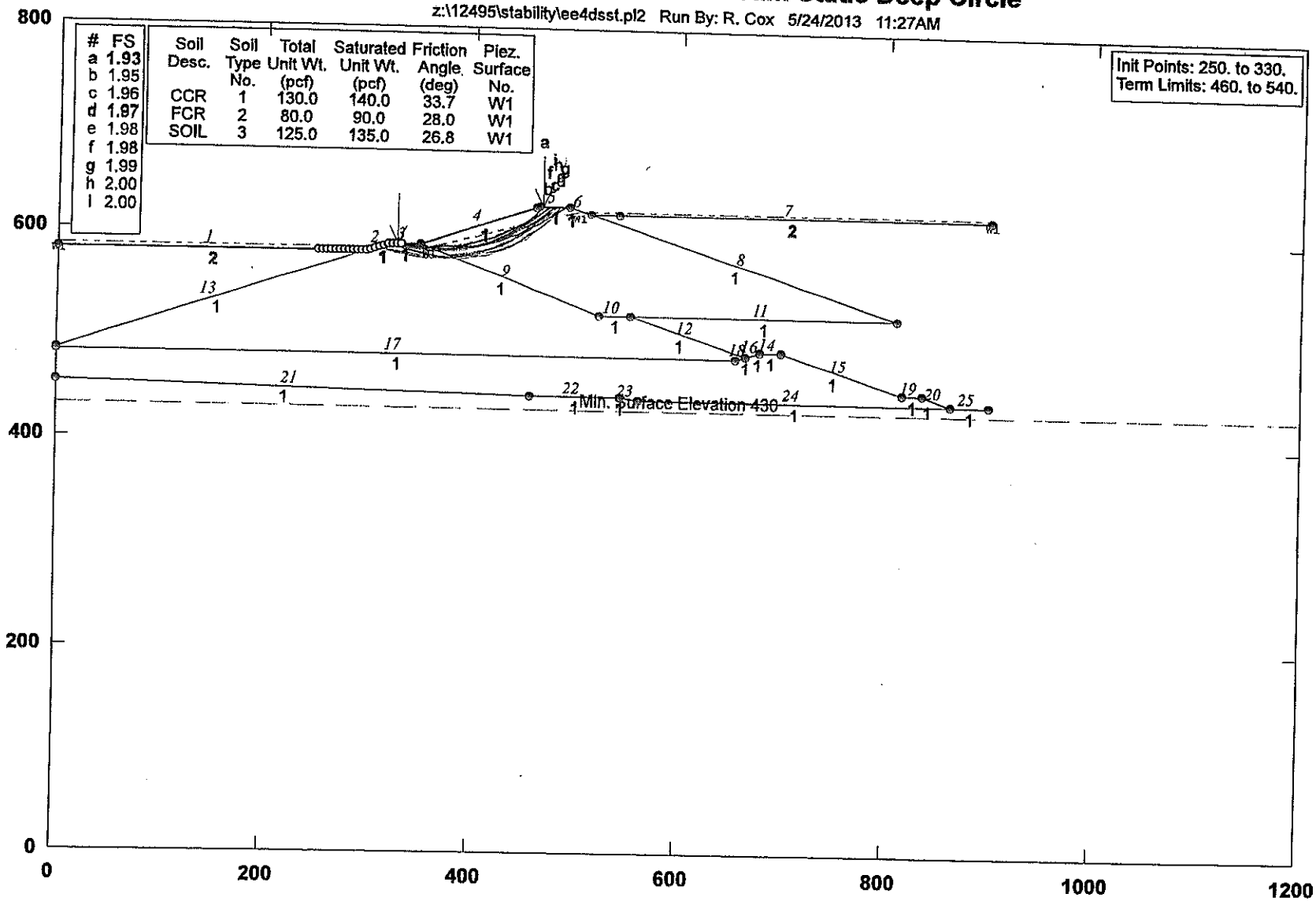
1	20.79	531.20
2	29.73	526.73
3	38.82	522.55
4	48.03	518.66
5	57.37	515.08
6	66.81	511.79
7	76.36	508.82
8	86.00	506.15
9	95.72	503.80
10	105.51	501.76
11	115.36	500.04
12	125.26	498.64
13	135.20	497.55
14	145.17	496.79
15	155.16	496.35
16	165.16	496.24
17	175.16	496.45
18	185.15	496.98
19	195.11	497.83
20	205.04	499.00
21	214.93	500.50
22	224.76	502.31
23	234.53	504.44
24	244.23	506.88
25	253.84	509.64
26	263.36	512.70
27	272.78	516.07
28	282.08	519.74
29	291.26	523.71
30	300.30	527.98
31	309.20	532.53
32	317.96	537.37
33	326.55	542.49
34	334.97	547.88
35	343.21	553.55
36	351.26	559.47
37	359.12	565.66
38	366.78	572.09
39	374.22	578.77
40	381.45	585.68
41	388.44	592.83
42	395.21	600.19
43	401.73	607.77
44	408.00	615.56
45	413.21	622.47

Circle Center At X = 163.7 ; Y = 805.9 and Radius, 309.7

*** 1.770 ***

Section E-E Phase 12 Downstream Static Deep Circle

z:\12495\stability\ee4dsst.pl2 Run By: R. Cox 5/24/2013 11:27AM



PCSTABL5M/si FSmin=1.93

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:27AM
Run By: R. Cox
Input Data Filename: Z:ee4dsst.
Output Filename: Z:ee4dsst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:ee4dsst.PLT
PROBLEM DESCRIPTION Section E-E Phase 12
Downstream Static Deep Circle

BOUNDARY COORDINATES
7 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	581.20	297.80	581.20	2
2	297.80	581.20	318.20	588.00	1
3	318.20	588.00	348.20	588.00	1
4	348.20	588.00	462.20	626.00	1
5	462.20	626.00	492.20	626.00	1
6	492.20	626.00	512.60	619.20	1
7	512.60	619.20	900.00	619.20	2
8	512.60	619.20	810.20	520.00	1
9	348.20	588.00	522.20	520.00	1
10	522.20	520.00	552.20	520.00	1
11	552.20	520.00	810.20	520.00	1
12	552.20	520.00	663.20	483.00	1
13	0.00	481.93	297.80	581.20	1
14	678.20	488.00	698.20	488.00	1
15	698.20	488.00	815.20	449.00	1
16	663.20	483.00	678.20	488.00	1
17	0.00	480.00	654.20	480.00	1
18	654.20	480.00	663.20	483.00	1
19	815.20	449.00	835.20	449.00	1
20	835.20	449.00	862.20	440.00	1
21	0.00	451.15	456.05	442.00	1
22	456.05	442.00	542.15	442.00	1
23	542.15	442.00	560.23	440.00	1
24	560.23	440.00	862.20	440.00	1
25	862.20	440.00	900.00	440.00	1

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	585.00
2	357.20	585.00
3	501.20	623.00
4	900.00	623.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 250.00 ft.
and X = 330.00 ft.
Each Surface Terminates Between X = 460.00 ft.
and X = 540.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.79	588.00
2	335.47	585.49
3	345.31	583.69
4	355.25	582.60
5	365.24	582.24
6	375.23	582.60
7	385.18	583.69
8	395.01	585.49
9	404.69	588.00
10	414.17	591.20
11	423.38	595.08
12	432.29	599.62
13	440.85	604.79
14	449.02	610.56
15	456.74	616.91
16	463.98	623.81
17	465.97	626.00

Circle Center At X = 365.2 ; Y = 720.3 and Radius, 138.0
*** 1.934 ***
Individual data on the 23 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	1578.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2.7	959.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	7.2	3448.7	0.0	297.7	0.0	0.0	0.0	0.0	0.0
4	2.9	1723.6	0.0	266.9	0.0	0.0	0.0	0.0	0.0
5	7.0	5809.7	0.0	890.0	0.0	0.0	0.0	0.0	0.0
6	0.6	658.0	0.0	94.6	0.0	0.0	0.0	0.0	0.0
7	1.3	1447.1	0.0	201.9	0.0	0.0	0.0	0.0	0.0
8	5.5	6957.5	0.0	1094.3	0.0	0.0	0.0	0.0	0.0
9	2.5	3732.8	0.0	690.4	0.0	0.0	0.0	0.0	0.0
10	10.0	17372.5	0.0	3633.5	0.0	0.0	0.0	0.0	0.0
11	9.9	20824.1	0.0	4784.9	0.0	0.0	0.0	0.0	0.0
12	9.8	23086.5	0.0	5489.4	0.0	0.0	0.0	0.0	0.0
13	9.7	24141.0	0.0	5743.1	0.0	0.0	0.0	0.0	0.0
14	9.5	24009.5	0.0	5544.9	0.0	0.0	0.0	0.0	0.0
15	9.2	22752.2	0.0	4895.8	0.0	0.0	0.0	0.0	0.0
16	8.9	20467.1	0.0	3799.1	0.0	0.0	0.0	0.0	0.0
17	8.6	17287.2	0.0	2260.7	0.0	0.0	0.0	0.0	0.0
18	5.2	8863.9	0.0	436.6	0.0	0.0	0.0	0.0	0.0
19	3.0	4532.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	7.7	9190.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	5.5	3958.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.8	704.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	2.0	283.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	321.58	588.00
2	331.25	585.45
3	341.07	583.56
4	351.00	582.35
5	360.98	581.81
6	370.98	581.95
7	380.95	582.76
8	390.83	584.25
9	400.60	586.41
10	410.19	589.23

11	419.57	592.69
12	428.70	596.78
13	437.53	601.49
14	446.01	606.77
15	454.12	612.63
16	461.81	619.02
17	469.05	625.91
18	469.13	626.00

Circle Center At X = 363.9 ; Y = 729.0 and Radius, 147.2

*** 1.947 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.79	588.00
2	335.58	585.97
3	345.48	584.53
4	355.44	583.68
5	365.44	583.44
6	375.43	583.79
7	385.39	584.73
8	395.27	586.28
9	405.04	588.40
10	414.66	591.11
11	424.11	594.40
12	433.34	598.24
13	442.33	602.62
14	451.04	607.54
15	459.44	612.96
16	467.50	618.88
17	475.19	625.27
18	475.97	626.00

Circle Center At X = 364.6 ; Y = 750.4 and Radius, 167.0

*** 1.955 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	321.58	588.00
2	330.83	584.20
3	340.33	581.09
4	350.04	578.69
5	359.90	577.02
6	369.86	576.08
7	379.85	575.88
8	389.84	576.41
9	399.76	577.69
10	409.56	579.69
11	419.18	582.41
12	428.58	585.83
13	437.69	589.94
14	446.48	594.71
15	454.89	600.12
16	462.88	606.14
17	470.41	612.72
18	477.42	619.85
19	482.64	626.00

Circle Center At X = 377.6 ; Y = 711.1 and Radius, 135.3

*** 1.972 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.79	588.00
2	334.90	583.89
3	344.32	580.52
4	353.98	577.92
5	363.81	576.10
6	373.76	575.09
7	383.76	574.88
8	393.74	575.47
9	403.64	576.86
10	413.40	579.05

11	422.95	582.01
12	432.23	585.74
13	441.18	590.19
14	449.75	595.36
15	457.87	601.19
16	465.49	607.67
17	472.57	614.73
18	479.06	622.34
19	481.70	626.00

Circle Center At X = 381.4 ; Y = 699.0 and Radius, 124.2

*** 1.977 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	330.00	588.00
2	339.92	586.70
3	349.89	585.97
4	359.89	585.79
5	369.88	586.18
6	379.84	587.12
7	389.72	588.62
8	399.51	590.68
9	409.16	593.28
10	418.66	596.42
11	427.96	600.09
12	437.04	604.27
13	445.88	608.96
14	454.43	614.14
15	462.68	619.79
16	470.61	625.89
17	470.74	626.00

Circle Center At X = 358.0 ; Y = 763.8 and Radius, 178.1

*** 1.981 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.79	588.00
2	335.60	586.05
3	345.50	584.63
4	355.46	583.74
5	365.45	583.38
6	375.45	583.56
7	385.42	584.28
8	395.35	585.53
9	405.19	587.30
10	414.92	589.61
11	424.51	592.43
12	433.94	595.76
13	443.18	599.58
14	452.20	603.90
15	460.97	608.70
16	469.48	613.96
17	477.69	619.66
18	485.59	625.80
19	485.82	626.00

Circle Center At X = 367.1 ; Y = 770.1 and Radius, 186.7

*** 1.993 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	308.95	584.92
2	318.50	581.96
3	328.22	579.59
4	338.06	577.83
5	347.99	576.68
6	357.98	576.14
7	367.98	576.21
8	377.95	576.91
9	387.87	578.21
10	397.68	580.12

11	407.36	582.64
12	416.87	585.74
13	426.17	589.42
14	435.22	593.67
15	443.99	598.47
16	452.46	603.80
17	460.57	609.64
18	468.32	615.97
19	475.65	622.76
20	478.75	626.00

Circle Center At X = 361.7 ; Y = 738.2 and Radius, 162.1

*** 2.000 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	308.95	584.92
2	318.38	581.58
3	328.01	578.89
4	337.80	576.86
5	347.70	575.49
6	357.68	574.79
7	367.68	574.76
8	377.66	575.41
9	387.57	576.73
10	397.37	578.71
11	407.02	581.35
12	416.47	584.63
13	425.67	588.54
14	434.59	593.06
15	443.18	598.17
16	451.41	603.85
17	459.24	610.07
18	466.64	616.81
19	473.56	624.02
20	475.21	626.00

Circle Center At X = 363.1 ; Y = 722.9 and Radius, 148.2

*** 2.004 ***

Failure Surface Specified By 21 Coordinate Points

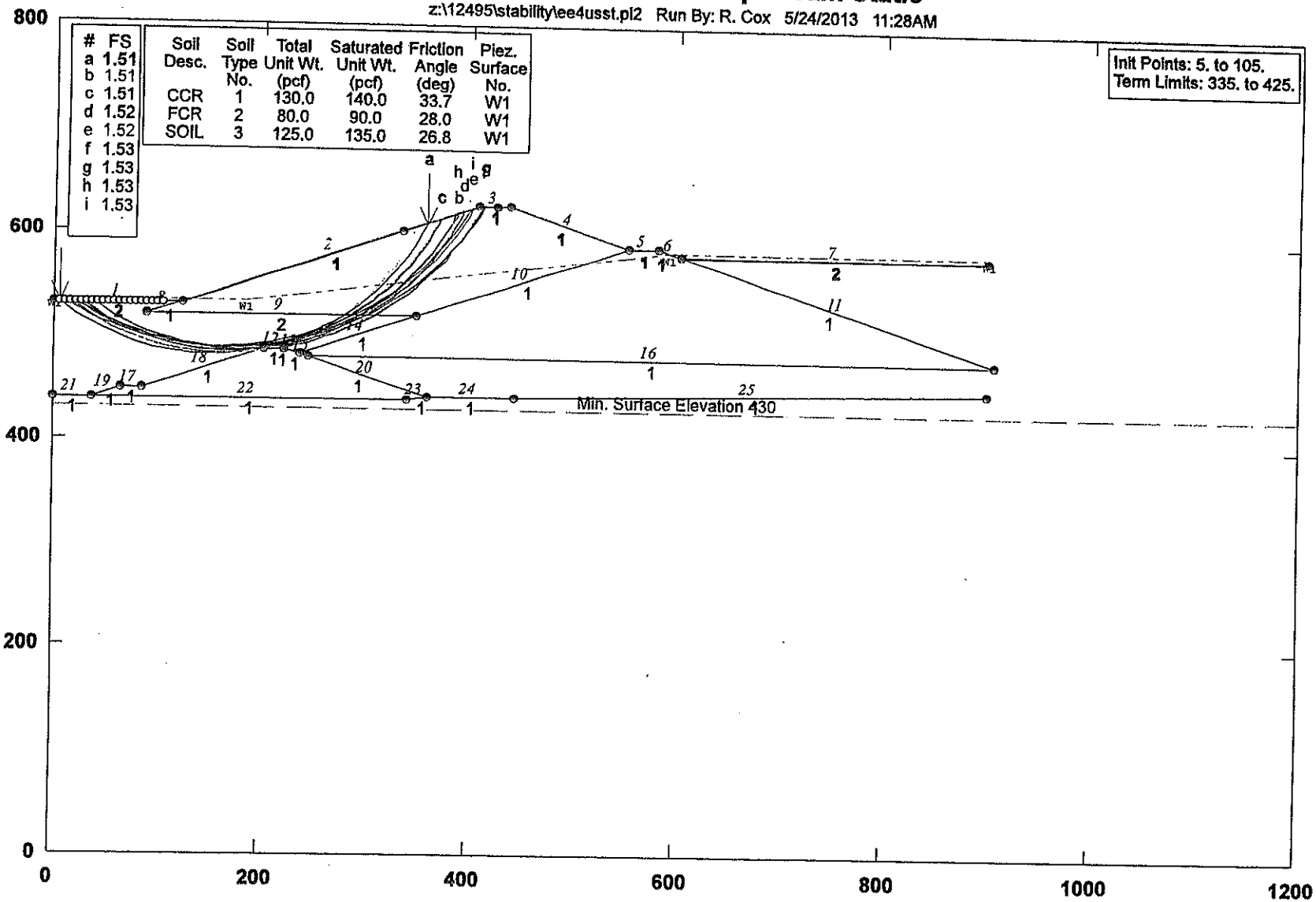
Point No.	X-Surf (ft)	Y-Surf (ft)
1	304.74	583.51
2	314.28	580.54
3	323.99	578.11
4	333.81	576.24
5	343.72	574.94
6	353.70	574.21
7	363.70	574.04
8	373.69	574.45
9	383.64	575.43
10	393.52	576.98
11	403.29	579.09
12	412.93	581.76
13	422.40	584.97
14	431.67	588.72
15	440.71	592.99
16	449.50	597.78
17	457.99	603.05
18	466.17	608.81
19	474.00	615.02
20	481.47	621.67
21	485.80	626.00

Circle Center At X = 361.5 ; Y = 748.8 and Radius, 174.8

*** 2.012 ***

Section E-E Phase 12 Upstream Static

z:\12495\stability\ee4usst.pl2 Run By: R. Cox 5/24/2013 11:28AM



PCSTABL5M/si FSmin=1.51

Safety Factors Are Calculated By The Modified Bishop Method

STED

** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/24/2013
Time of Run: 11:28AM
Run By: R. Cox
Input Data Filename: Z:ee4usst.in
Output Filename: Z:ee4usst.OUT
Unit: ENGLISH
Plotted Output Filename: Z:ee4usst.PLT
PROBLEM DESCRIPTION Section E-E Phase 12 Upstream Static
BOUNDARY COORDINATES
7 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	531.20	123.40	531.20	2
2	123.40	531.20	407.80	626.00	1
3	407.80	626.00	437.80	626.00	1
4	437.80	626.00	551.80	588.00	1
5	551.80	588.00	581.50	588.00	1
6	581.50	588.00	603.10	580.90	1
7	603.10	580.90	900.00	580.90	2
8	89.80	520.00	123.40	531.20	1
9	89.80	520.00	347.80	520.00	2
10	347.80	520.00	551.80	588.00	1
11	603.10	580.90	905.80	480.00	1
12	201.80	488.00	221.80	488.00	1
13	221.80	488.00	236.80	483.00	1
14	236.80	483.00	347.80	520.00	1
15	236.80	483.00	245.80	480.00	1
16	245.80	480.00	905.80	480.00	1
17	64.80	449.00	84.80	449.00	1
18	84.80	449.00	201.80	488.00	1
19	37.80	440.00	64.80	449.00	1
20	245.80	480.00	359.80	442.00	1
21	0.00	440.00	37.80	440.00	1
22	37.80	440.00	339.80	440.00	1
23	339.80	440.00	359.80	442.00	1
24	359.80	442.00	443.90	442.00	1
25	443.90	442.00	900.00	451.10	1

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	535.00
2	184.80	535.00
3	590.80	585.00
4	900.00	585.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 5.00 ft.
and X = 105.00 ft.
Each Surface Terminates Between X = 335.00 ft.
and X = 425.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y =430.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	5.00	531.20
2	13.01	525.21
3	21.27	519.58
4	29.76	514.30
5	38.47	509.38
6	47.39	504.85
7	56.48	500.70
8	65.75	496.94
9	75.17	493.58
10	84.72	490.62
11	94.39	488.08
12	104.16	485.94
13	114.01	484.23
14	123.93	482.94
15	133.89	482.08
16	143.88	481.64
17	153.88	481.63
18	163.88	482.05
19	173.84	482.89
20	183.76	484.15
21	193.62	485.84
22	203.39	487.95
23	213.07	490.47
24	222.63	493.40
25	232.05	496.74
26	241.33	500.48
27	250.44	504.61
28	259.36	509.13
29	268.08	514.02
30	276.59	519.28
31	284.86	524.90
32	292.88	530.86
33	300.65	537.17
34	308.13	543.79
35	315.33	550.74
36	322.23	557.98
37	328.80	565.51
38	335.06	573.32
39	340.97	581.38
40	346.53	589.69
41	351.73	598.23
42	356.57	606.99
43	357.72	609.31

Circle Center At X = 149.2 ; Y = 715.8 and Radius, 234.2
*** 1.507 ***
Individual data on the 50 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.0	2157.7	1899.6	4238.5	0.0	0.0	0.0	0.0	0.0
2	8.3	6544.3	1958.5	7864.8	0.0	0.0	0.0	0.0	0.0
3	8.5	10901.3	2013.7	11271.1	0.0	0.0	0.0	0.0	0.0
4	8.7	15175.7	2065.3	14451.2	0.0	0.0	0.0	0.0	0.0
5	8.9	19316.6	2113.2	17399.3	0.0	0.0	0.0	0.0	0.0
6	9.1	23275.5	2157.2	20110.0	0.0	0.0	0.0	0.0	0.0
7	9.3	27006.7	2197.2	22578.4	0.0	0.0	0.0	0.0	0.0
8	9.4	30467.6	2233.3	24800.0	0.0	0.0	0.0	0.0	0.0
9	9.6	33619.3	2265.2	26770.7	0.0	0.0	0.0	0.0	0.0
10	5.1	18855.8	1204.4	14764.0	0.0	0.0	0.0	0.0	0.0
11	4.6	17746.5	1088.7	13723.1	0.0	0.0	0.0	0.0	0.0

12	9.8	40401.4	2316.8	29945.8	0.0	0.0	0.0	0.0	0.0
13	9.9	44054.8	2336.2	31144.2	0.0	0.0	0.0	0.0	0.0
14	9.4	44709.5	2225.5	30342.1	0.0	0.0	0.0	0.0	0.0
15	0.5	2608.4	129.6	1738.2	0.0	0.0	0.0	0.0	0.0
16	10.0	51796.5	1286.1	32752.3	0.0	0.0	0.0	0.0	0.0
17	10.0	57042.0	0.0	33158.8	0.0	0.0	0.0	0.0	0.0
18	10.0	61630.8	0.0	33299.3	0.0	0.0	0.0	0.0	0.0
19	10.0	65724.1	0.0	33173.4	0.0	0.0	0.0	0.0	0.0
20	10.0	69292.7	0.0	32781.4	0.0	0.0	0.0	0.0	0.0
21	9.9	72312.9	0.0	32124.0	0.0	0.0	0.0	0.0	0.0
22	1.0	7765.1	0.0	3343.8	0.0	0.0	0.0	0.0	0.0
23	8.8	67015.8	0.0	27951.2	0.0	0.0	0.0	0.0	0.0
24	4.8	37586.8	0.0	15289.9	0.0	0.0	0.0	0.0	0.0
25	3.4	26553.7	0.0	10567.0	0.0	0.0	0.0	0.0	0.0
26	1.6	12679.2	0.0	4982.3	0.0	0.0	0.0	0.0	0.0
27	0.2	1610.4	0.0	637.2	0.0	0.0	0.0	0.0	0.0
28	9.5	76561.2	0.0	29510.2	0.0	0.0	0.0	0.0	0.0
29	9.6	78982.0	0.0	29191.5	0.0	0.0	0.0	0.0	0.0
30	9.4	79204.5	0.0	27973.3	0.0	0.0	0.0	0.0	0.0
31	9.3	78847.8	0.0	26495.0	0.0	0.0	0.0	0.0	0.0
32	9.1	77927.1	0.0	24759.5	0.0	0.0	0.0	0.0	0.0
33	8.9	76462.8	0.0	22769.7	0.0	0.0	0.0	0.0	0.0
34	8.7	74480.2	0.0	20529.2	0.0	0.0	0.0	0.0	0.0
35	8.5	72010.7	0.0	18042.4	0.0	0.0	0.0	0.0	0.0
36	1.1	8939.5	0.0	2126.9	0.0	0.0	0.0	0.0	0.0
37	7.2	59267.8	0.0	13186.7	0.0	0.0	0.0	0.0	0.0
38	8.0	62596.1	0.0	12347.8	0.0	0.0	0.0	0.0	0.0
39	7.8	56619.0	0.0	9150.4	0.0	0.0	0.0	0.0	0.0
40	7.5	50374.7	0.0	5727.2	0.0	0.0	0.0	0.0	0.0
41	7.2	43945.8	0.0	2084.6	0.0	0.0	0.0	0.0	0.0
42	0.4	2098.1	0.0	5.5	0.0	0.0	0.0	0.0	0.0
43	6.5	35516.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	6.6	31495.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	6.3	25433.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	5.9	19514.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	5.6	13822.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	5.2	8443.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	4.8	3461.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	1.2	145.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.79	531.20
2	29.10	525.64
3	37.63	520.41
4	46.35	515.53
5	55.27	511.00
6	64.35	506.82
7	73.60	503.01
8	82.99	499.57
9	92.51	496.51
10	102.14	493.83
11	111.88	491.53
12	121.69	489.62
13	131.58	488.10
14	141.51	486.98
15	151.49	486.25
16	161.48	485.92
17	171.48	485.99
18	181.47	486.46
19	191.43	487.32
20	201.35	488.57
21	211.22	490.22
22	221.01	492.27
23	230.71	494.69
24	240.30	497.51
25	249.78	500.70
26	259.12	504.26
27	268.32	508.20
28	277.35	512.49

29	286.20	517.15
30	294.86	522.15
31	303.31	527.49
32	311.55	533.16
33	319.55	539.16
34	327.31	545.46
35	334.81	552.08
36	342.04	558.98
37	349.00	566.17
38	355.66	573.63
39	362.02	581.34
40	368.07	589.31
41	373.79	597.51
42	379.19	605.92
43	384.25	614.55
44	386.59	618.93

Circle Center At X = 164.8 ; Y = 737.3 and Radius, 251.4

*** 1.508 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.05	531.20
2	34.22	525.43
3	42.62	520.01
4	51.26	514.96
5	60.10	510.30
6	69.14	506.01
7	78.35	502.13
8	87.72	498.64
9	97.24	495.56
10	106.88	492.90
11	116.62	490.65
12	126.45	488.83
13	136.36	487.44
14	146.31	486.47
15	156.30	485.94
16	166.30	485.83
17	176.29	486.16
18	186.26	486.93
19	196.19	488.12
20	206.06	489.74
21	215.85	491.78
22	225.54	494.25
23	235.11	497.13
24	244.56	500.42
25	253.85	504.12
26	262.97	508.22
27	271.91	512.70
28	280.64	517.57
29	289.16	522.82
30	297.44	528.42
31	305.47	534.38
32	313.24	540.68
33	320.72	547.31
34	327.92	554.25
35	334.80	561.50
36	341.37	569.05
37	347.60	576.86
38	353.50	584.95
39	359.03	593.27
40	364.20	601.83
41	369.00	610.61
42	370.45	613.55

Circle Center At X = 163.6 ; Y = 717.1 and Radius, 231.3

*** 1.509 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.58	531.20
2	44.86	525.60

3	53.37	520.34
4	62.09	515.44
5	71.00	510.91
6	80.09	506.74
7	89.35	502.96
8	98.75	499.56
9	108.29	496.55
10	117.94	493.94
11	127.70	491.73
12	137.53	489.93
13	147.43	488.53
14	157.39	487.55
15	167.37	486.97
16	177.37	486.81
17	187.36	487.06
18	197.34	487.73
19	207.28	488.80
20	217.17	490.29
21	226.99	492.18
22	236.73	494.48
23	246.35	497.18
24	255.86	500.27
25	265.24	503.75
26	274.46	507.62
27	283.51	511.86
28	292.39	516.48
29	301.06	521.46
30	309.52	526.79
31	317.75	532.47
32	325.74	538.48
33	333.48	544.81
34	340.94	551.47
35	348.13	558.42
36	355.02	565.67
37	361.61	573.19
38	367.88	580.98
39	373.83	589.02
40	379.43	597.30
41	384.69	605.81
42	389.60	614.52
43	392.92	621.04

Circle Center At X = 176.3 ; Y = 728.8 and Radius, 242.0

*** 1.520 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.79	531.20
2	29.32	525.98
3	38.04	521.09
4	46.93	516.51
5	55.99	512.27
6	65.19	508.36
7	74.54	504.80
8	84.00	501.58
9	93.58	498.71
10	103.26	496.20
11	113.03	494.04
12	122.87	492.25
13	132.76	490.82
14	142.71	489.75
15	152.68	489.06
16	162.68	488.73
17	172.68	488.76
18	182.67	489.17
19	192.64	489.95
20	202.57	491.09
21	212.46	492.59
22	222.28	494.46
23	232.03	496.69
24	241.69	499.28

25	251.25	502.22
26	260.69	505.51
27	270.00	509.15
28	279.18	513.13
29	288.20	517.44
30	297.06	522.09
31	305.74	527.05
32	314.23	532.33
33	322.52	537.92
34	330.60	543.82
35	338.46	550.00
36	346.08	556.48
37	353.46	563.22
38	360.59	570.24
39	367.45	577.51
40	374.04	585.03
41	380.35	592.79
42	386.37	600.78
43	392.09	608.98
44	397.51	617.38
45	401.34	623.85

Circle Center At X = 166.6 ; Y = 760.2 and Radius, 271.5

*** 1.523 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.79	531.20
2	29.19	525.78
3	37.79	520.67
4	46.57	515.89
5	55.52	511.42
6	64.63	507.29
7	73.88	503.50
8	83.27	500.05
9	92.77	496.94
10	102.38	494.19
11	112.09	491.79
12	121.88	489.75
13	131.74	488.07
14	141.65	486.75
15	151.61	485.80
16	161.59	485.22
17	171.59	485.00
18	181.59	485.15
19	191.57	485.66
20	201.53	486.54
21	211.46	487.79
22	221.33	489.40
23	231.13	491.37
24	240.85	493.70
25	250.49	496.39
26	260.02	499.43
27	269.42	502.81
28	278.70	506.54
29	287.84	510.61
30	296.82	515.01
31	305.63	519.73
32	314.27	524.78
33	322.71	530.14
34	330.95	535.80
35	338.97	541.77
36	346.78	548.02
37	354.34	554.56
38	361.66	561.37
39	368.73	568.45
40	375.53	575.78
41	382.06	583.35
42	388.31	591.16
43	394.26	599.20
44	399.92	607.44

45	405.27	615.89
46	410.30	624.53
47	411.09	626.00

Circle Center At X = 172.5 ; Y = 757.3 and Radius, 272.3

*** 1.527 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.79	531.20
2	29.39	526.10
3	38.16	521.30
4	47.10	516.81
5	56.19	512.64
6	65.42	508.80
7	74.78	505.28
8	84.26	502.09
9	93.84	499.23
10	103.52	496.71
11	113.28	494.54
12	123.11	492.71
13	133.00	491.22
14	142.94	490.09
15	152.91	489.30
16	162.90	488.86
17	172.90	488.78
18	182.89	489.05
19	192.87	489.66
20	202.83	490.63
21	212.74	491.95
22	222.60	493.61
23	232.40	495.62
24	242.11	497.97
25	251.75	500.67
26	261.28	503.69
27	270.69	507.06
28	279.99	510.75
29	289.15	514.76
30	298.16	519.09
31	307.01	523.74
32	315.70	528.70
33	324.21	533.96
34	332.52	539.51
35	340.64	545.35
36	348.54	551.48
37	356.23	557.87
38	363.69	564.54
39	370.90	571.46
40	377.87	578.63
41	384.59	586.04
42	391.04	593.68
43	397.21	601.55
44	403.11	609.62
45	408.72	617.90
46	413.80	626.00

Circle Center At X = 170.3 ; Y = 773.4 and Radius, 284.6

*** 1.527 ***

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	15.53	531.20
2	23.70	525.44
3	32.10	520.02
4	40.71	514.93
5	49.52	510.20
6	58.51	505.82
7	67.67	501.80
8	76.98	498.15
9	86.43	494.88
10	96.00	491.99
11	105.68	489.48

12	115.46	487.36
13	125.31	485.64
14	135.22	484.31
15	145.17	483.38
16	155.16	482.85
17	165.16	482.71
18	175.16	482.98
19	185.13	483.65
20	195.08	484.71
21	204.97	486.18
22	214.79	488.03
23	224.54	490.28
24	234.18	492.92
25	243.72	495.94
26	253.12	499.34
27	262.38	503.11
28	271.49	507.25
29	280.42	511.75
30	289.16	516.61
31	297.70	521.81
32	306.03	527.35
33	314.12	533.21
34	321.98	539.40
35	329.58	545.89
36	336.92	552.69
37	343.98	559.77
38	350.75	567.13
39	357.22	574.75
40	363.38	582.63
41	369.23	590.75
42	374.74	599.09
43	379.91	607.65
44	384.74	616.41
45	385.88	618.69

Circle Center At X = 163.5 ; Y = 732.6 and Radius, 249.9

*** 1.528 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.26	531.20
2	18.88	526.13
3	27.67	521.36
4	36.62	516.90
5	45.73	512.77
6	54.97	508.96
7	64.35	505.47
8	73.84	502.32
9	83.43	499.51
10	93.12	497.03
11	102.89	494.90
12	112.73	493.12
13	122.63	491.68
14	132.57	490.60
15	142.54	489.86
16	152.54	489.48
17	162.54	489.45
18	172.53	489.77
19	182.51	490.44
20	192.46	491.47
21	202.36	492.85
22	212.21	494.57
23	221.99	496.64
24	231.70	499.06
25	241.31	501.81
26	250.82	504.90
27	260.21	508.33
28	269.48	512.09
29	278.61	516.17
30	287.59	520.57
31	296.41	525.28

3001-15
part 15

R10340

APPENDIX C

SOIL BORINGS AND LABORATORY TESTS

SOIL BORINGS AND LABORATORY TESTS POND CREEK MINE #1 REFUSE DISPOSAL AREA WILLIAMSON COUNTY, ILLINOIS

Prepared for:

Foresight Management
208 Public Square, 4th Floor
Benton, Illinois 62812

Prepared by:

HOLCOMB FOUNDATION ENGINEERING CO.
Carbondale, Illinois
618-529-5262

July 11, 2012

HFE File Number: H-08283

TABLE OF CONTENTS

	PAGE
REPORT	1
BORING LOCATION DIAGRAM	2
BORING LOGS (22)	3-26
MONITORING WELL COMPLETION REPORT	27
ATTERBERG LIMIT TEST RESULTS	28
CONSOLIDATION TEST D-1 10'	29-51
TRIAXIAL SHEAR TEST REPORTS (2)	52-65
D-2 (13.5-16.0')	52-58
D-2 (18.5-21.0')	59-65
GENERAL NOTES	66
UNIFIED SOIL CLASSIFICATIONS	67

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

July 11, 2012

Foresight Management
208 Public Square, 4th Floor
Benton, Illinois 62812

Attention: Mr. Joe Lowry, P.E.

Re: Soil Borings and Laboratory Tests
Pond Creek Mine #1 Refuse Disposal Area
Williamson County, Illinois
HFE File H-08283

Dear Sir:

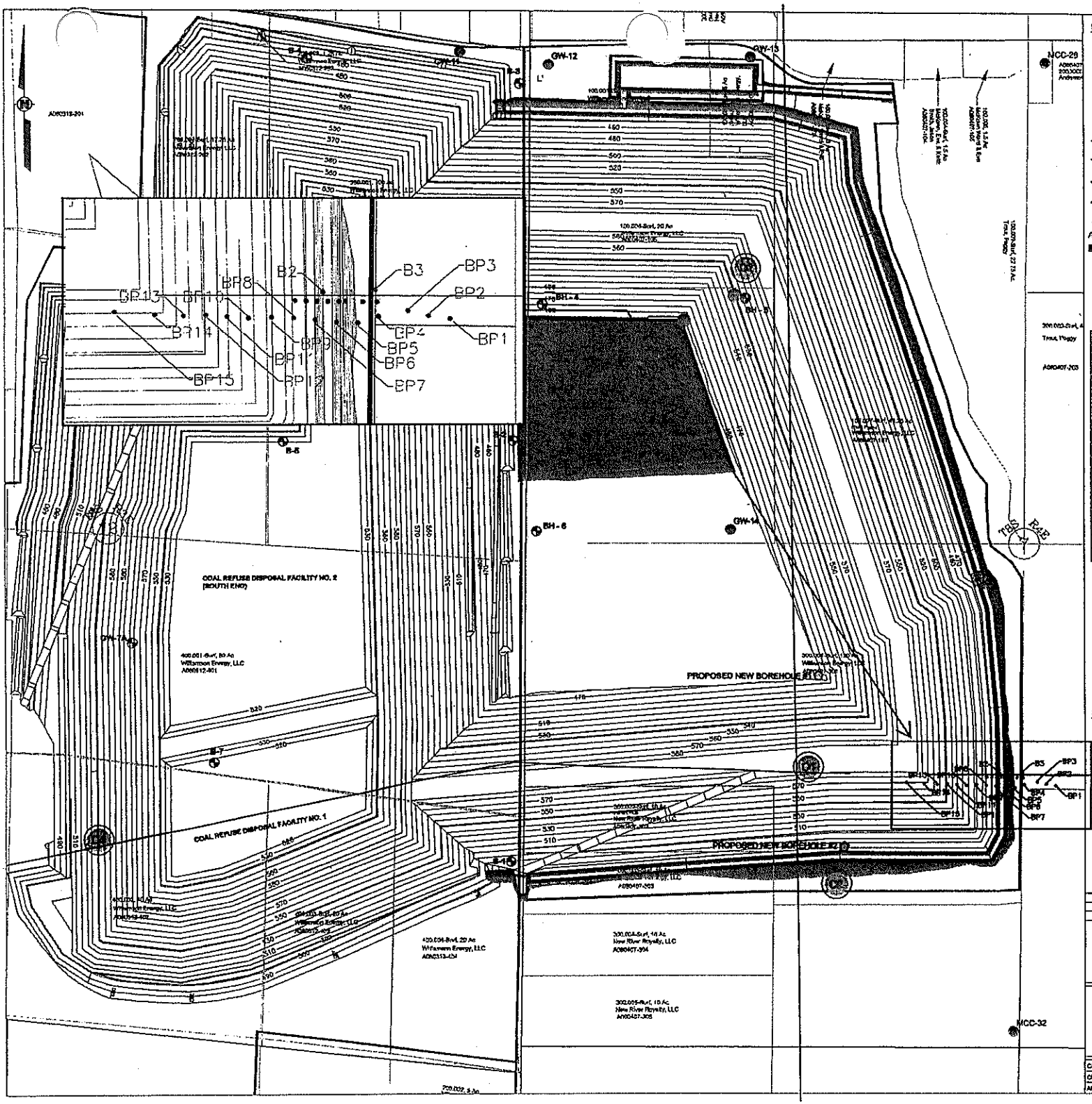
From May 30 until June 8, 2012, we drilled 22 soil borings at this site. The borings are located as indicated on the enclosed Boring Location Diagram. Soils sampled in Borings D-1 and D-2 were subjected to Atterberg limits tests, a consolidation test, and consolidated-undrained triaxial tests.

The Boring Logs, Well Completion Diagram, and Laboratory Test Results are attached. If you should have any questions please feel free to contact us at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

Timothy J. Holcomb, P.E.



SURVEYED BOREHOLE LOCATIONS

BORING NUMBER	NORTHING	EASTING	TOP OF PIPE	GROUND ELEVATION
BH-4	429343	360407	---	436.27
BH-5	429376	361483	---	444.28
BH-6	428184	360375	---	452.07
GW-7A	427587	358275	---	452.0
GW-10	429483	358105	437.68	435.17
GW-11	430660	359981	440.50	437.77
GW-12	430598	360443	438.13	435.25
GW-13	430637	361492	444.57	441.57
GW-14	428172	361383	456.52	453.58
B-1	428451	360239	---	481.8
B-2	428637	360254	---	446.3
B-3	430497	360292	---	435.4
B-4	430626	359192	---	442.2
B-5	428836	359062	---	447.9
B-7	428984	358695	---	459.4

NOTES:

1) FOR GEOLOGIC CROSS SECTION A–AA', SEE DRAWING NO. B12-271-E2

2) FOR GEOLOGIC CROSS SECTION B–BB', SEE DRAWING NO. B12-271-E3

REFERENCES:

1) TOPOGRAPHIC MAPPING PROVIDED BY WILLIAMSON ENERGY, LLC.

2) INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2 WAS ACQUIRED FROM ALLIANCE CONSULTING INC.'S (ALLIANCE) DRAWING NO. B09-018-M2.

3) LOCATIONS FOR BORING NOS. B-1, B-2, B-3, B-4, B-5, B-7 AND GW-7A WERE OBTAINED FROM ALLIANCE'S DRAWING NO. B05-330-M25.

4) COORDINATE AND ELEVATION DATA FOR BORINGS BH-4, BH-5, BH-6 AND GW-10 THROUGH GW-14 WERE OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS.

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers - Constructors - Scientists

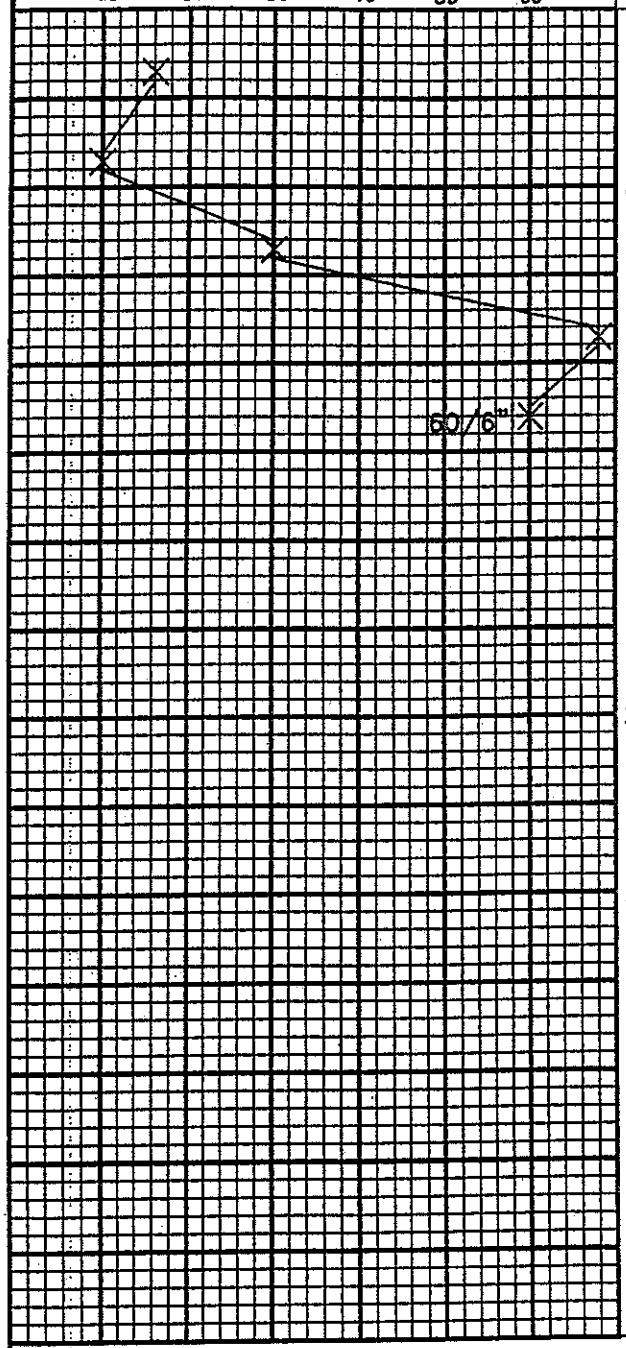
PROPOSED BOREHOLE LOCATION MAP

CAD BY	BSM	06/17/15	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO B12-271-E1

R10344

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-1



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Silty CLAY (CL)
	2	ss		
5	3	ss		
				Brown Sandy CLAY (CL)
	4	ss		Brown Weathered Sandstone
10	5	ss		Brown Sandstone
				End of Boring @ -12.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

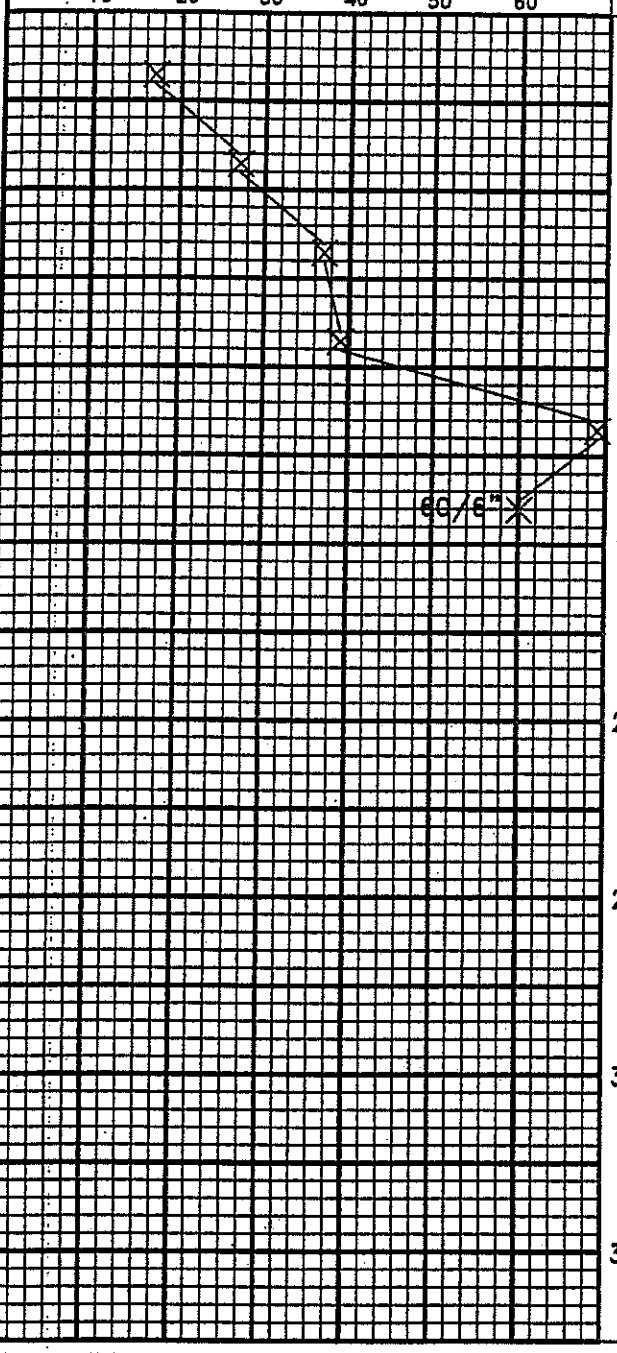
Date of Boring
May 30, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-2



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
5	2	ss		Brown Mott. Gray Weathered Shale
	3	ss		Brown Mott. Gray Shale
10	4	ss		
	5	ss		
	6	ss		Gray Mott. Brown Shale
15				End of Boring @ -14.5'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

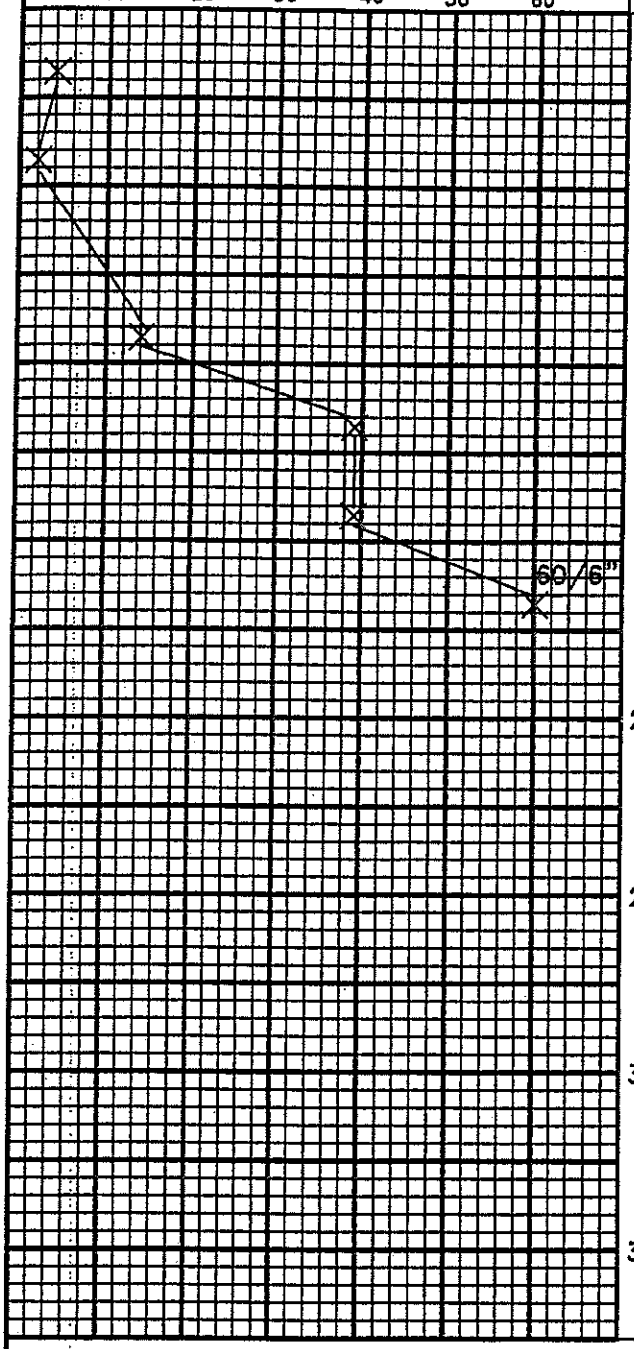
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-3

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
5	2	ss		Gray Mott. Brown Silty CLAY (CL)
	3	ss		Brown Mott. Gray Silty CLAY (CL)
	4	ss		
10	5	ss		Gray Mott. Brown Shale
	6	ss		
15	7	ss		
				End of Boring @ -17.5'
20				
25				*Note: Moved Rig 4' up & pushed Shelby Tube 3-5' Deep
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

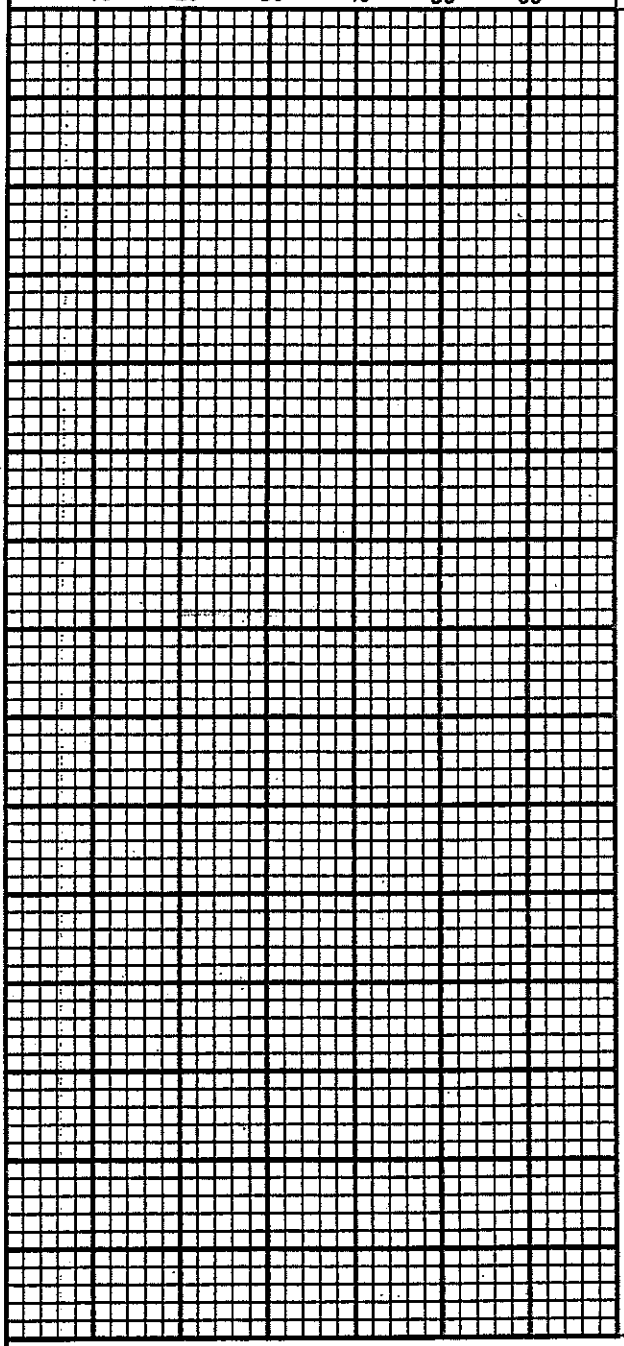
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Shale
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

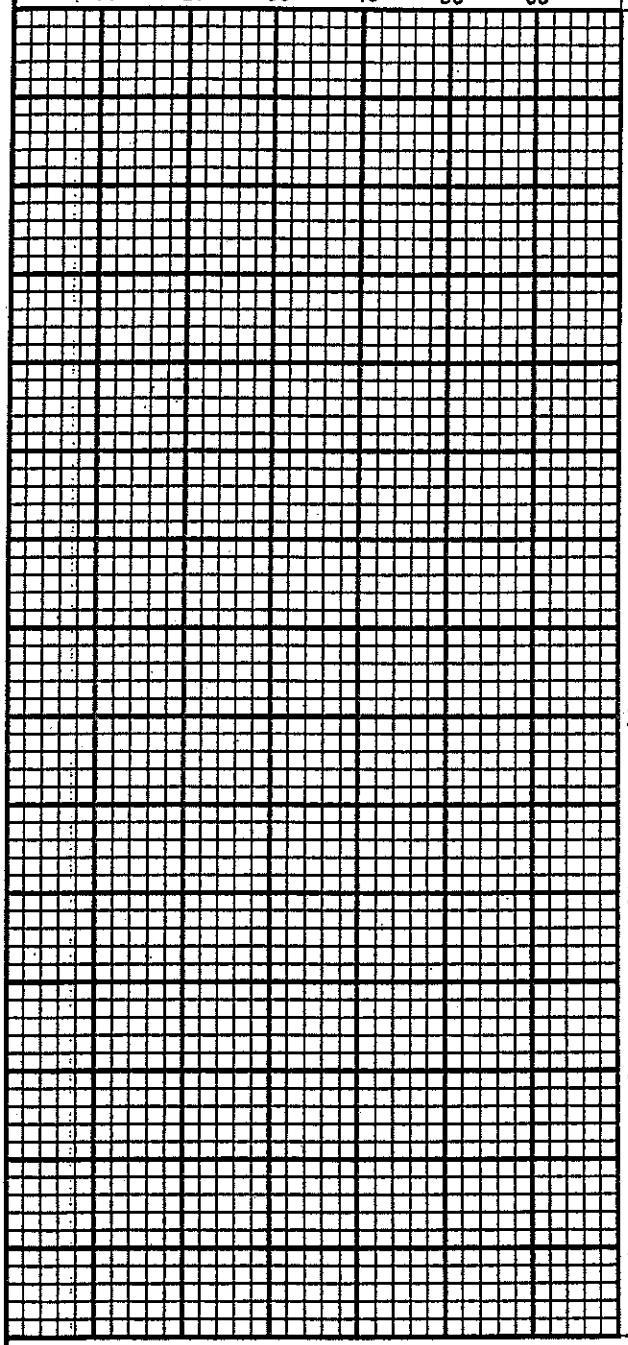
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
				Gray Shale
10				
				End of Boring @ -11.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP3

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Shale
15				End of Boring @ −14.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

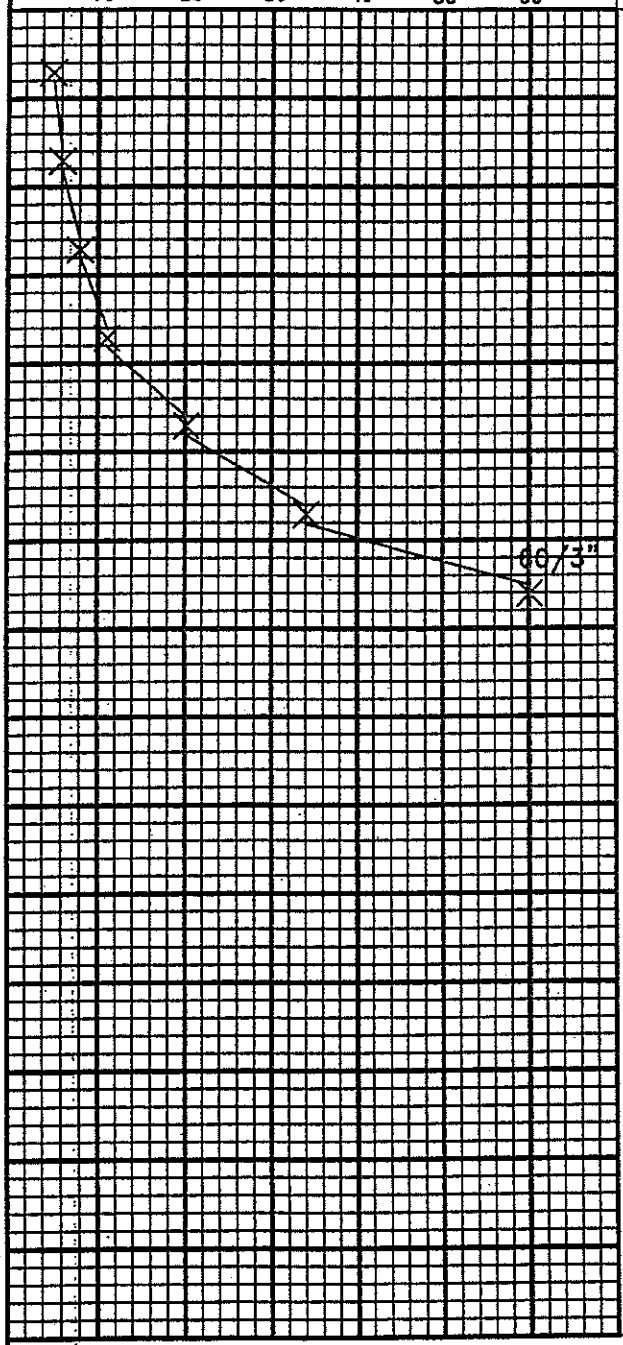
Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP4



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
5	2	ss		
	3	ss		
	4	ss		Brown Mott. Gray Sandy CLAY (CL)
10	5	ss		
				Gray Weathered Shale
	6	ss		
15	7	ss		
				End of Boring @ −17.0'
				Well set @ −16.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H−08283

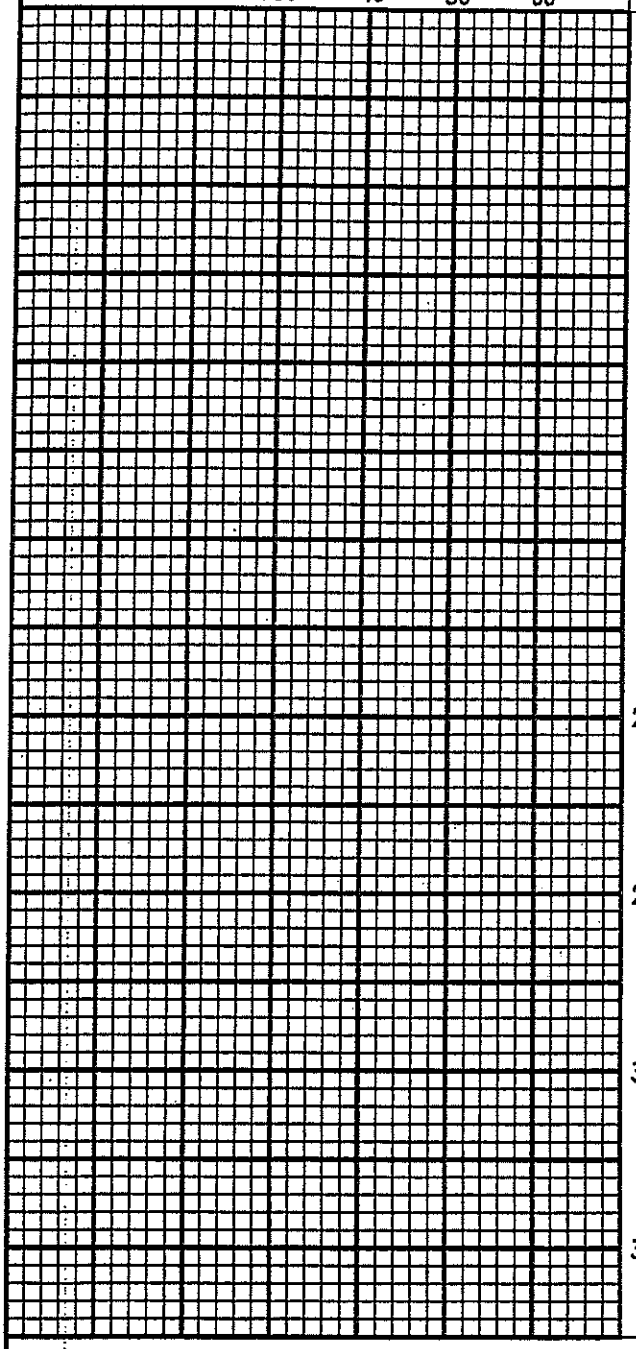
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP5

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Shale
				End of Boring @ −13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

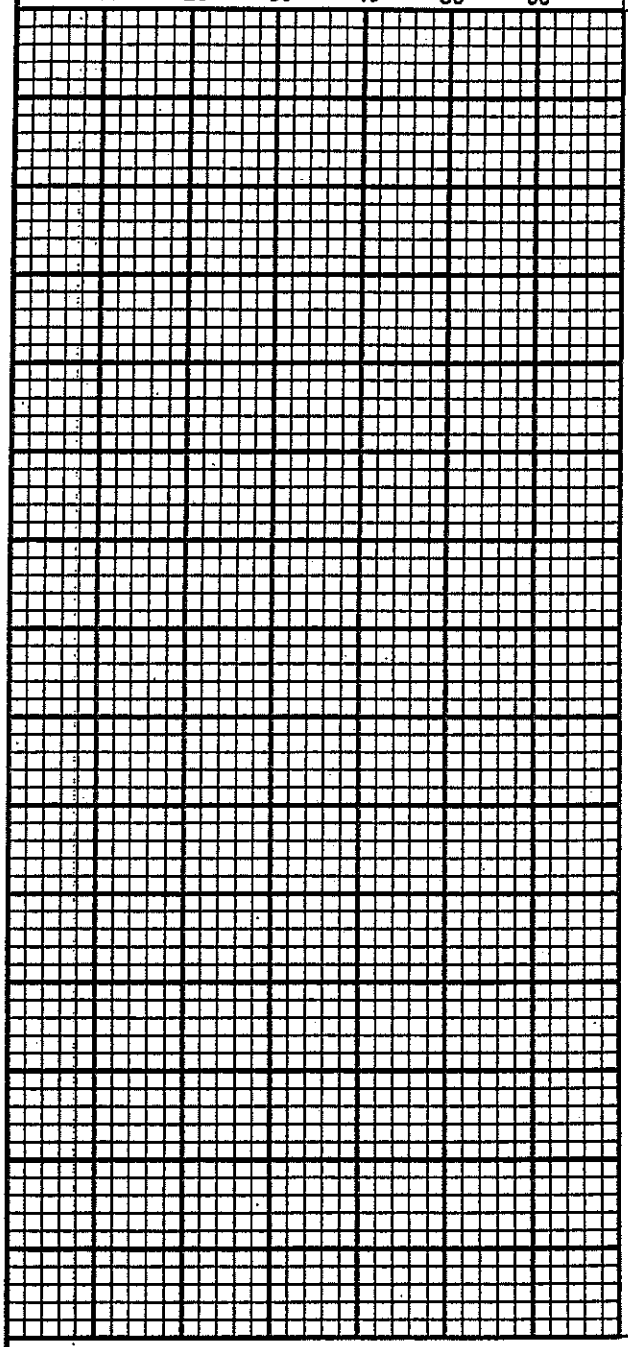
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP6

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
		Au		Brown Silty CLAY (CL)
				Gray Shale
				End of Boring @ -14.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP7

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
5		Au		Brown Silty CLAY (CL)
10				Gray Shale
15				End of Boring @ -13.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP8

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

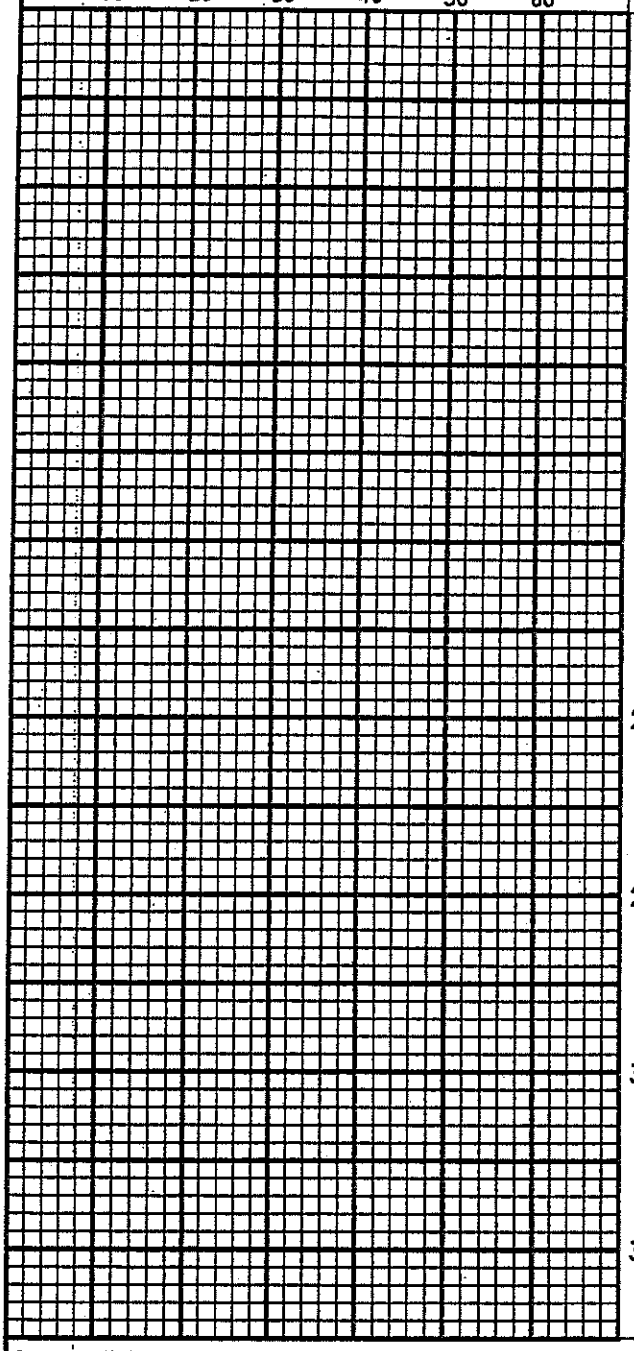
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP9

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
		Au		Brown Silty CLAY (CL)
				Gray Weathered Shale
				End of Boring @ −13.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP10

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5				
		Au		
10				
15				Gray Weathered Shale
				End of Boring @ -17.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP11

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5				
		Au		
10				
				Gray Weathered Shale
15				
				End of Boring @ -17.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

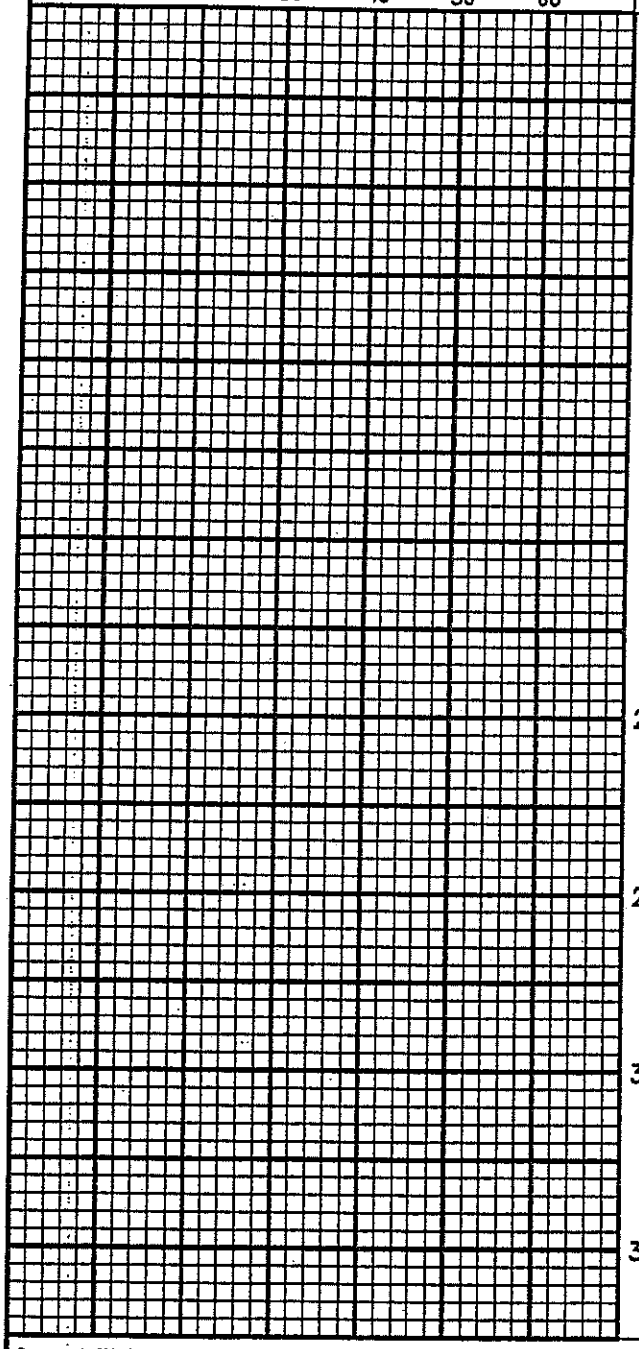
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP12

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Weathered Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

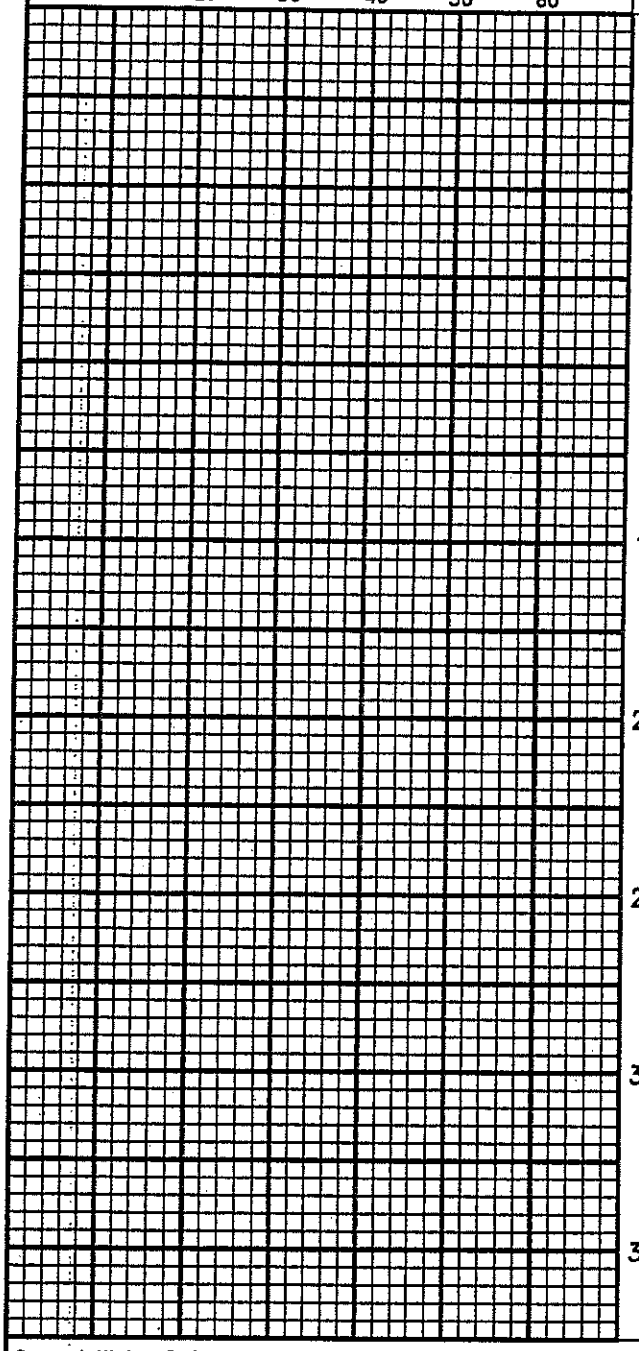
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP13

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Weathered Shale
15				End of Boring @ −14.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

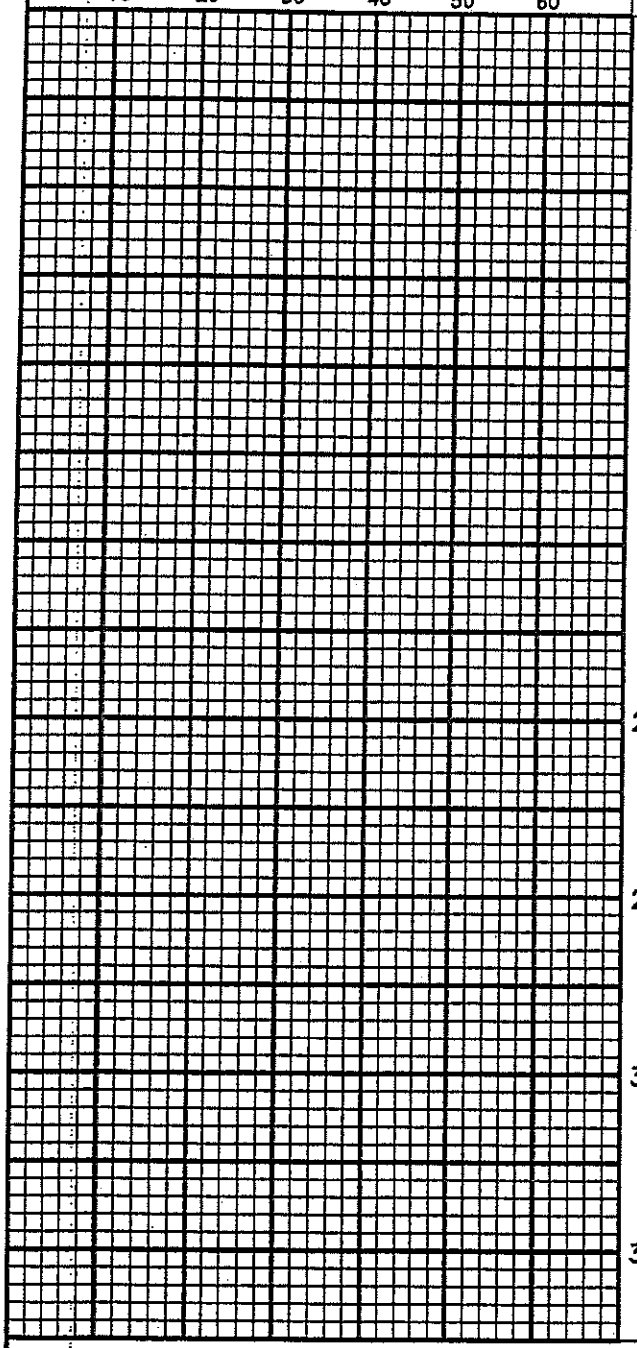
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP14

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Brown Weathered Shale
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP15

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Brown Weathered Shale
				End of Boring @ −13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H−08283

R10363

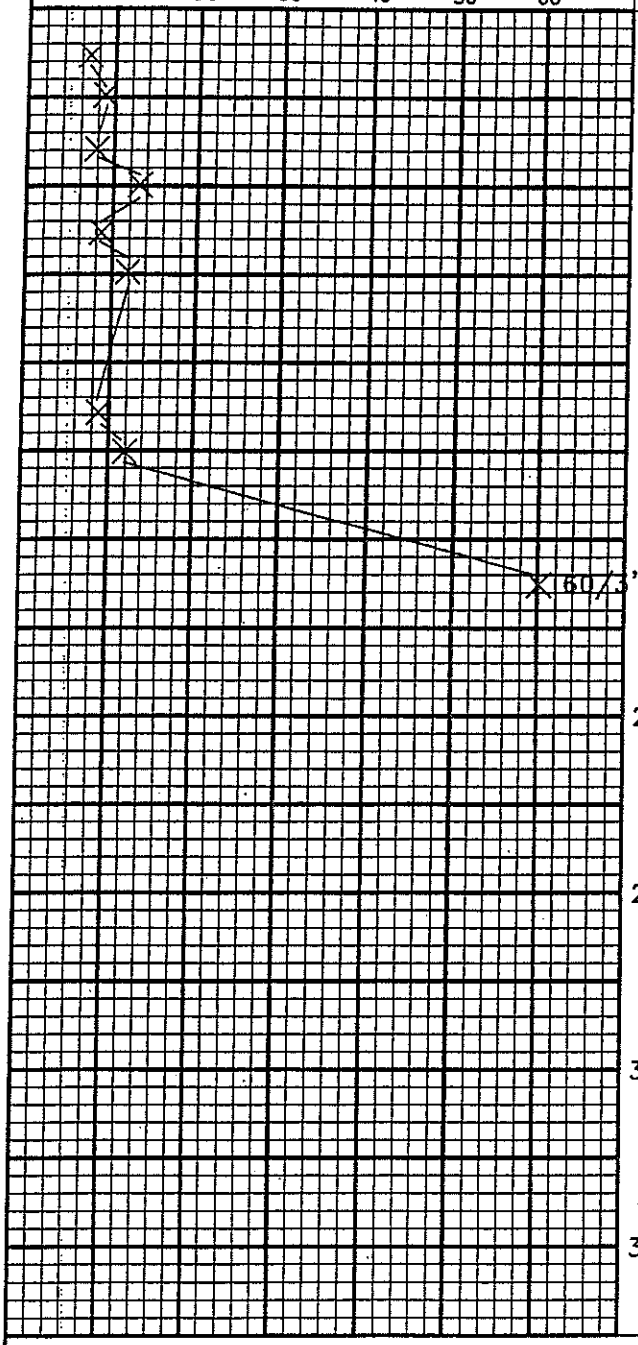
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
5	2	ss		
	3	ss		
10	4	st		
	5	ss		
	6	st		
15	7	ss		Brown Weathered SHALE
				End of Boring @ -15.5'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

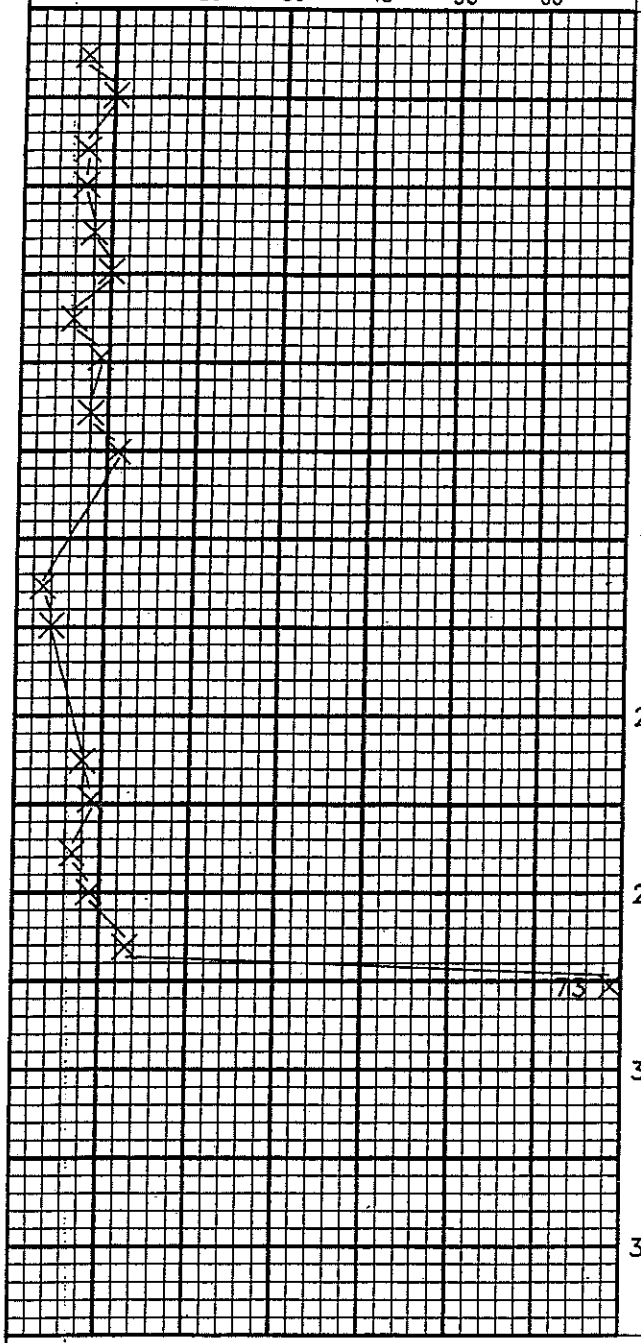
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
5	2	ss		
	3	ss		
	4	ss		
10	5	ss		
	6	st		
15	7	ss		Brown Mottled Gray Sandy CLAY(CL)
	8	st		
20	9	ss		
	10	ss		Gray Silty CLAY (CL)
25	11	ss		Gray – Brown Weathered SHALE
				Gray SHALE
				End of Boring @ –28.0'
30				
35				

Ground Water Data
Ground Water Encountered @ –16.0' During Drilling and @ –25.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring June 8, 2012
Client: Williamson Energy Marion, Illinois	Project No. H–08283

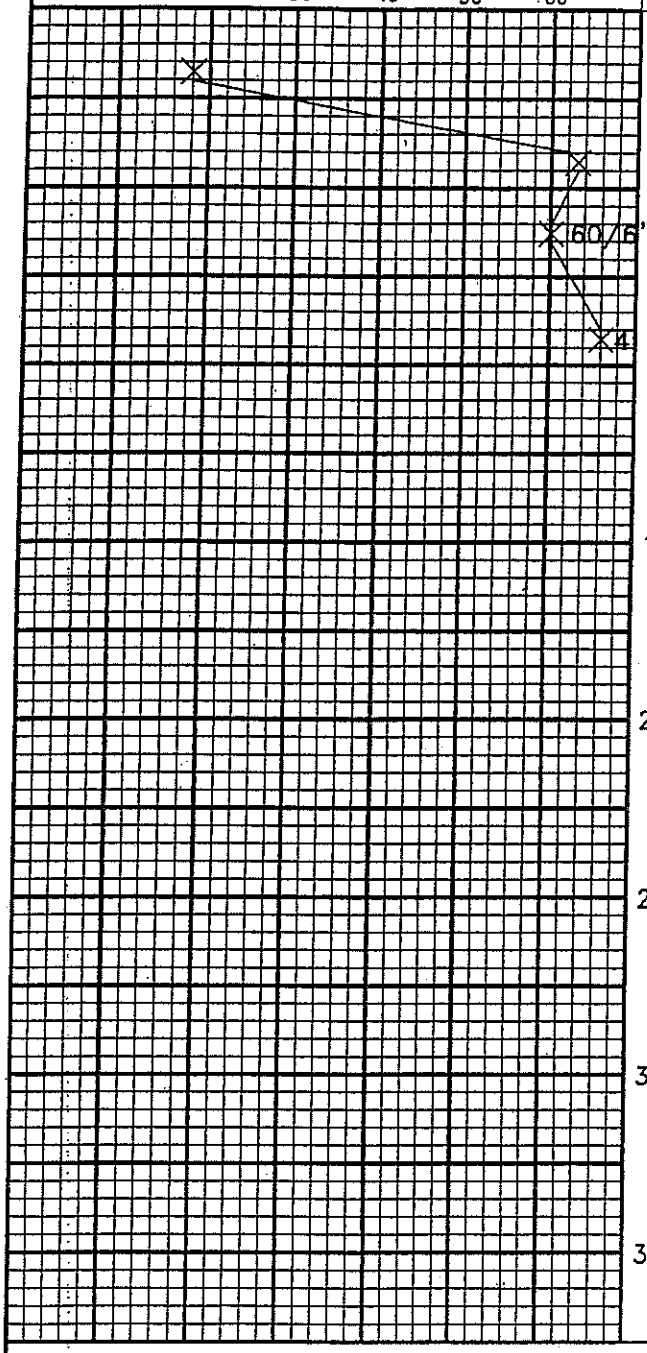
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" Topsoil
	1	ss		Brown Mottled Gray Silty CLAY (CL) with sand
	2	ss		
5	3	ss		Brown SANDSTONE
	4	ss		
10	5	rc		Gray Mottled Brown SHALE
15	6	rc		Gray SHALE
20	7	rc		
25	8	rc		
30	9	rc		
35	10	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ −8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area Williamson County, Illinois	Date of Boring June 8, 2012
Client: Williamson Energy Marion, Illinois	Project No. H−08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
40				
	11	rc		
45				
	12	rc		
50				Black SHALE
	13	rc		Gray Sandy SHALE
55				
	14	rc		
60				
	15	rc		
65				
	16	rc		
70				End of Boring @ −70.0'

Ground Water Data
No Ground Water Encountered During Drilling and @ −8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R10367

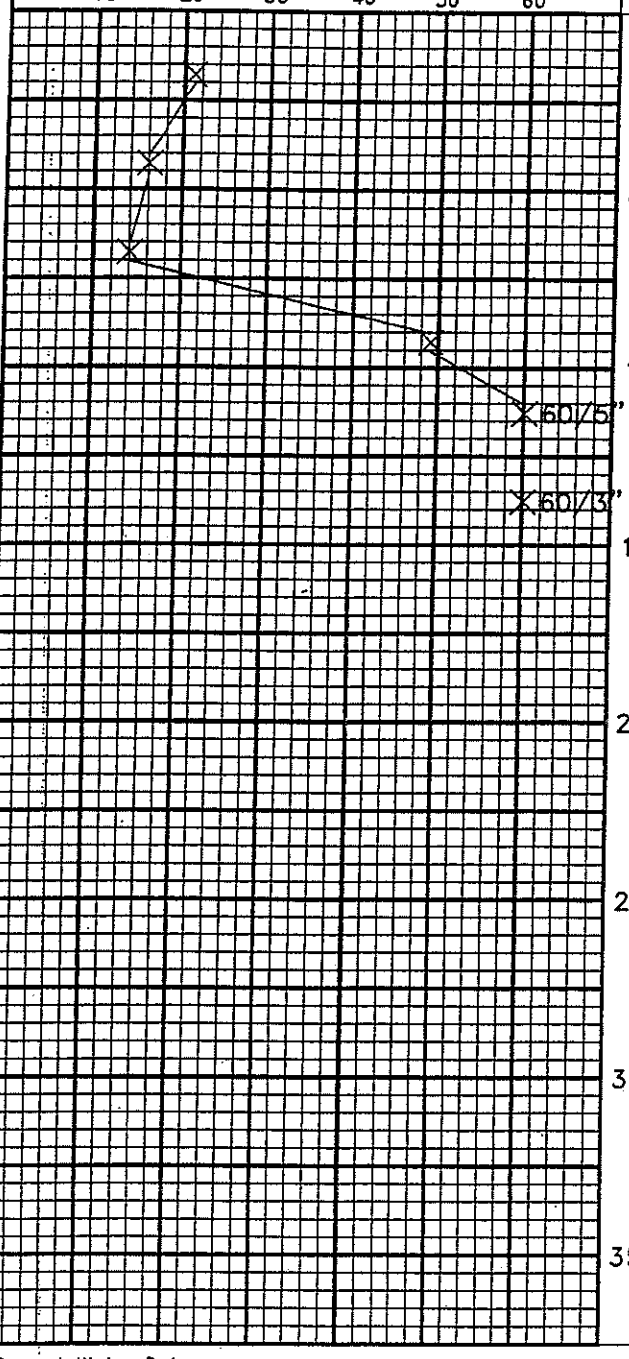
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
	2	ss		
5	3	ss		
	4	ss		Brown Mottled Gray SANDSTONE
10	5	ss		
	6	ss		
15	7	rc		
20	8	rc		
25	9	rc		
30	10	rc		Brown-Gray Clayey SHALE
35	11	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ −10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				GRay SHALE
40				
	12	rc		
45				
	13	rc		
50				
	14	rc		
55				
	15	rc		
60				
	16	rc		
65				End of Boring @ -65.0'
70				

Ground Water Data
No Ground Water Encountered During Drilling and @ -10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW28

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 6/5/2012

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 6/5/2012

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Sand Pack: FilterSil #0

Source of Sand: FilterSil Junction City, GA

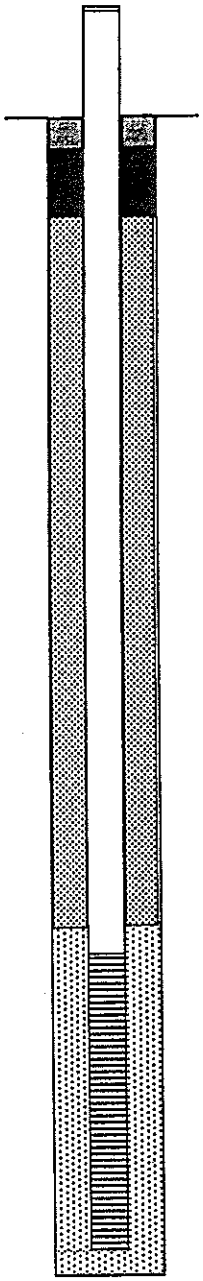
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			10.0'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			—	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



+3.0 MSL Top of Riser Pipe

0 MSL Ground Surface

2 ft. Concrete Seal

2 ft. Top of Bentonite

3 ft. Bentonite

5 ft. Top of Sand

6 ft. Top of Screen

10.0 ft. Total Screen Interval

16 ft. Bottom of Screen

17 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

Atterberg Limits Test Results

Pond Creek Mine #1
Refuse Disposal Area

HFE File: H-08283
Date: 6/30/12

Boring/Depth(Ft.)	Liquid Limit(%)	Plastic Limit(%)	Plasticity Index	Soil Classification
D-1 (8.5-11.0')	51.3	21.2	30.1	Fat CLAY (CH)
D-2 (13.5-16.0')	24.1	14.7	9.4	Silty CLAY (CL)
D-2 (18.5-21.0')	41.2	22.5	18.7	Silty CLAY (CL)

Geotechnology, Inc.
11816 Lackland Road, Suite 150
St. Louis, MO 63146
314-997-7440

GEOTECHNOLOGY, INC.
ENGINEERING AND ENVIRONMENTAL SERVICES

TEST REPORT

Prepared For:
Holcomb Foundation Engineering Company
P.O. Box 88
Carbondale, IL 62903
618-529-5262

Report No.:	**J019144.02**	**June 29, 2012**
Material:	**Sample**	**Page 1 of 23**
Project:	**Mach Mine**	
Sampled By:	**Client**	
Attention:	**Mr. Tim Holcomb**	

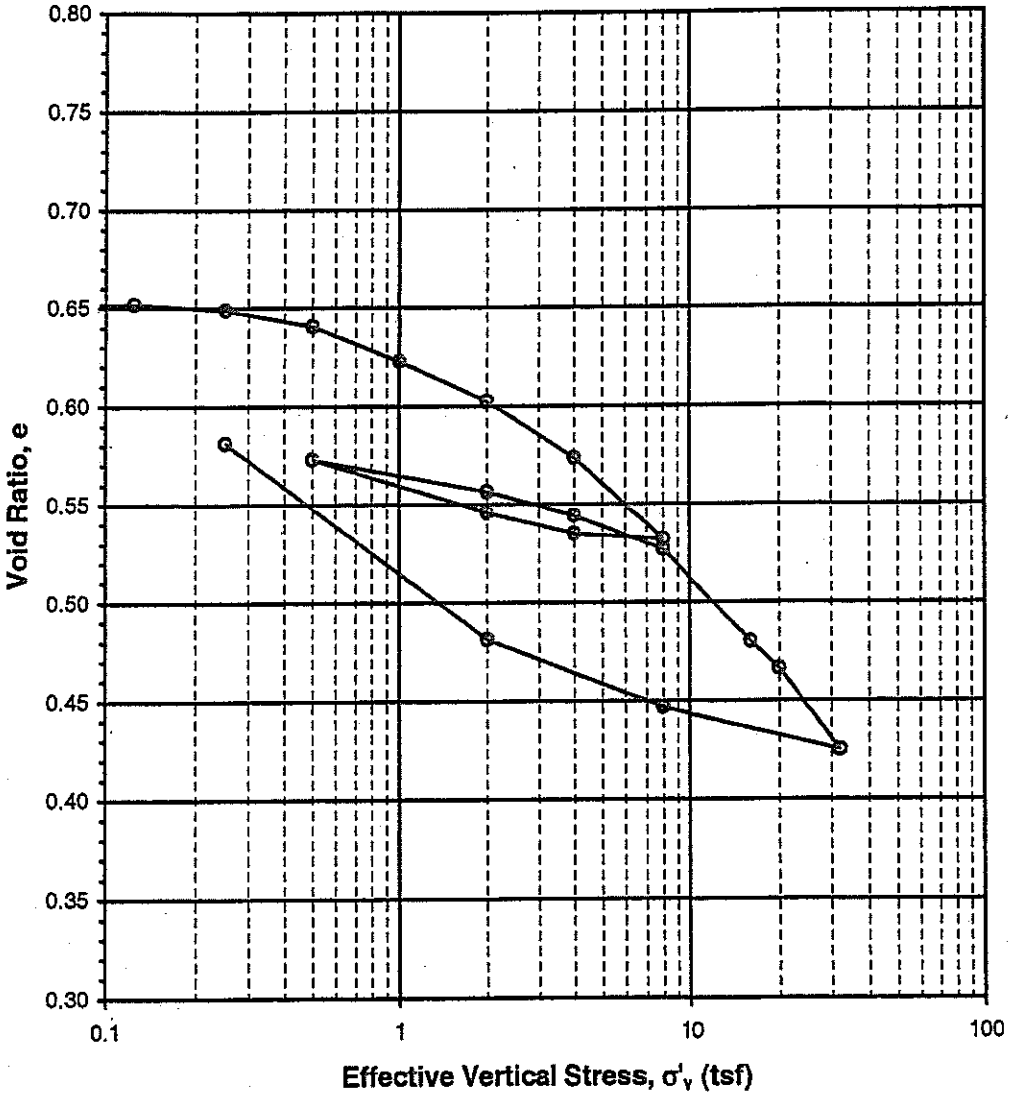
INCREMENTAL CONSOLIDATION TEST
ASTM D2435

Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)
23.0	126	102

Time curves and plot attached.

GEOTECHNOLOGY INC
FROM THE GROUND UP

Liquid Limit=		Plastic Limit=	
Plastic Index =		USCS:	
Compression Index, C_c =	0.144	Void Ratio, e_o =	0.652
Recompression Index, C_r =	0.038	Preconsolidation Pressure =	1.9 tsf



1-D CONSOLIDATION TEST: INCREMENTAL

ASTM D 2435
Project No.: J019144.02
Boring: D-1
Sample: - Depth: 10 ft.

ONE - DIMENSIONAL CONSOLIDATION TEST ASTM D2435:
INCREMENTAL LOADING DATA (Input: Deformation)

Project Number: J019144.02
Project Name: MACH MINE
Boring No.: D-1
Sample No.:
Depth (ft): 10

Test Station No.: INC-149
Data; Start: 6/12/2012
Completed: 6/22/2012
Initial Height, H_o (mm): 0.997

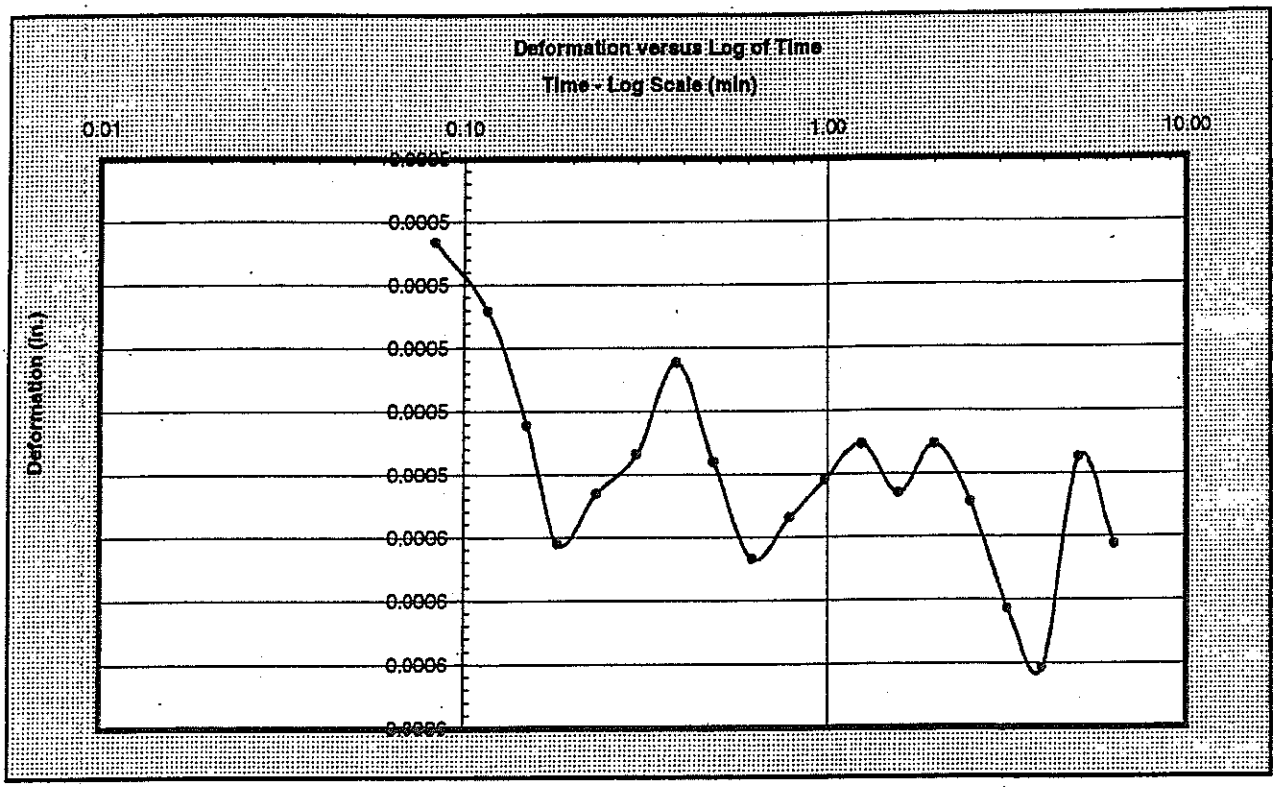
Dial Gauge No.: DG-149
Disp. Trans. No: DT-149
Station No.: 149
DT Factor (in/V/V): 151.918
Excitation Voltage,V: 10.0297

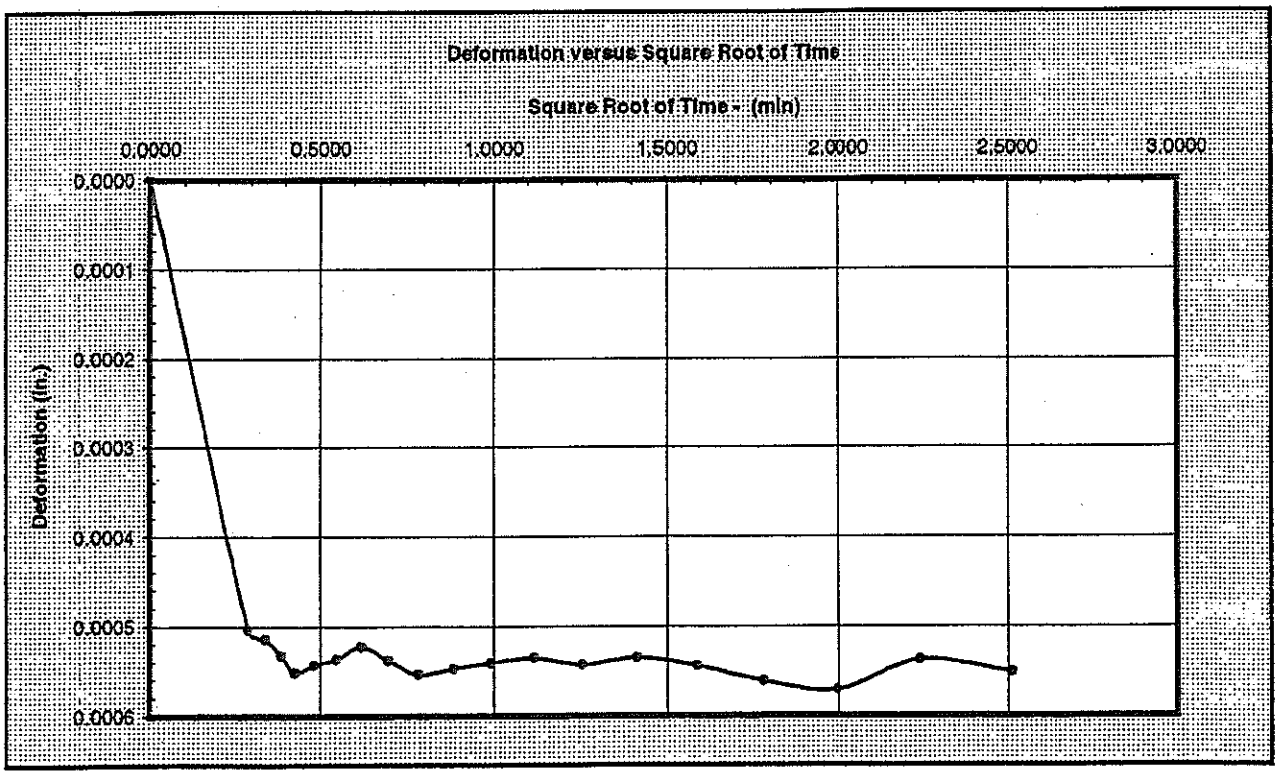
Notes:
(1) W - water added, S - stress level applied to prevent swelling,
(2) Increasing deformation reading or fitting value indicates: [X] compression or, [ ] swell.
(3) Value in brackets indicates, it is an assumed value.

Summary Data Inputted By: KA , _____ , _____

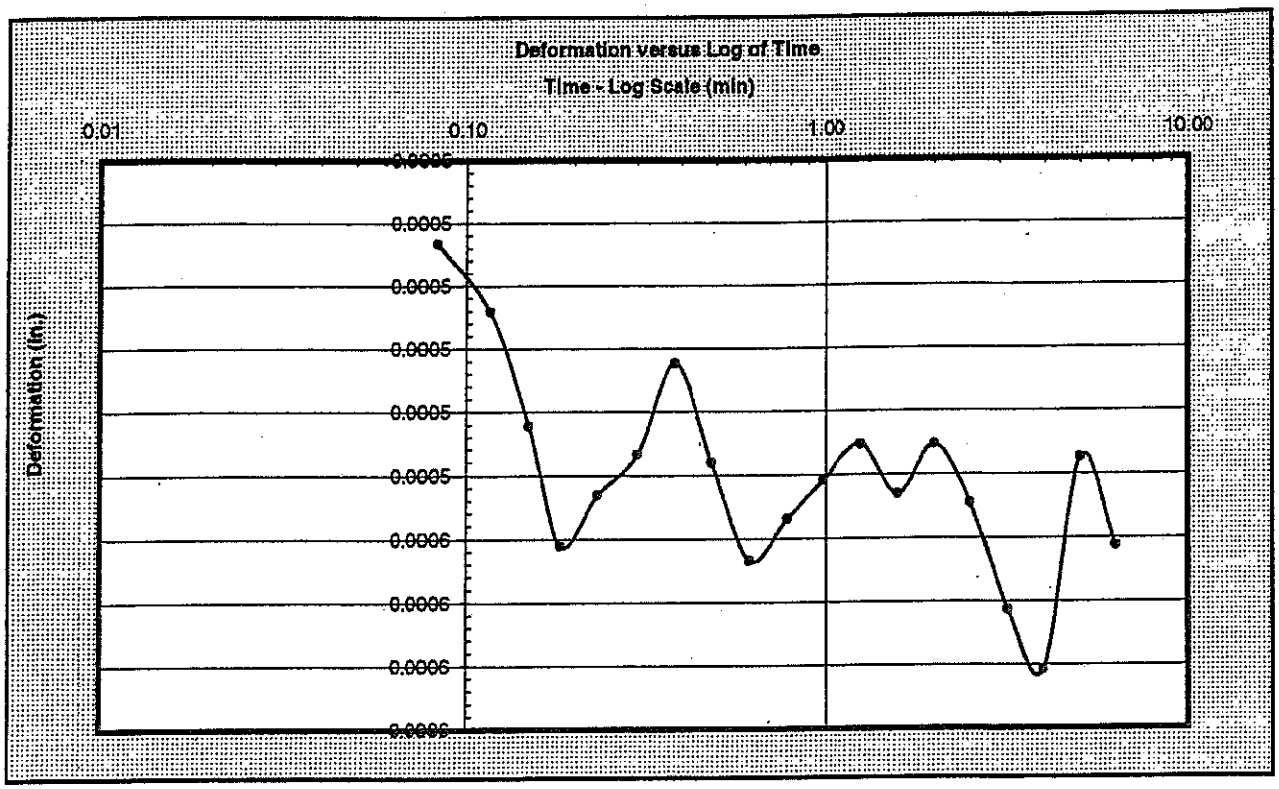
Reviewed By: _____
Spot Checked By: KA
Checked By: _____

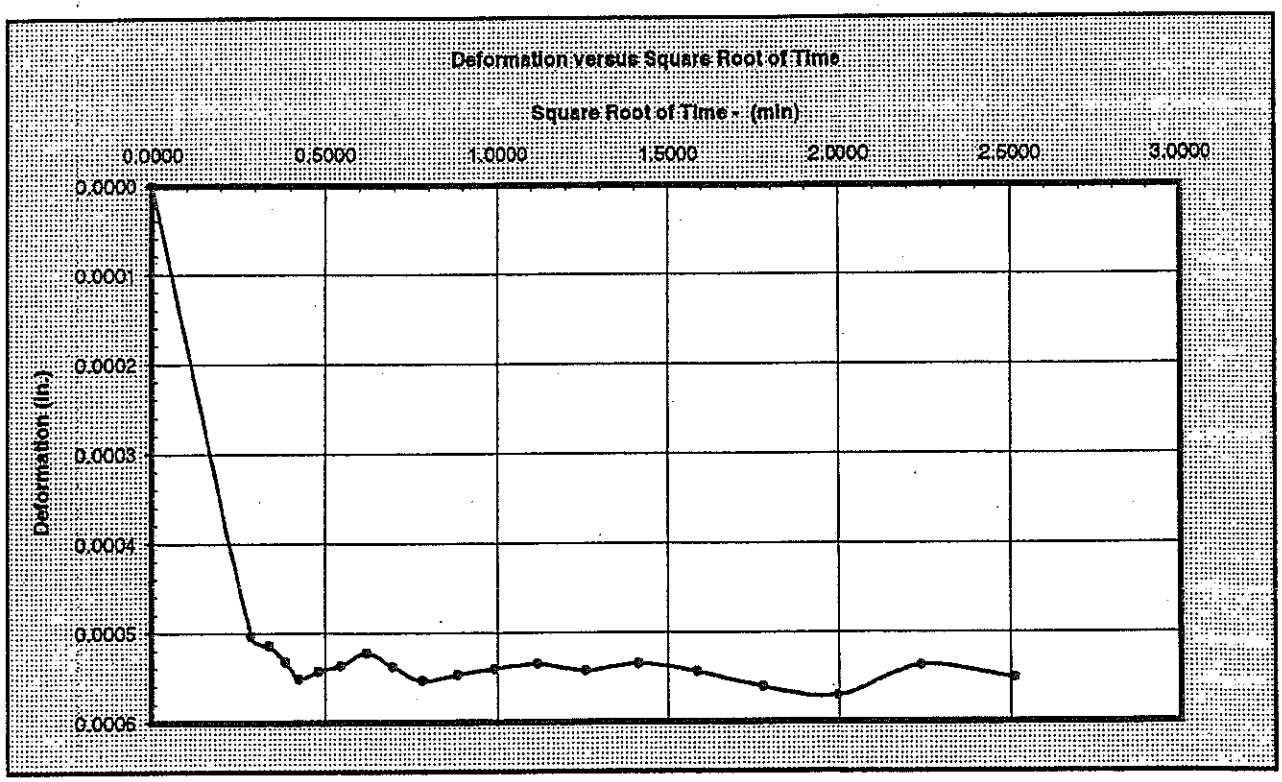
(1)	Final Applied Effective Stress, $\sigma'_{v,c}$ (tsf)	Volumetric (Axial) Strain, $\varepsilon_{v,n}$ ($\varepsilon_{a,n}$) $\Delta H_{c,n} / H_o$ (%)	Void Ratio e_n	Duration of Stress (Load) Increment (hr)	Final Deformation Reading, $d_{rf,n}$ (2) (in)	Total App. Flexibility Correction $\Sigma\Delta d_{afc,n}$ (2) (in)
	0.010	0.03	0.652		0.0005	0.0002
	0.125	0.04	0.652		0.0005	0.0003
	0.250	0.22	0.649		0.0055	0.0036
	0.500	0.72	0.640		0.0122	0.0086
	1.000	1.80	0.623		0.0211	0.0118
	2.000	3.04	0.602		0.0328	0.0143
	4.000	4.76	0.574		0.0500	0.0168
	8.000	7.28	0.532		0.0735	0.0177
	4.000	7.10	0.535		0.0712	0.0181
	2.000	6.45	0.546		0.0663	0.0201
	0.500	4.80	0.573		0.0496	0.0218
	2.000	5.81	0.557		0.0591	0.0230
	4.000	6.55	0.544		0.0671	0.0248
	8.000	7.60	0.527		0.0763	0.0253
	16.000	10.46	0.480		0.1058	0.0268
	20.000	11.28	0.466		0.1157	0.0300
	32.000	13.77	0.425		0.1423	0.0350
	8.000	12.45	0.447		0.1257	0.0365
	2.000	10.38	0.481		0.1075	0.0405
	0.250	4.30	0.581		0.0543	0.0519


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
Deformation (in.)
0.0005
0.0005
0.0005
0.0005
0.0005
0.0006
0.0006
0.0006

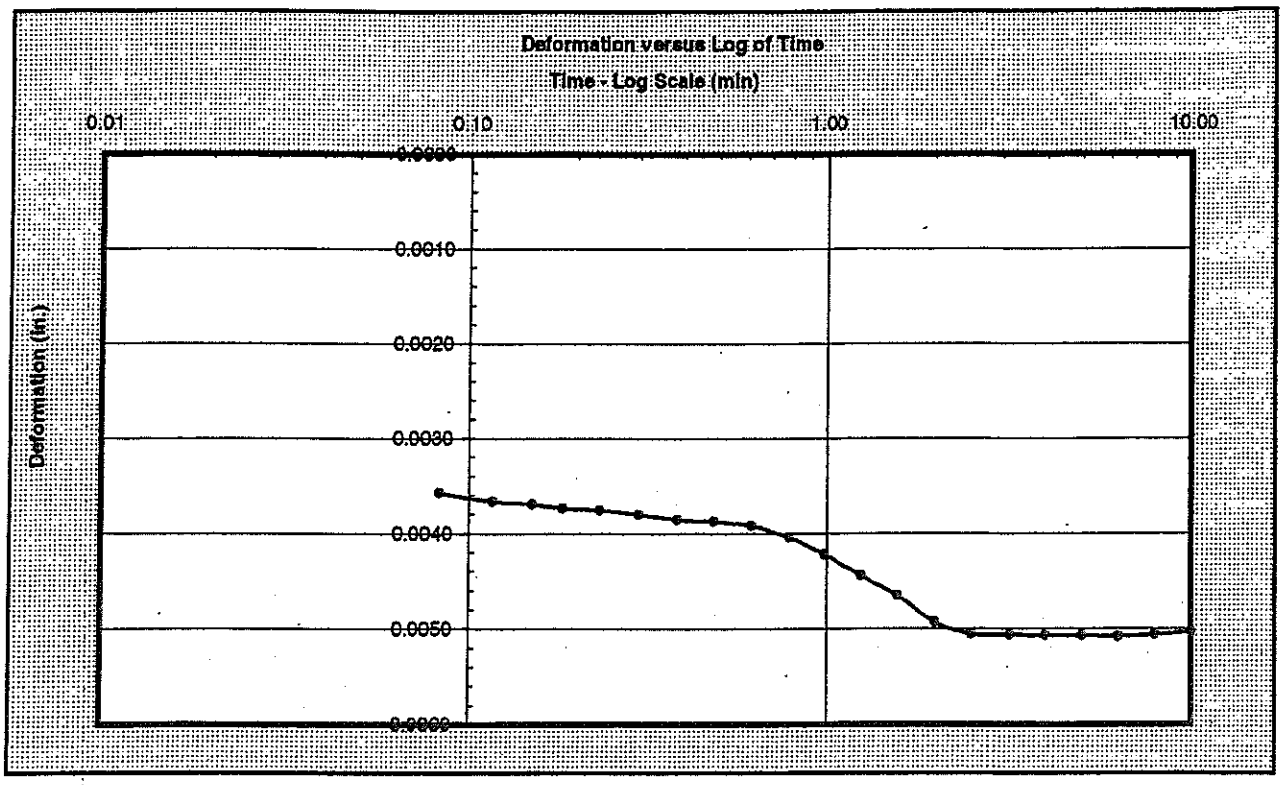

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
Deformation (in.)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006

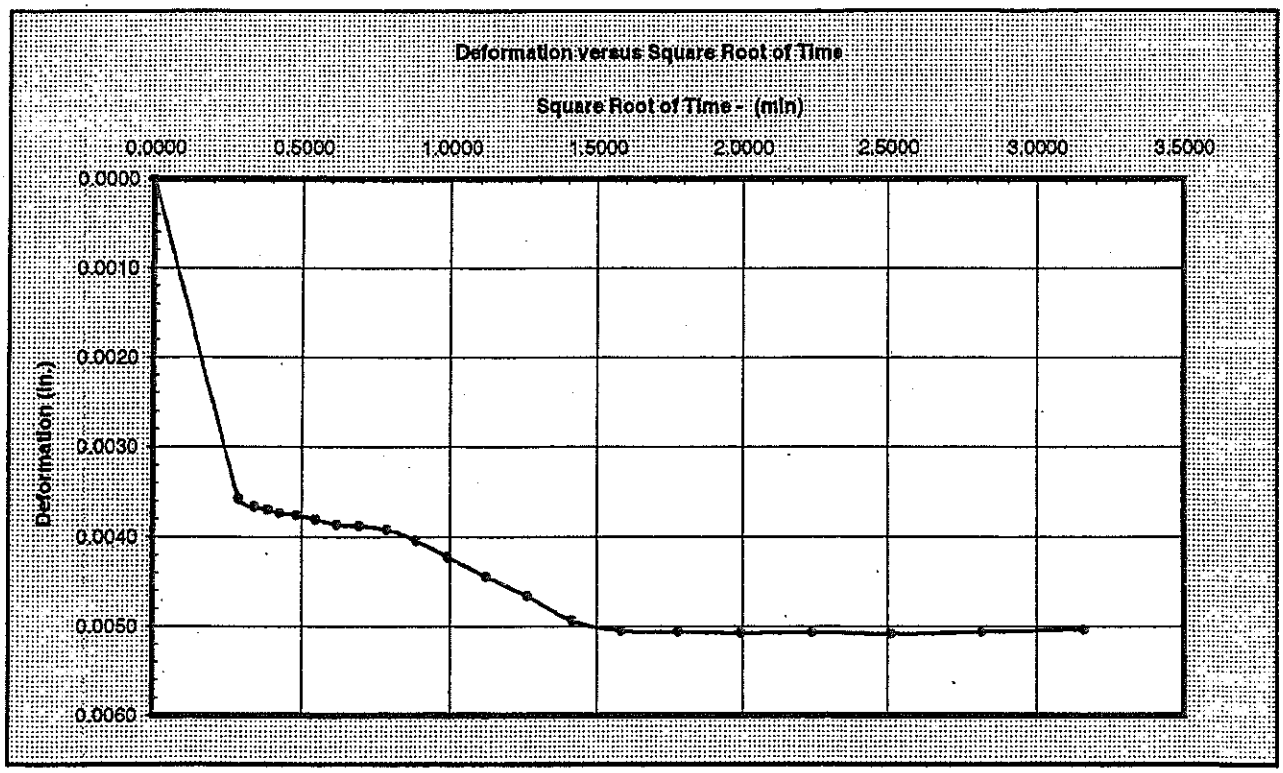
Seating


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
Deformation (in.)
0.0005
0.0005
0.0005
0.0005
0.0006
0.0006
0.0006

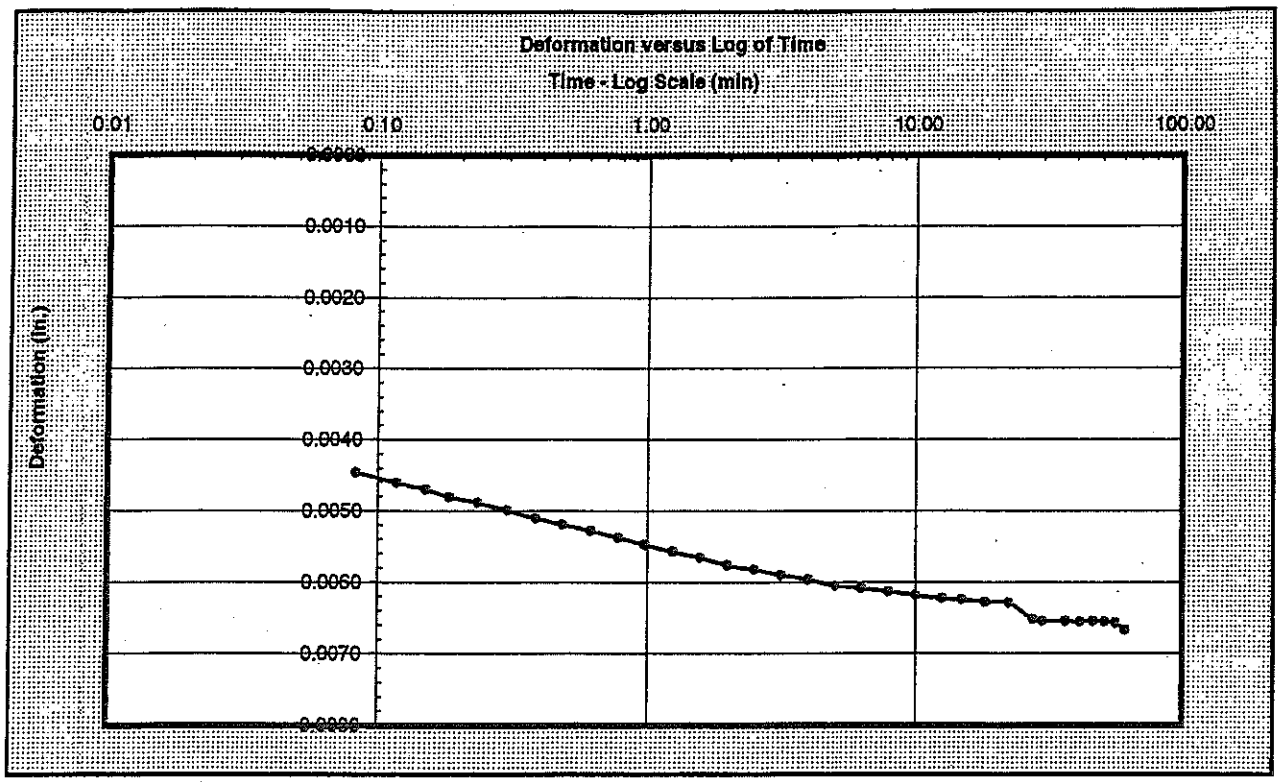

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
Deformation (in.)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006

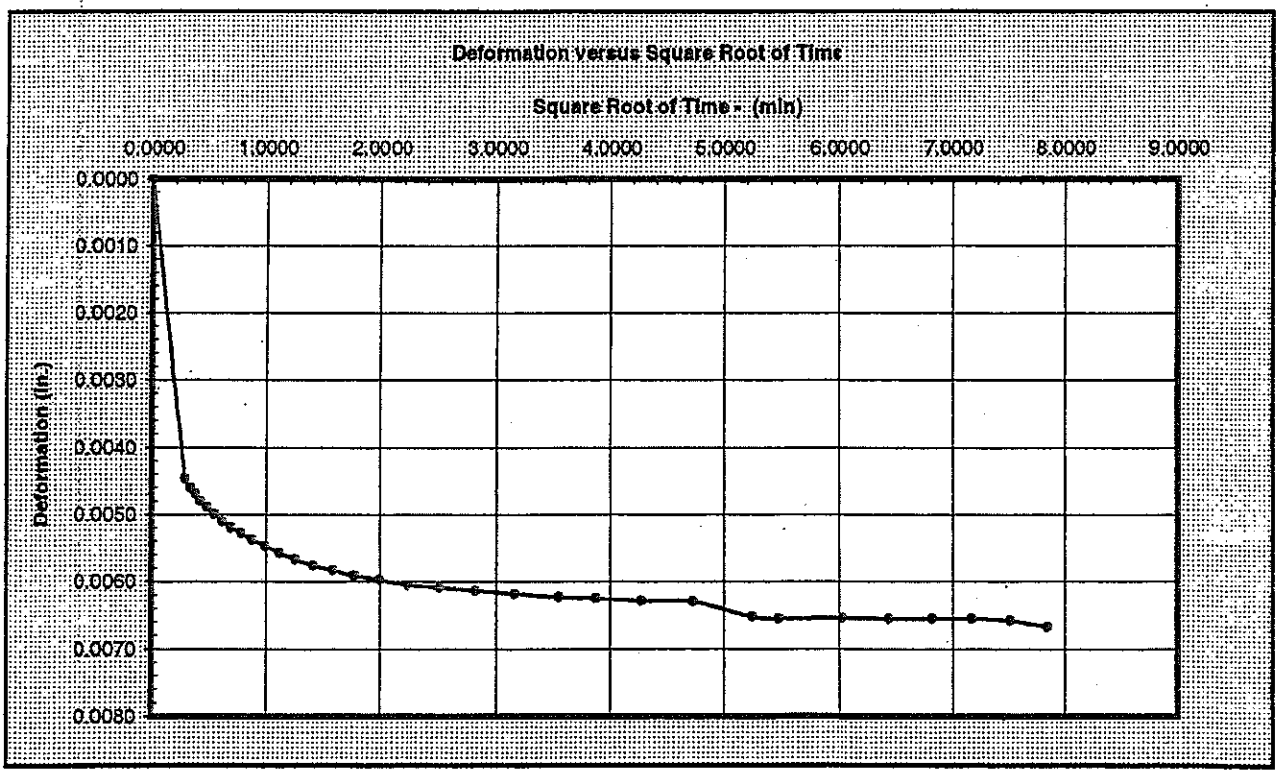
1/8 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
Deformation (in.)

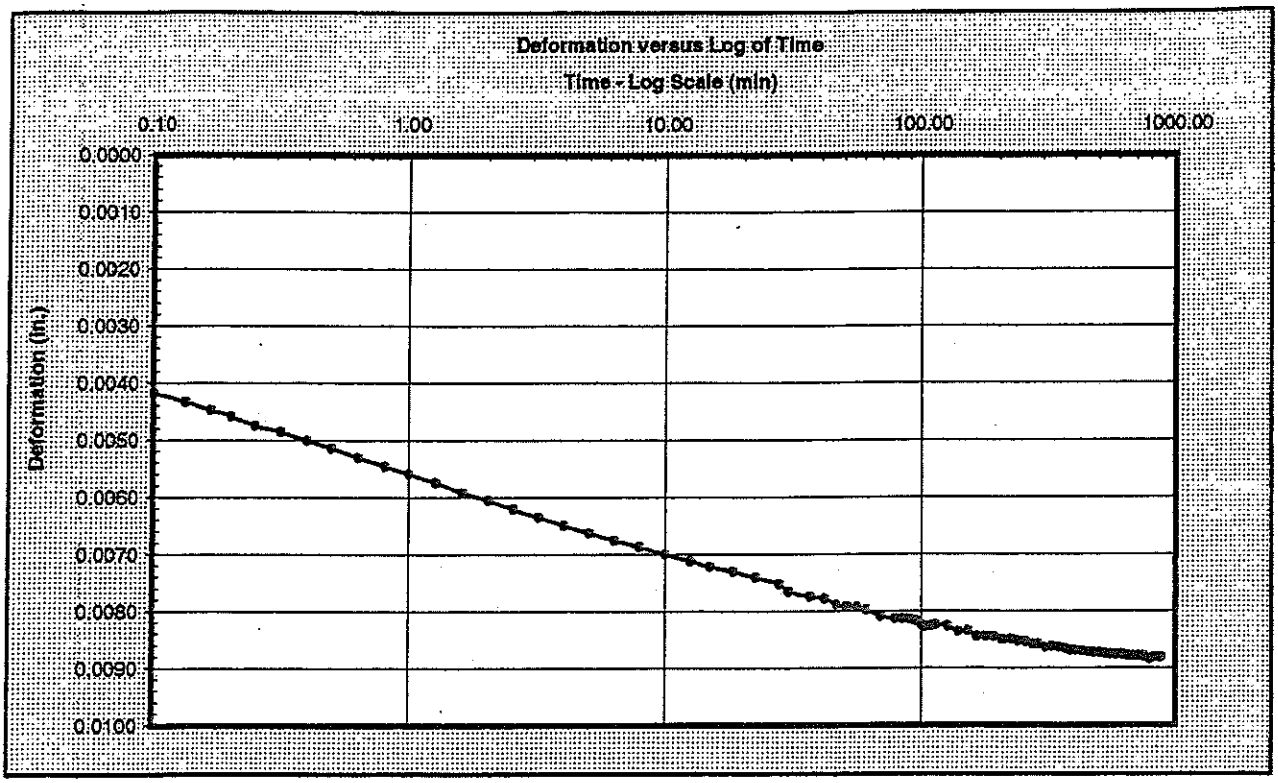

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
3.5000
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
Deformation (in.)

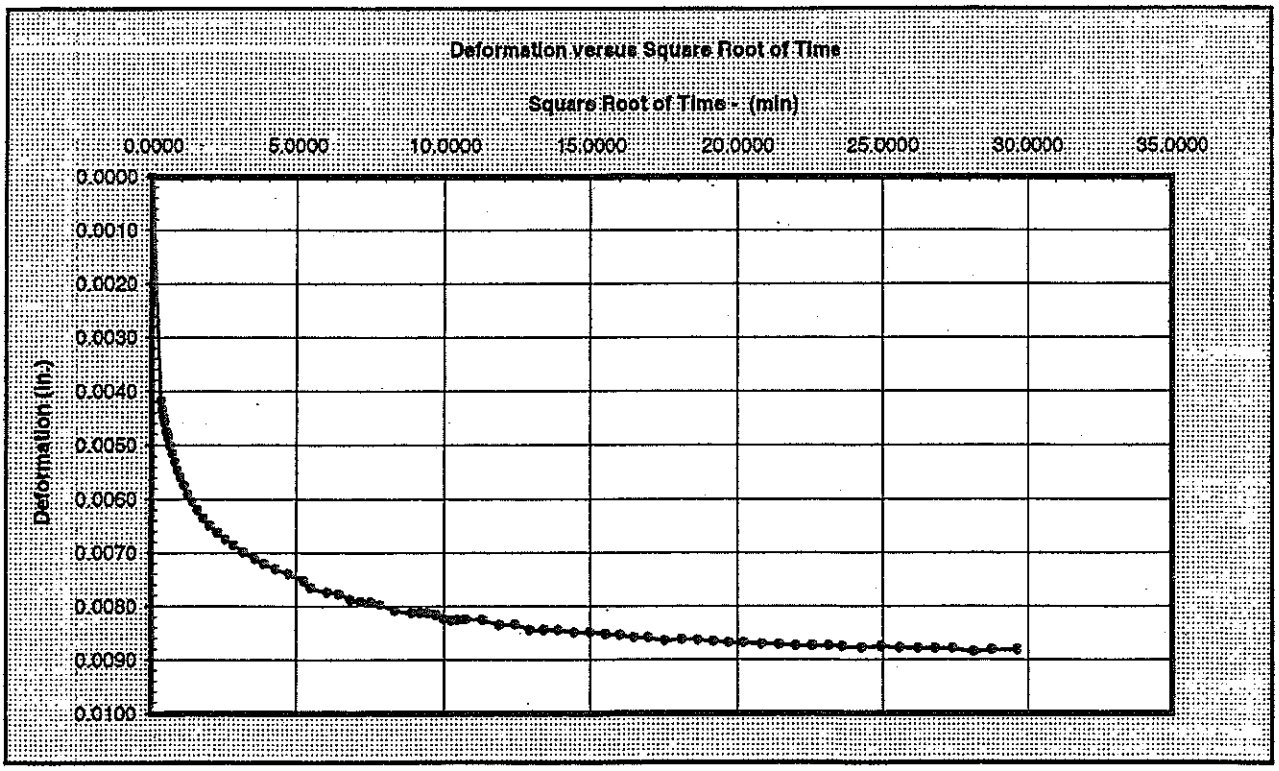
1/4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
Deformation (in.)

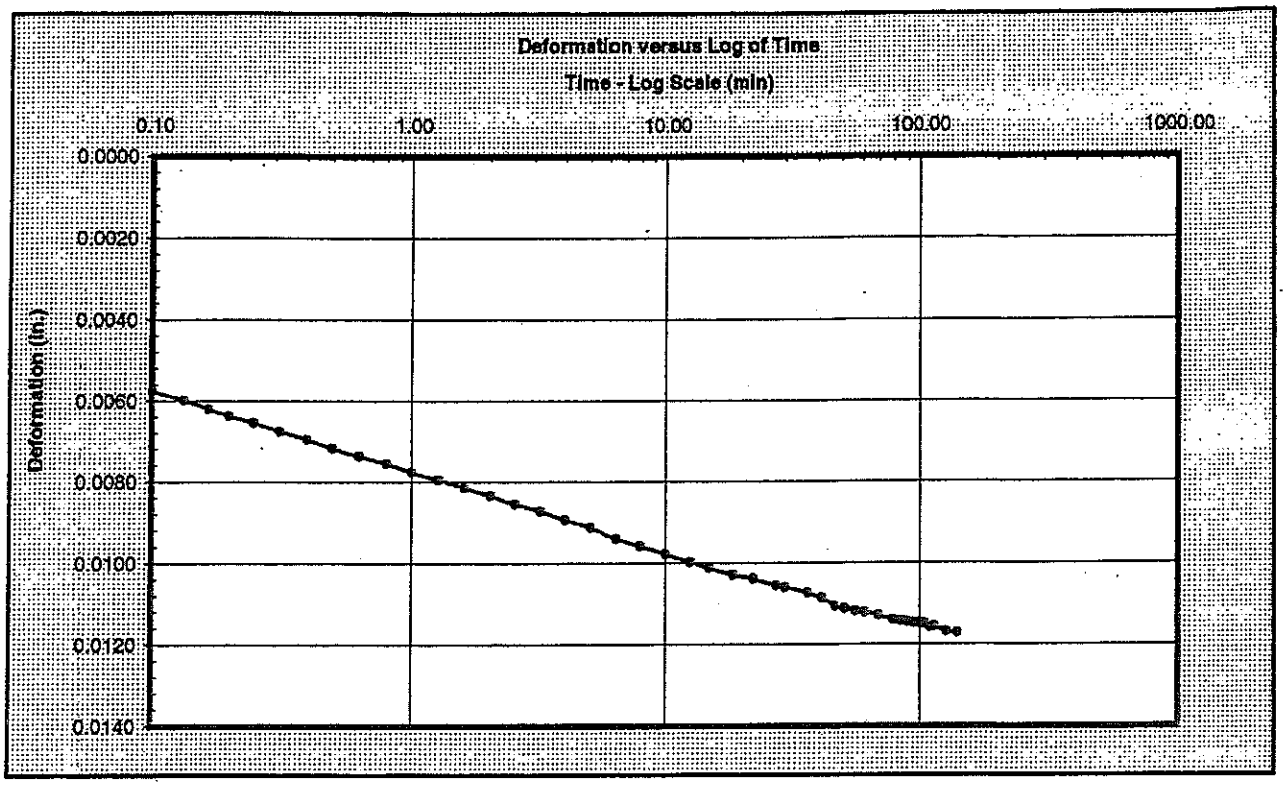

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
Deformation (in.)

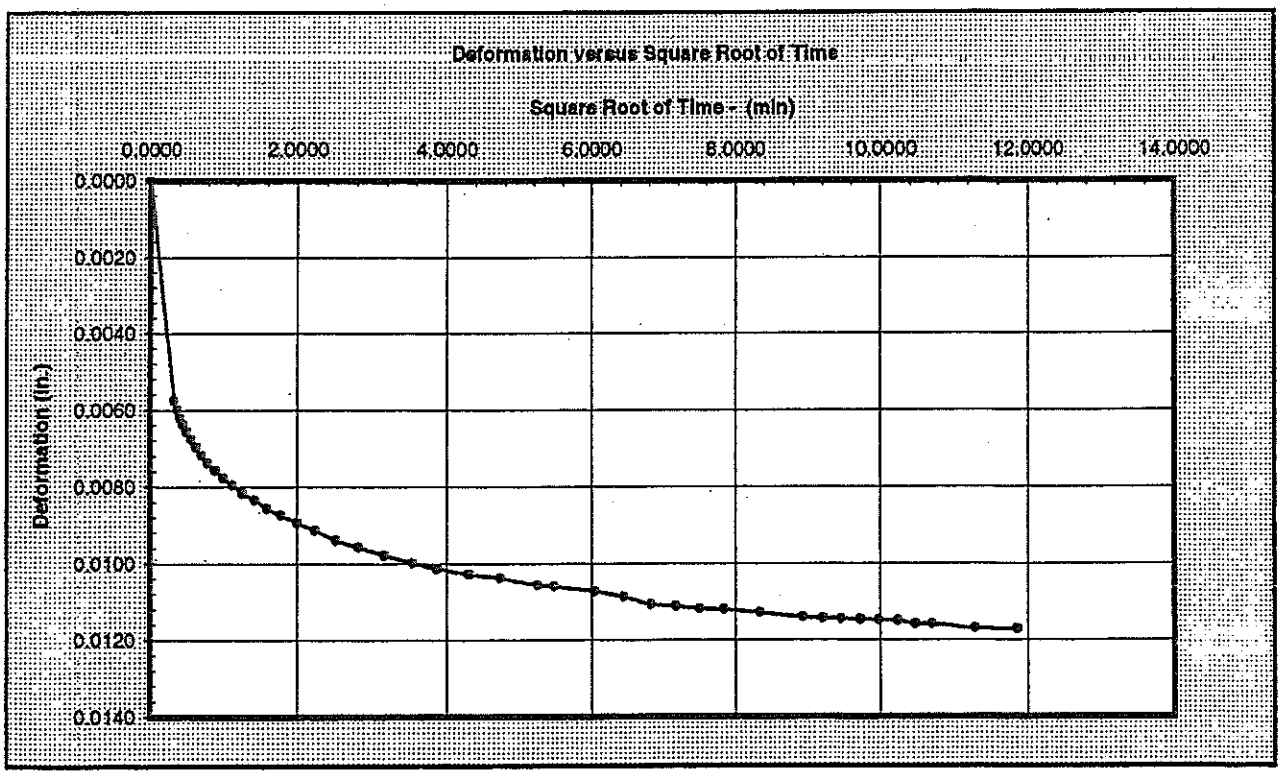
½ tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

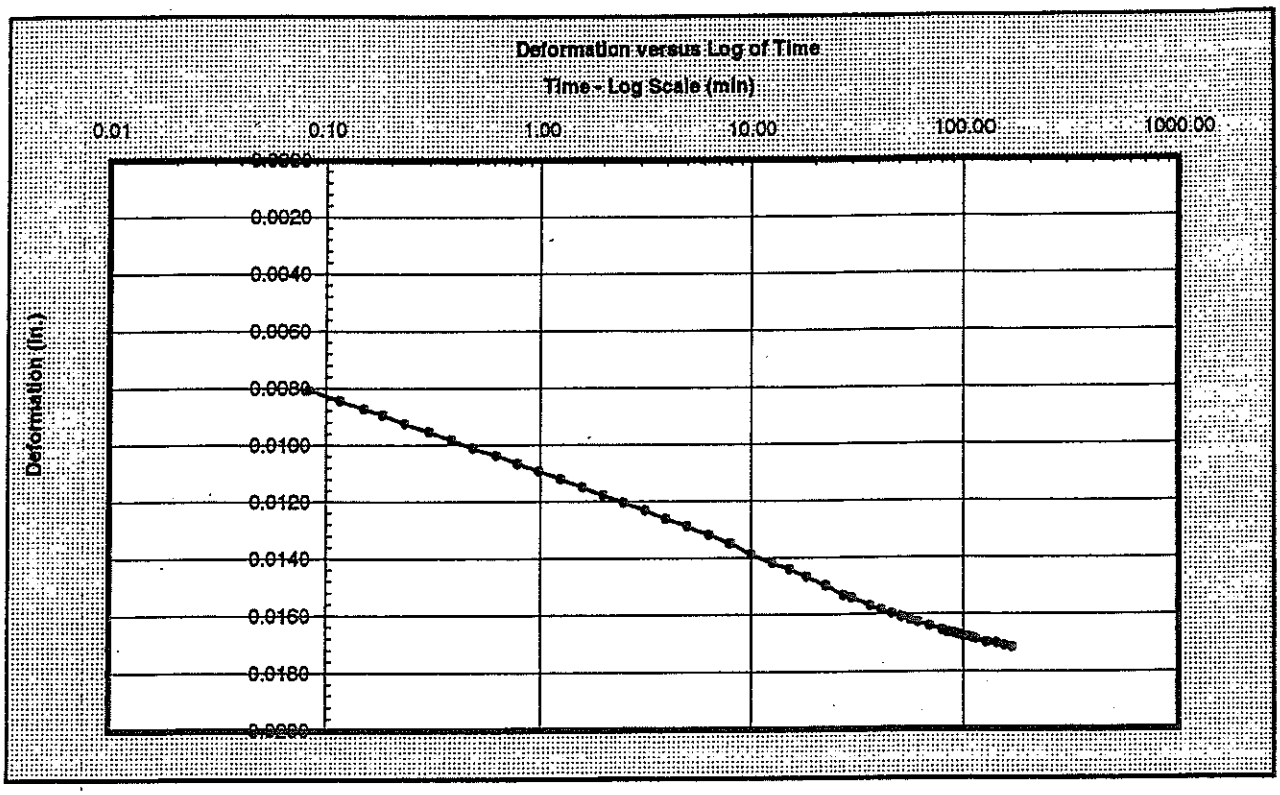

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

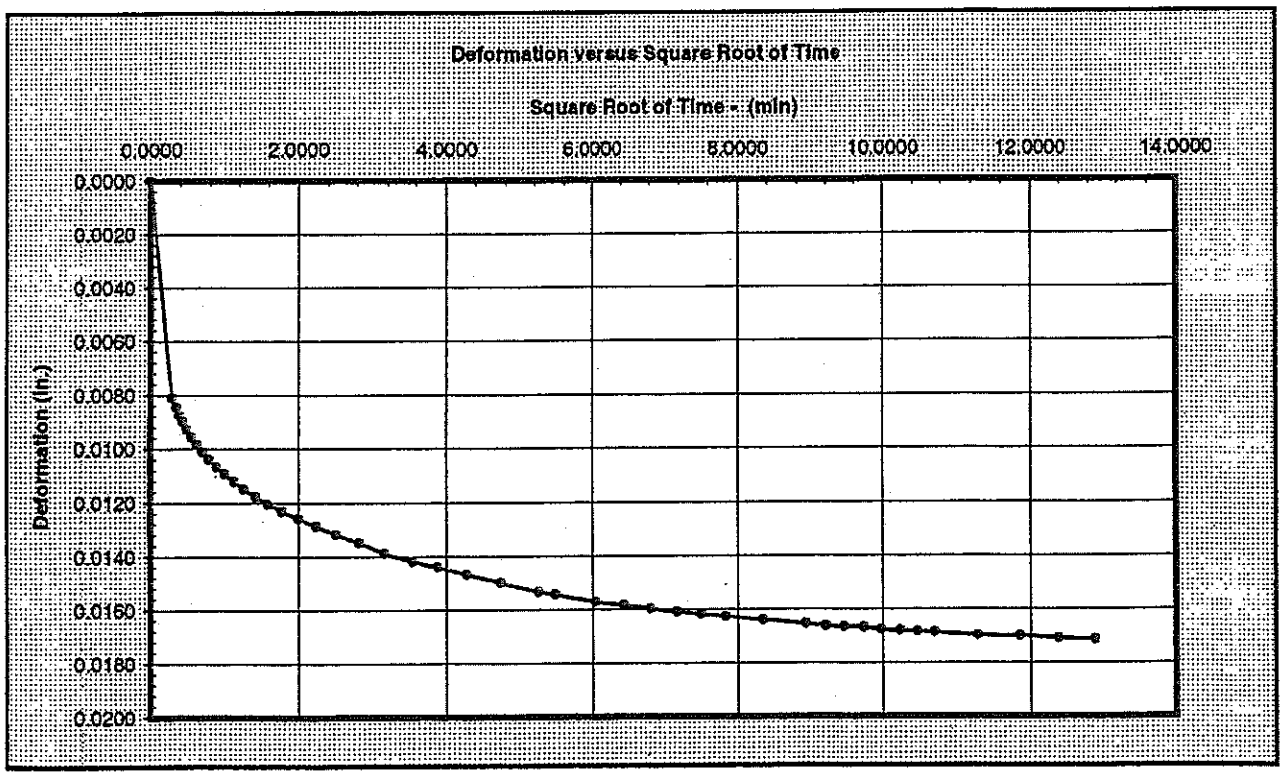
1 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
Deformation (in.)

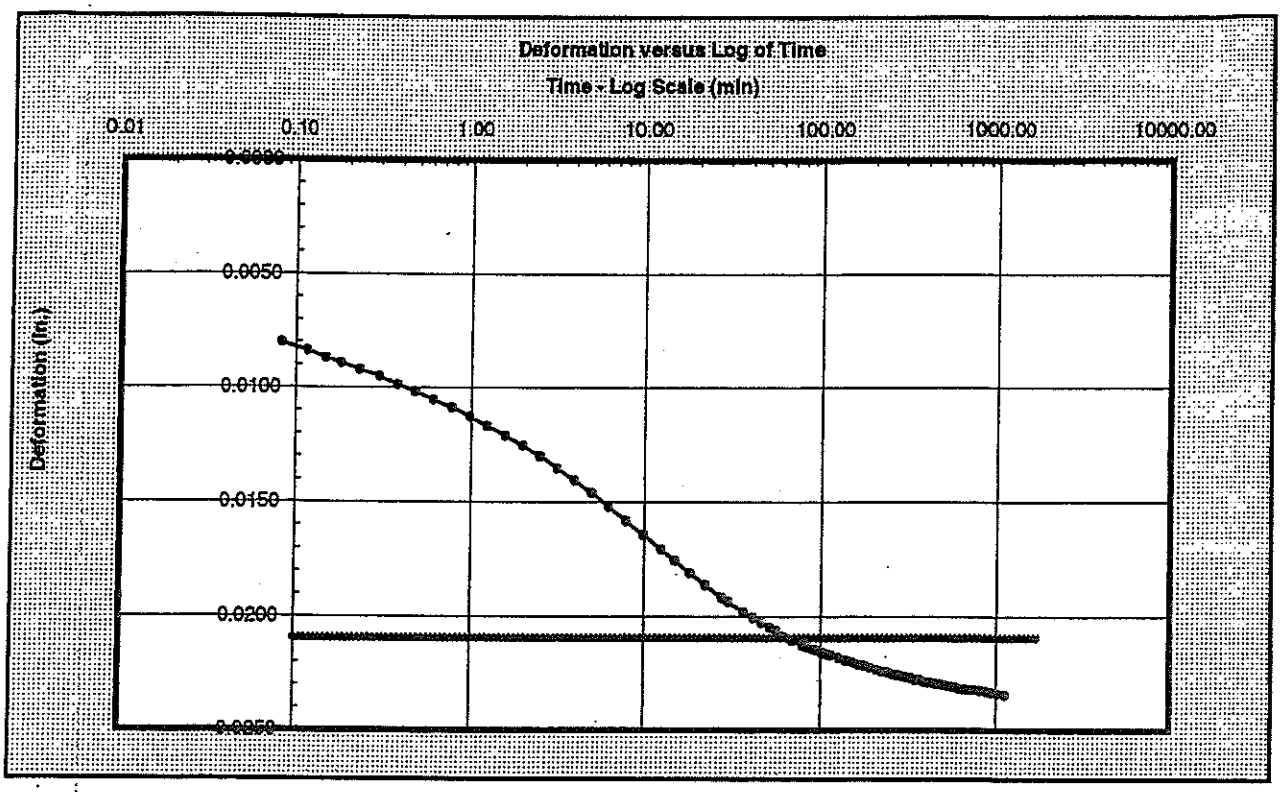

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
Deformation ((in.)

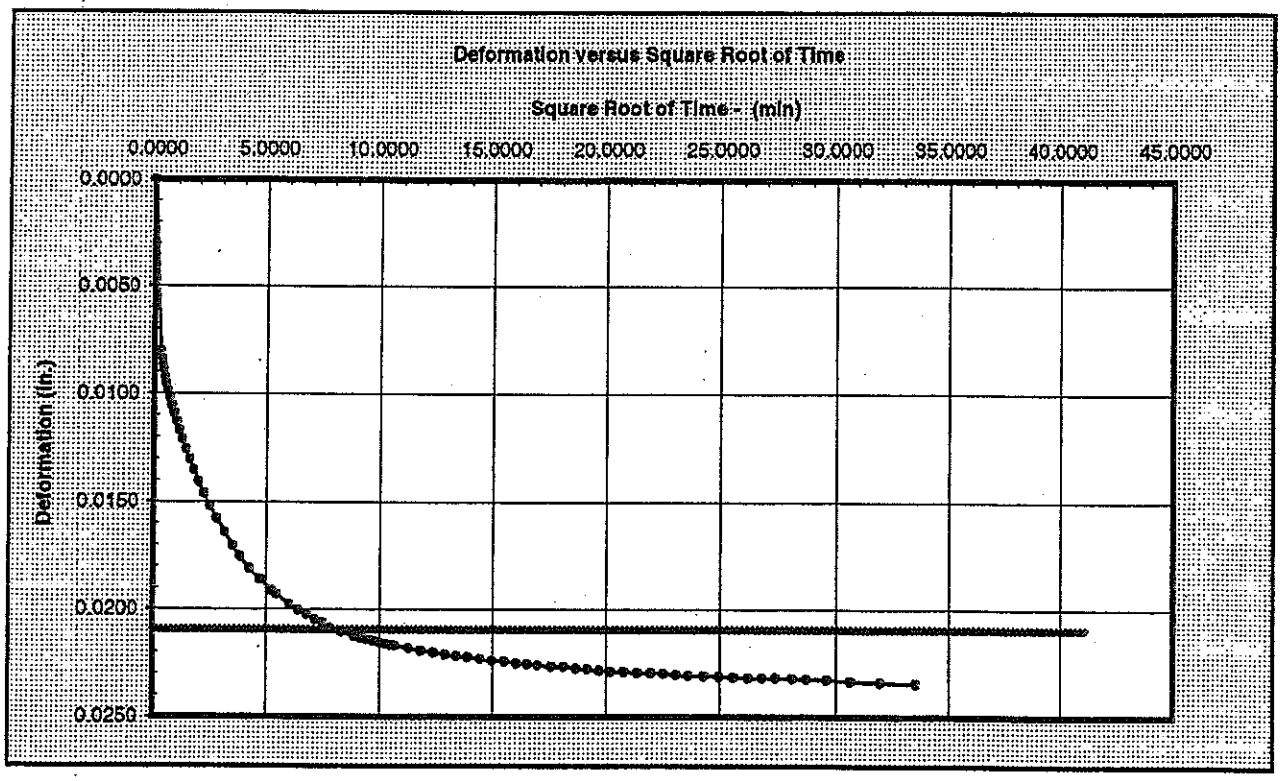
2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
0.0160
0.0180

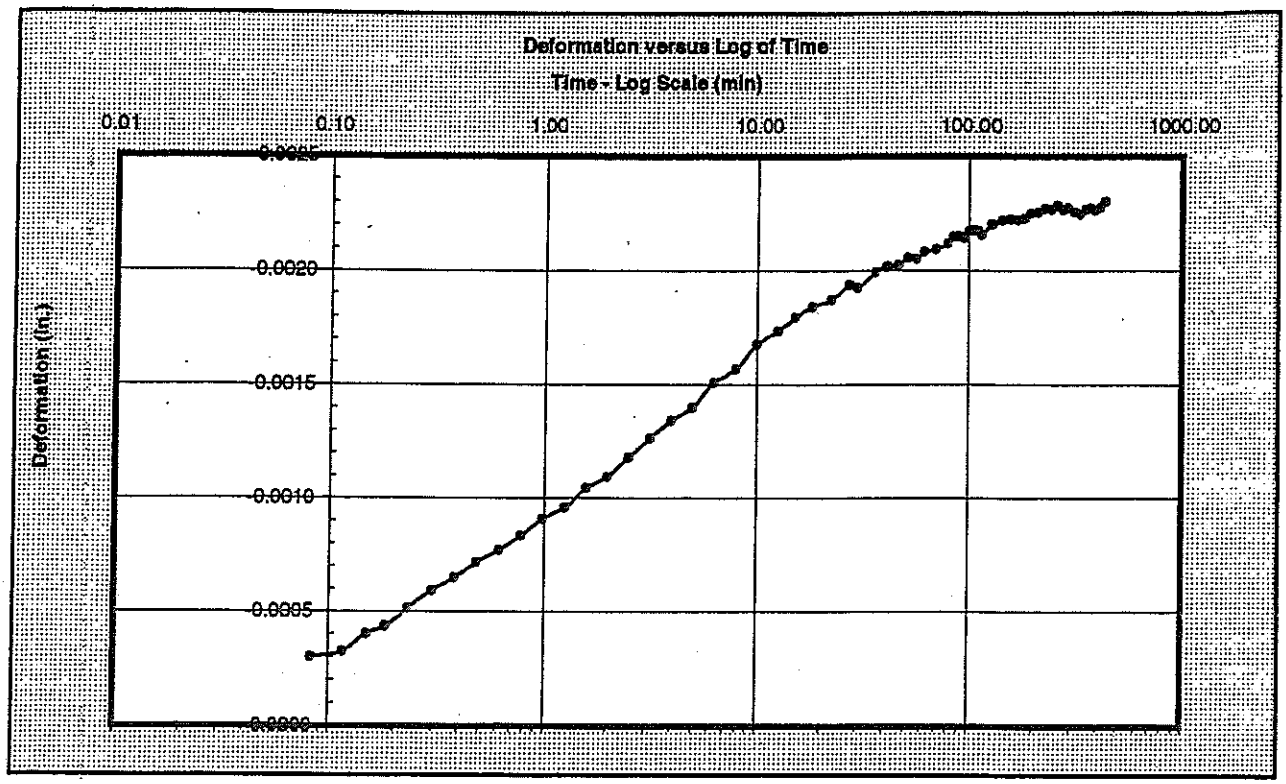

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
Deformation (in.)
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
0.0160
0.0180
0.0200

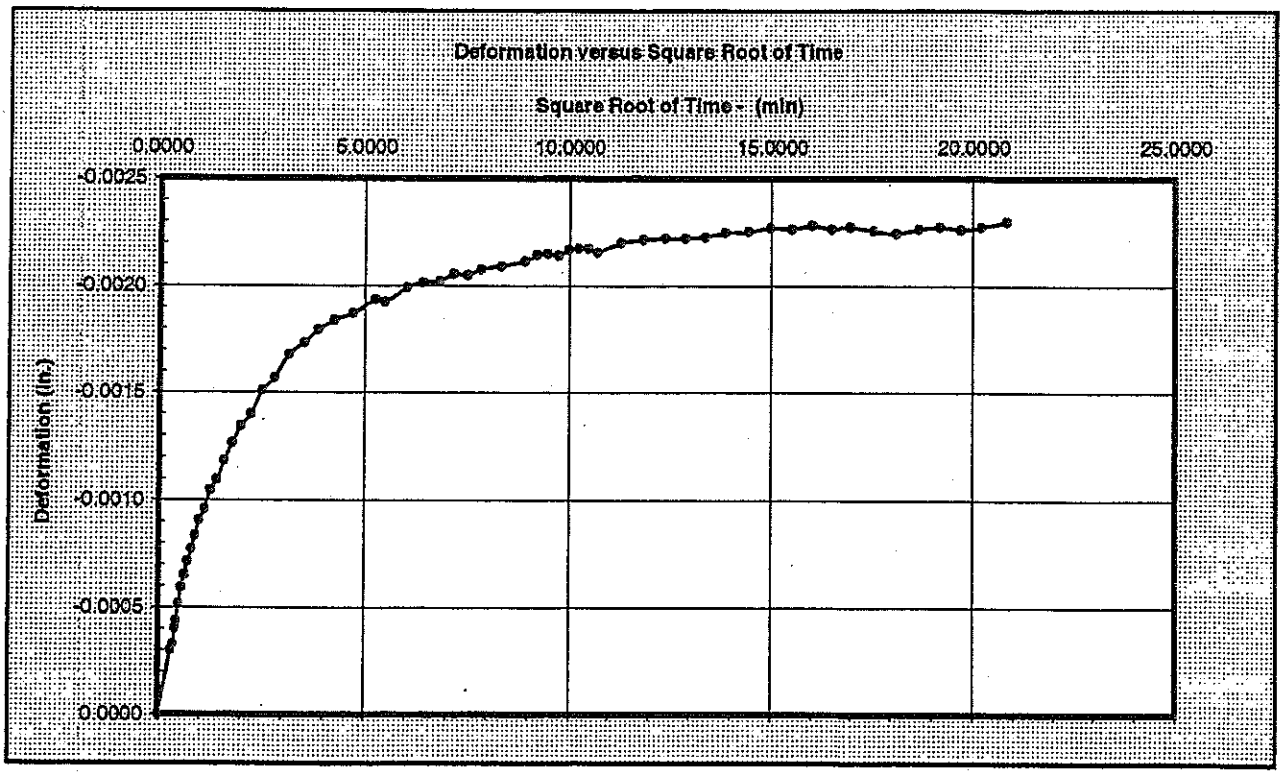
4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
Deformation (in.)

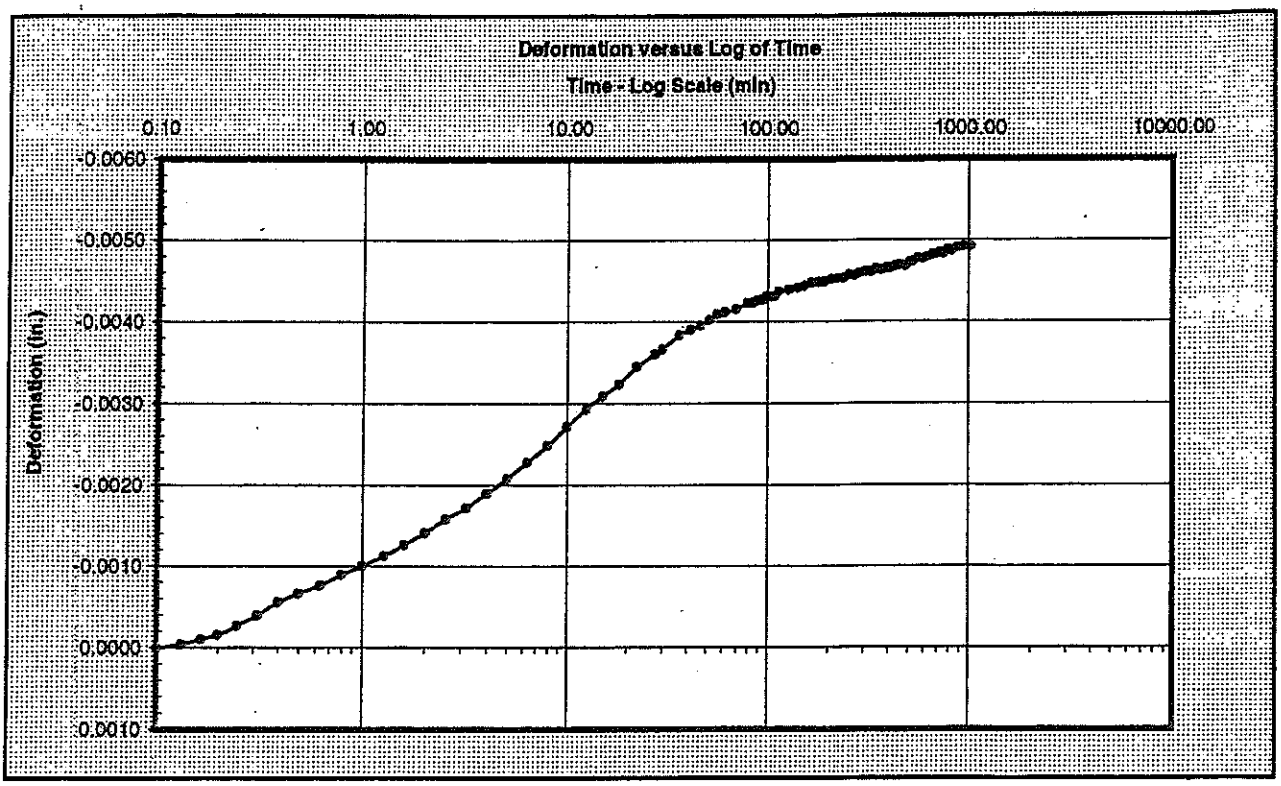

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
Deformation (in.)

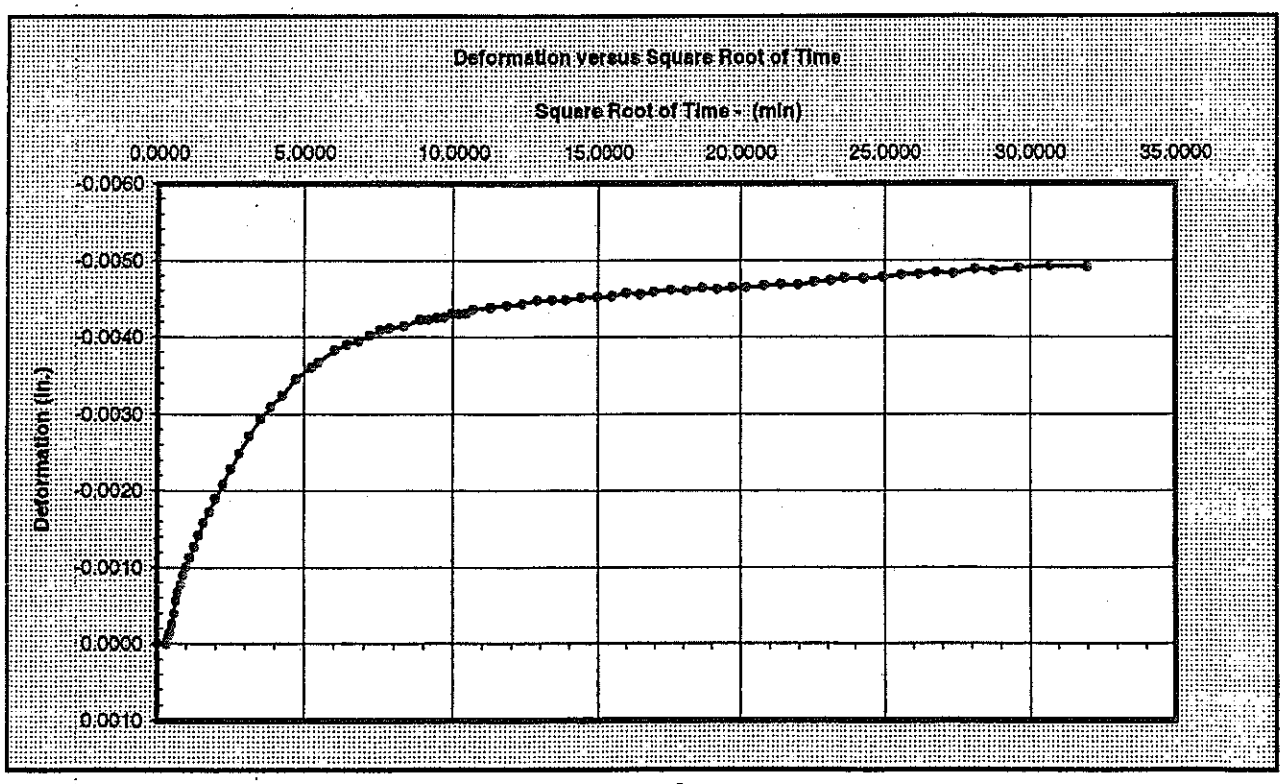
8 to 8


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
Deformation (in.)

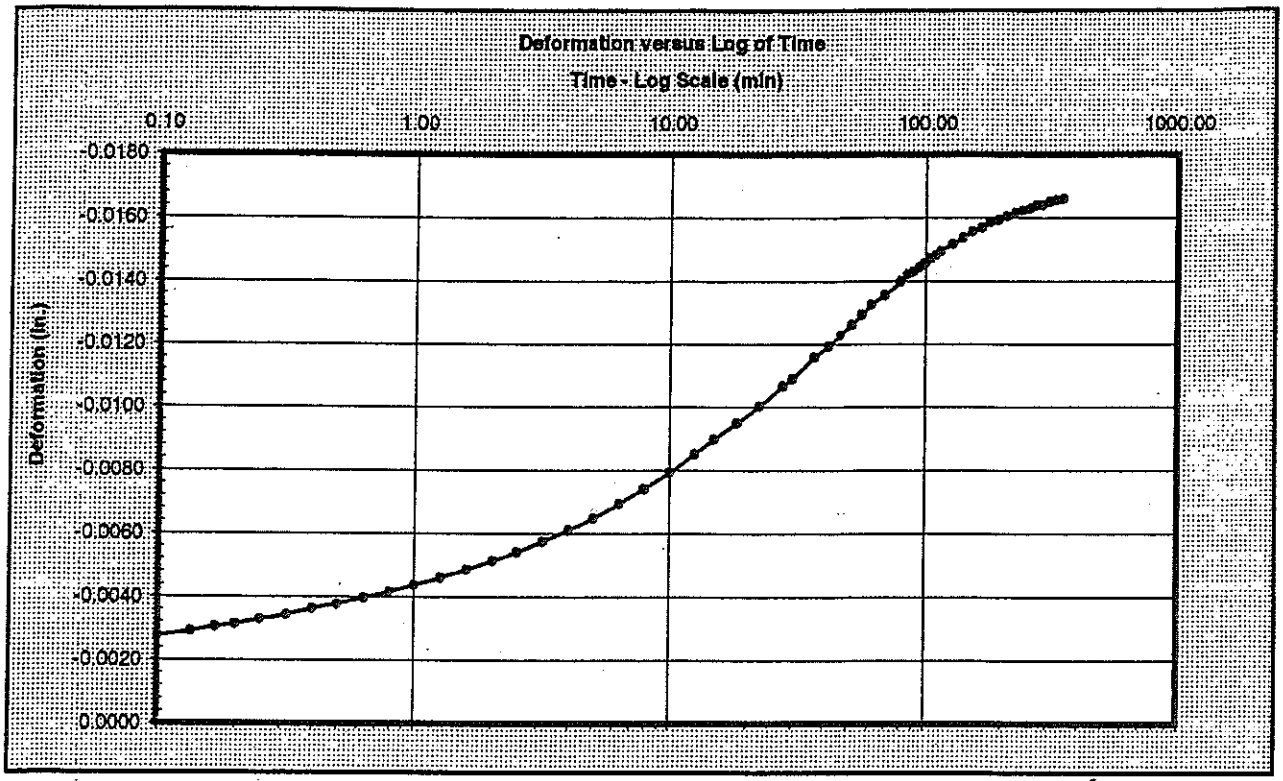

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
-0.0025
-0.0020
-0.0015
-0.0010
-0.0005
0.0000
Deformation (in.)

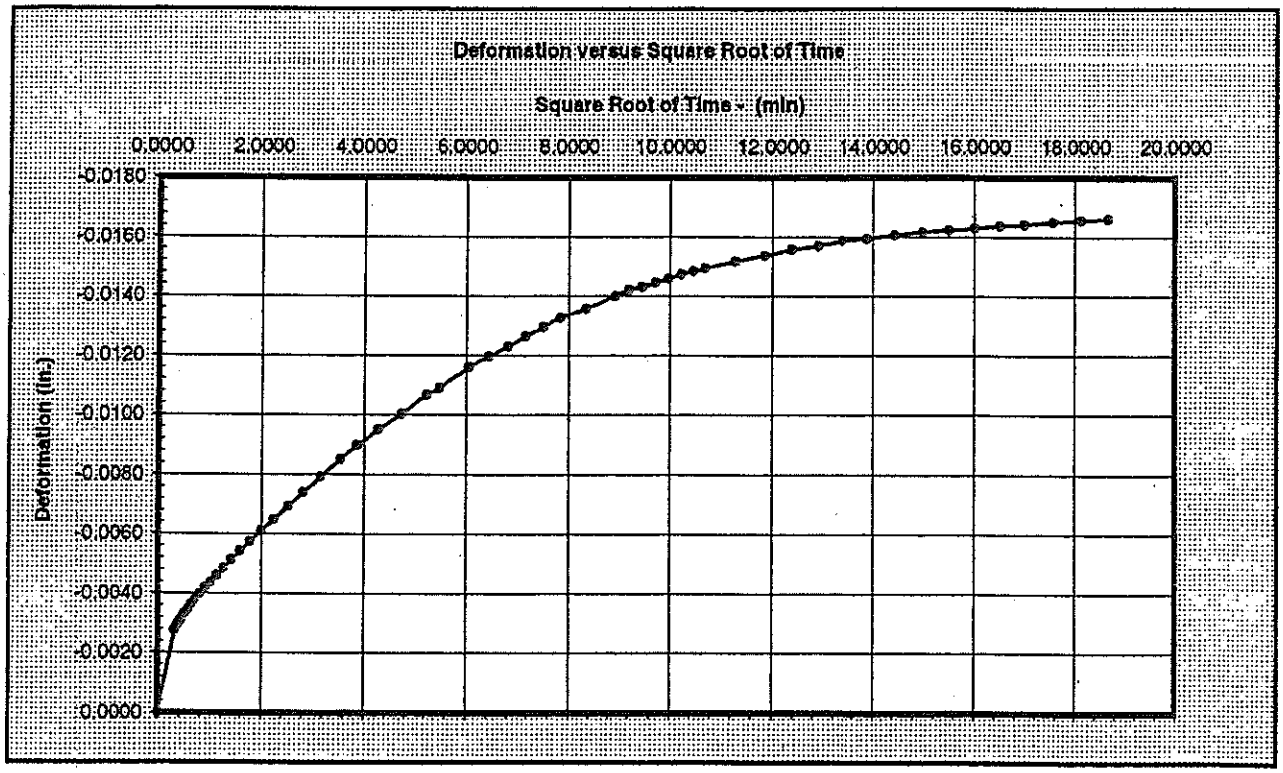
-4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
-0.0060
-0.0050
-0.0040
-0.0030
-0.0020
-0.0010
0.0000
0.0010
Deformation (in.)

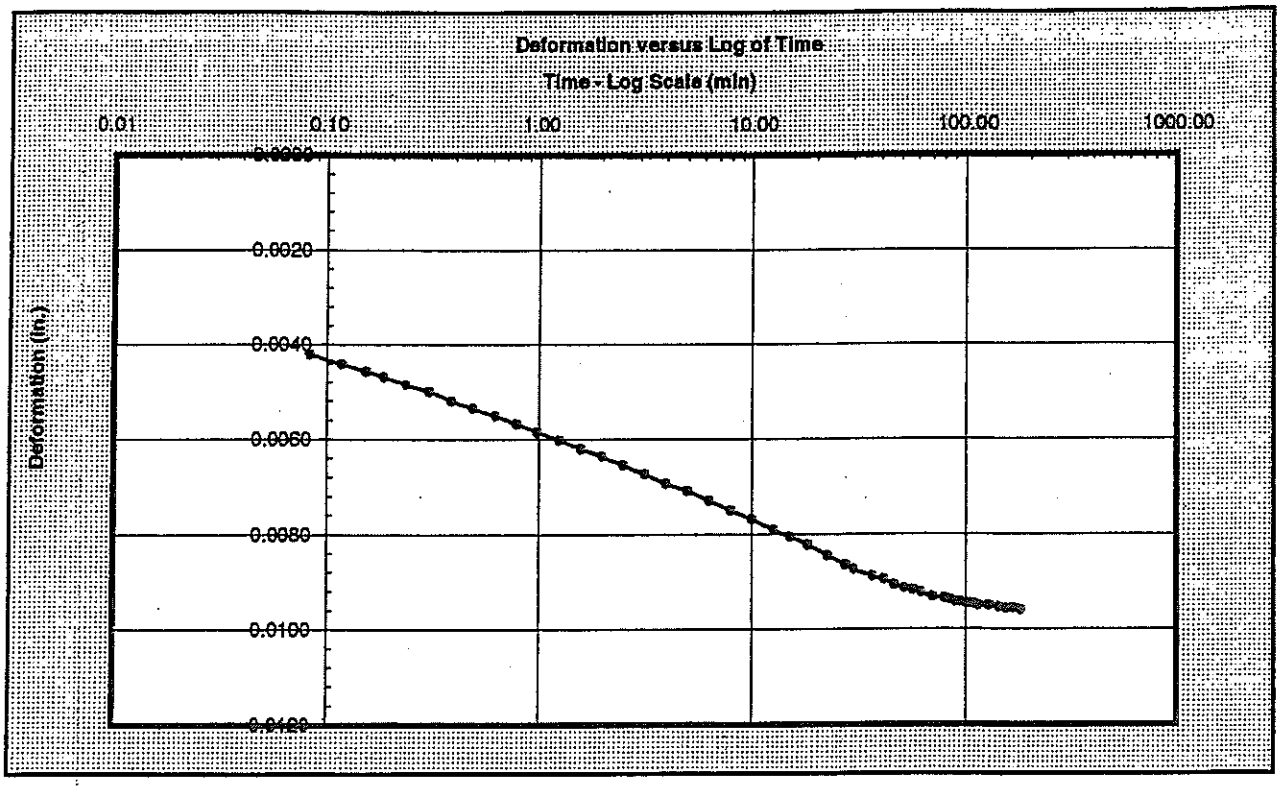

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
-0.0060
-0.0050
-0.0040
-0.0030
-0.0020
-0.0010
0.0000
0.0010
Deformation (in.)

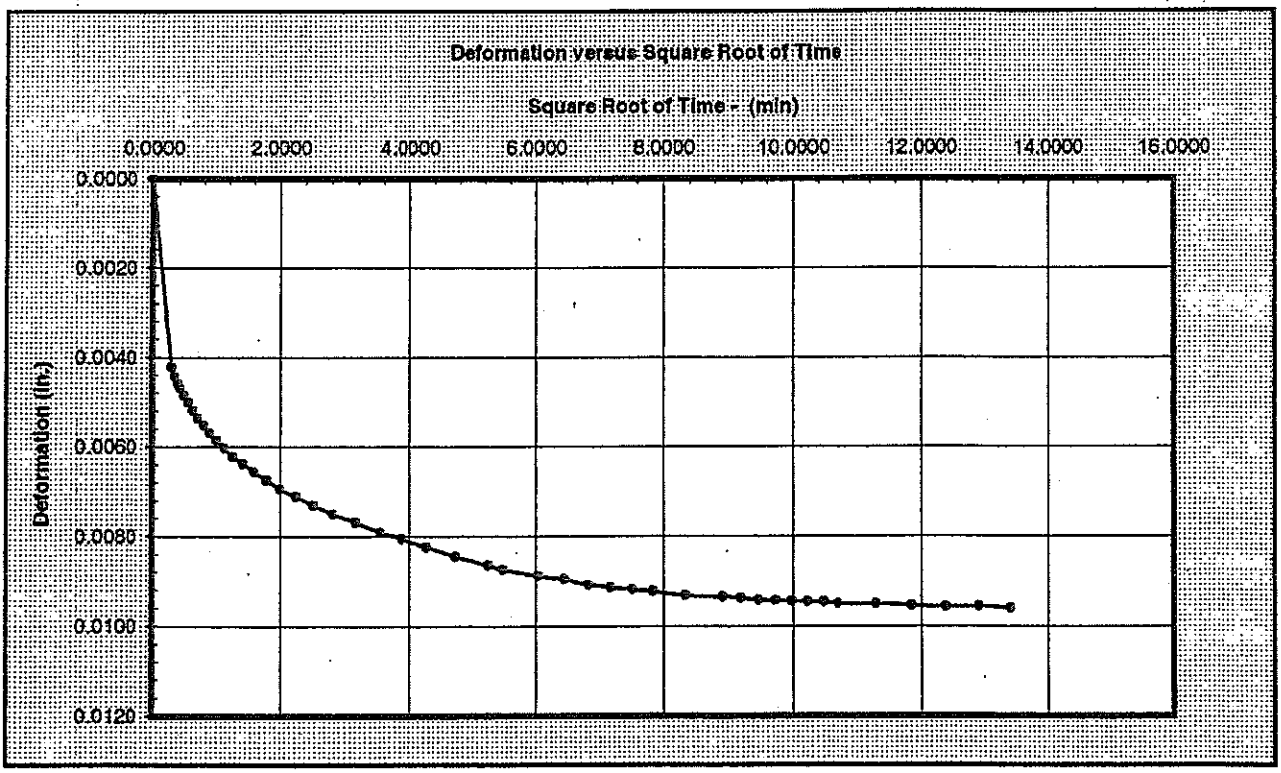
-2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

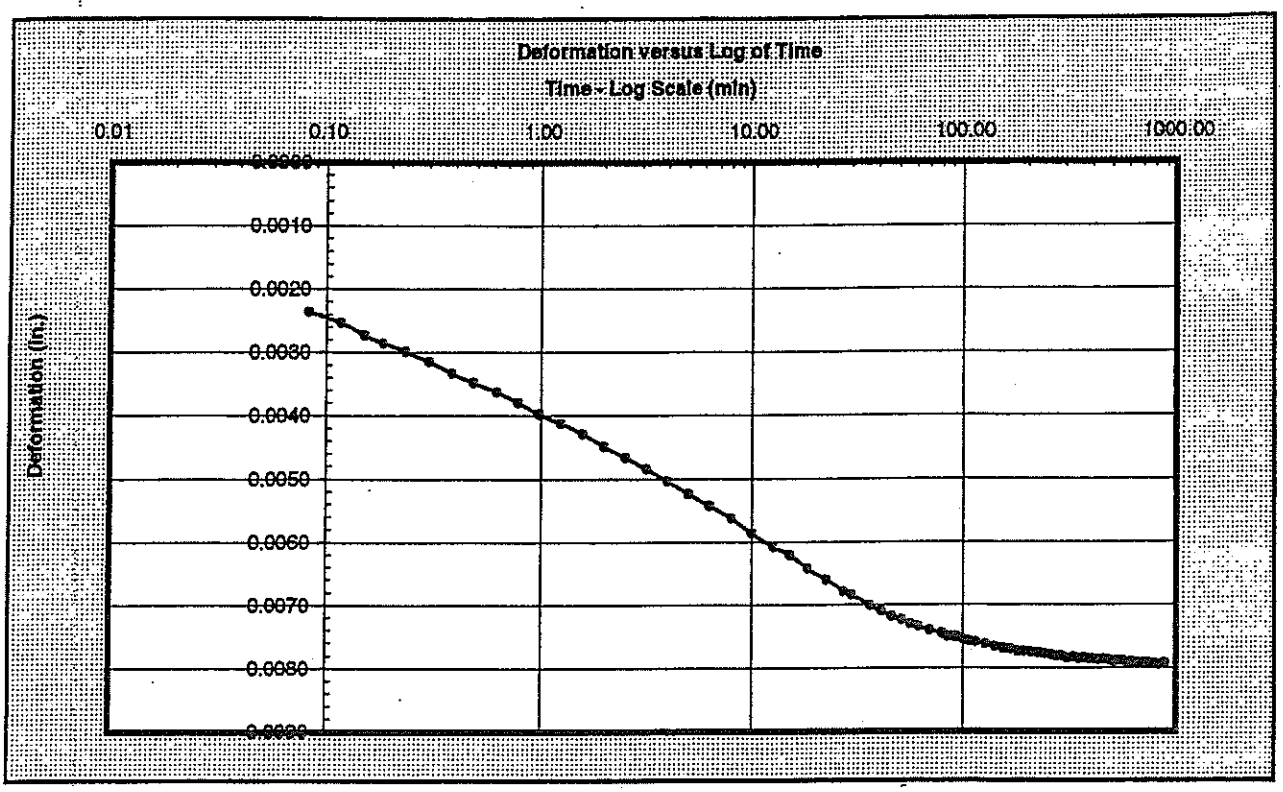

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
18.0000
20.0000
Deformation (in.)
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

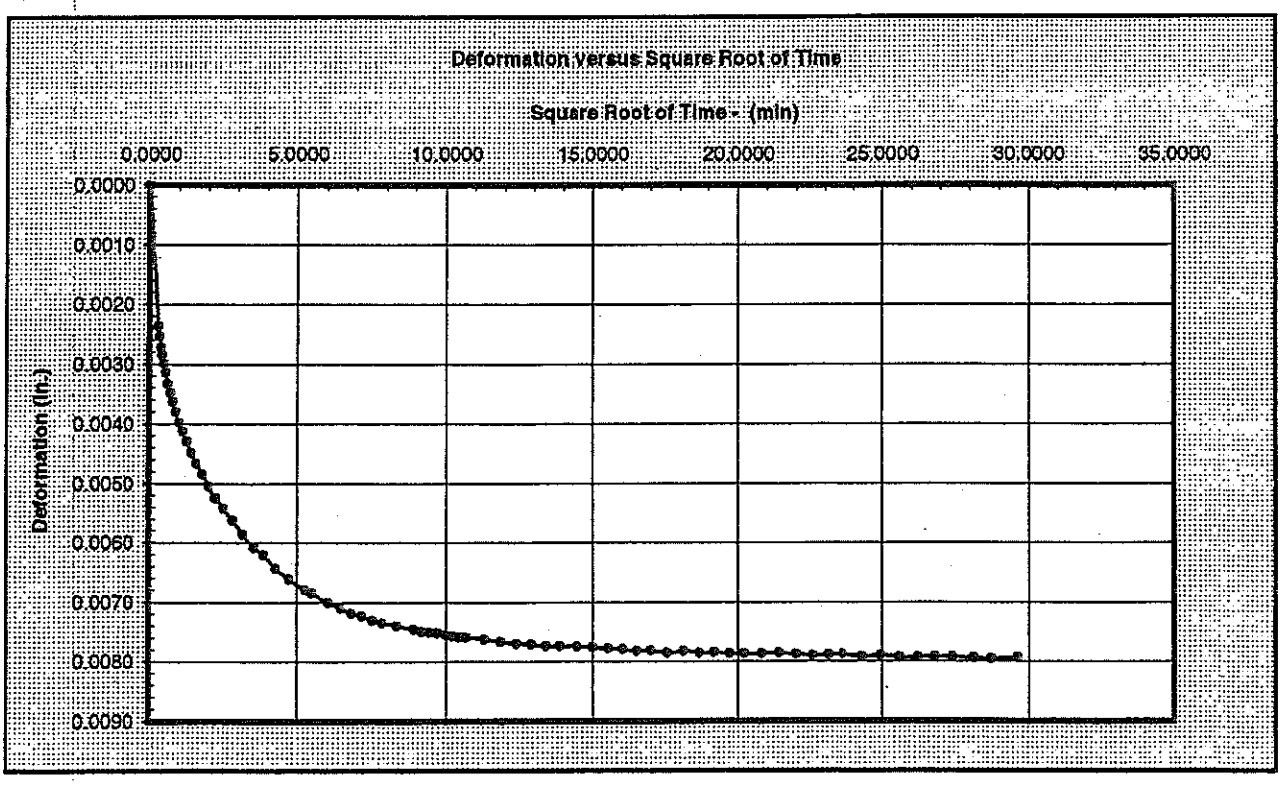
-1/2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
0.0020
0.0040
0.0060
0.0080
0.0100
Deformation (in.)

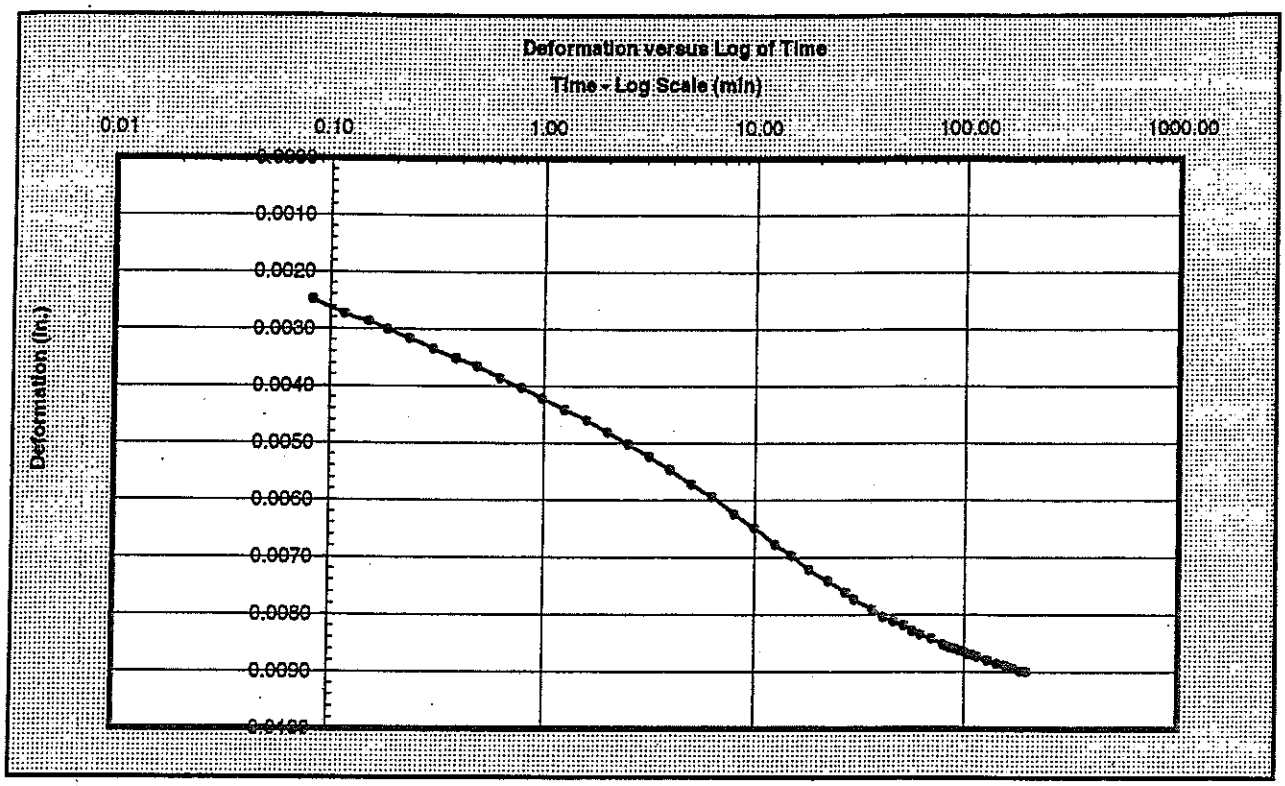

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

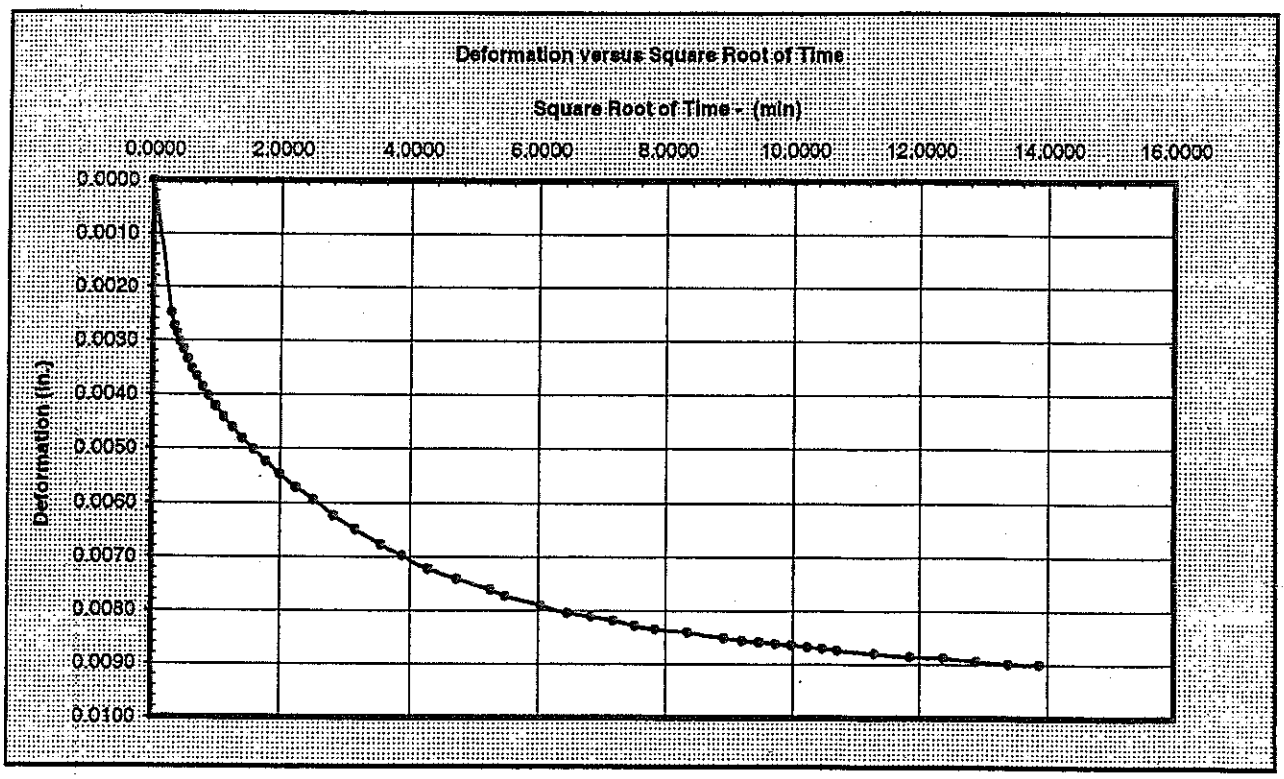
2a+sf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080

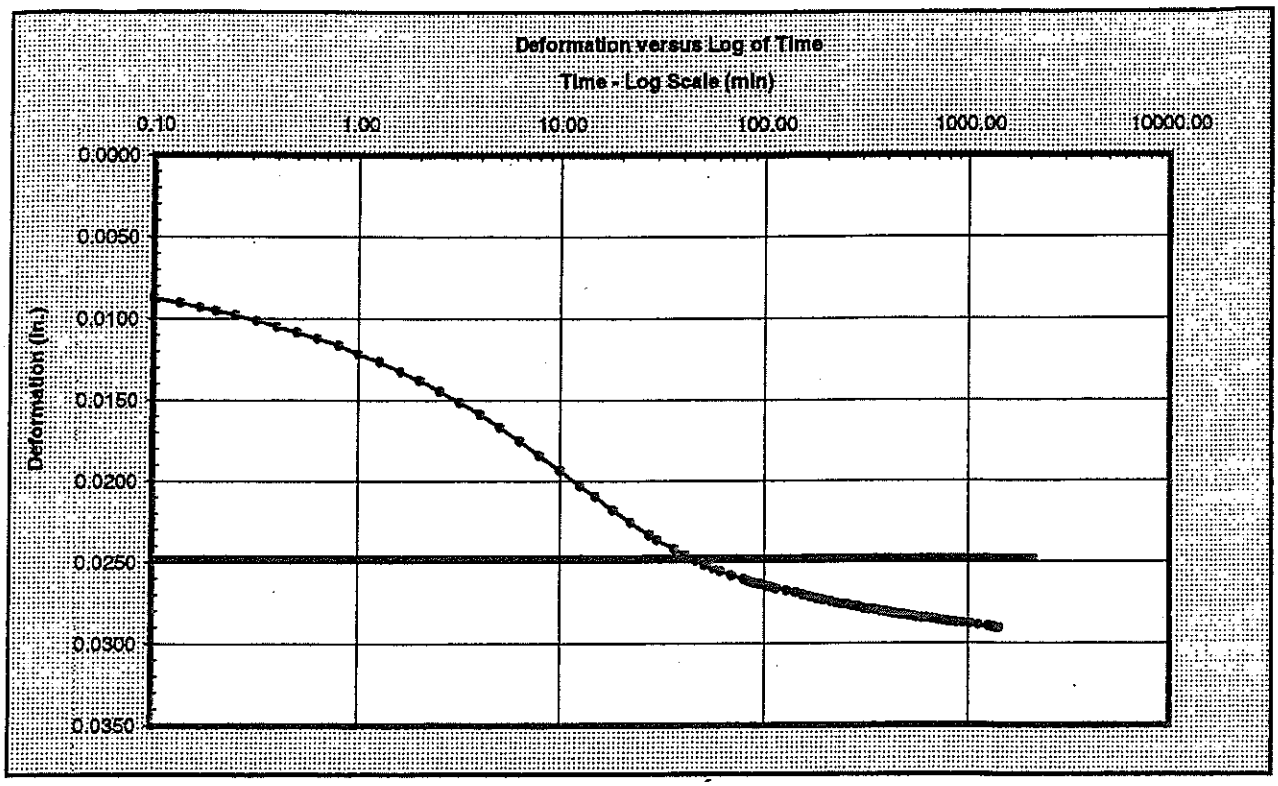

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090

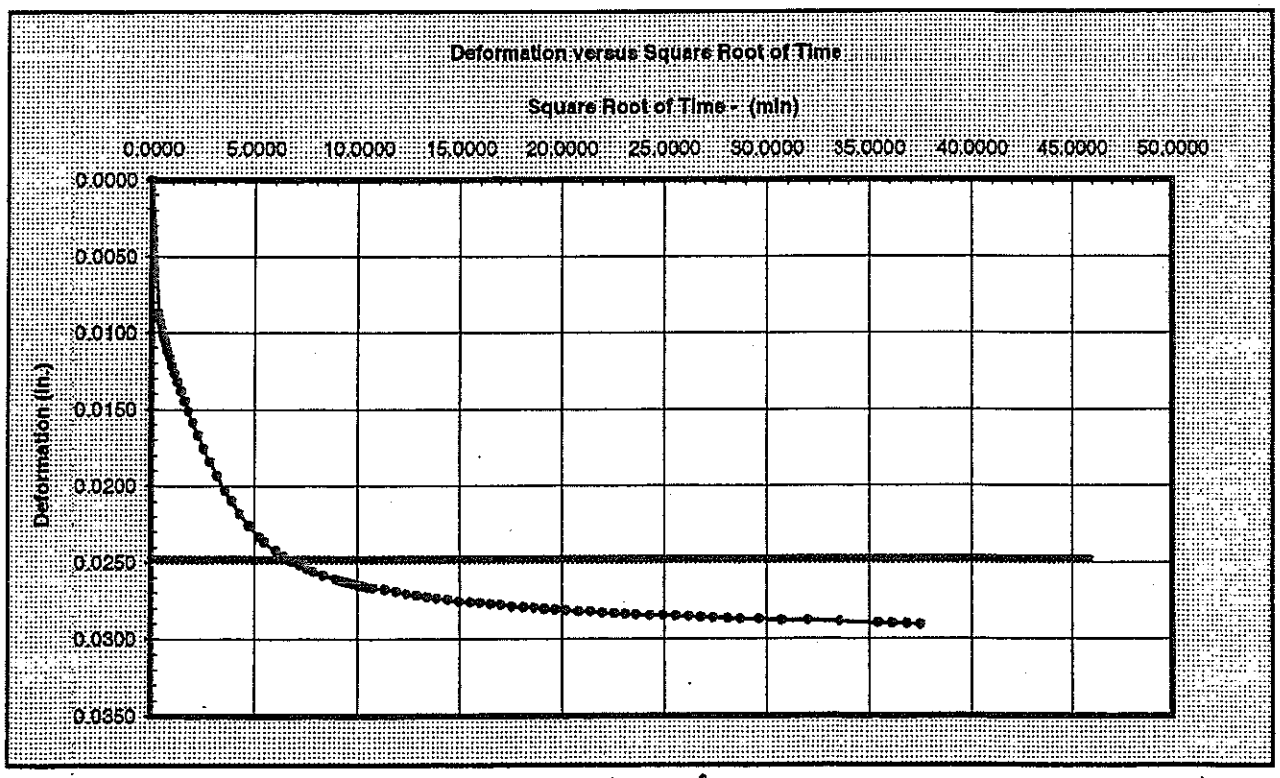
4a tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090

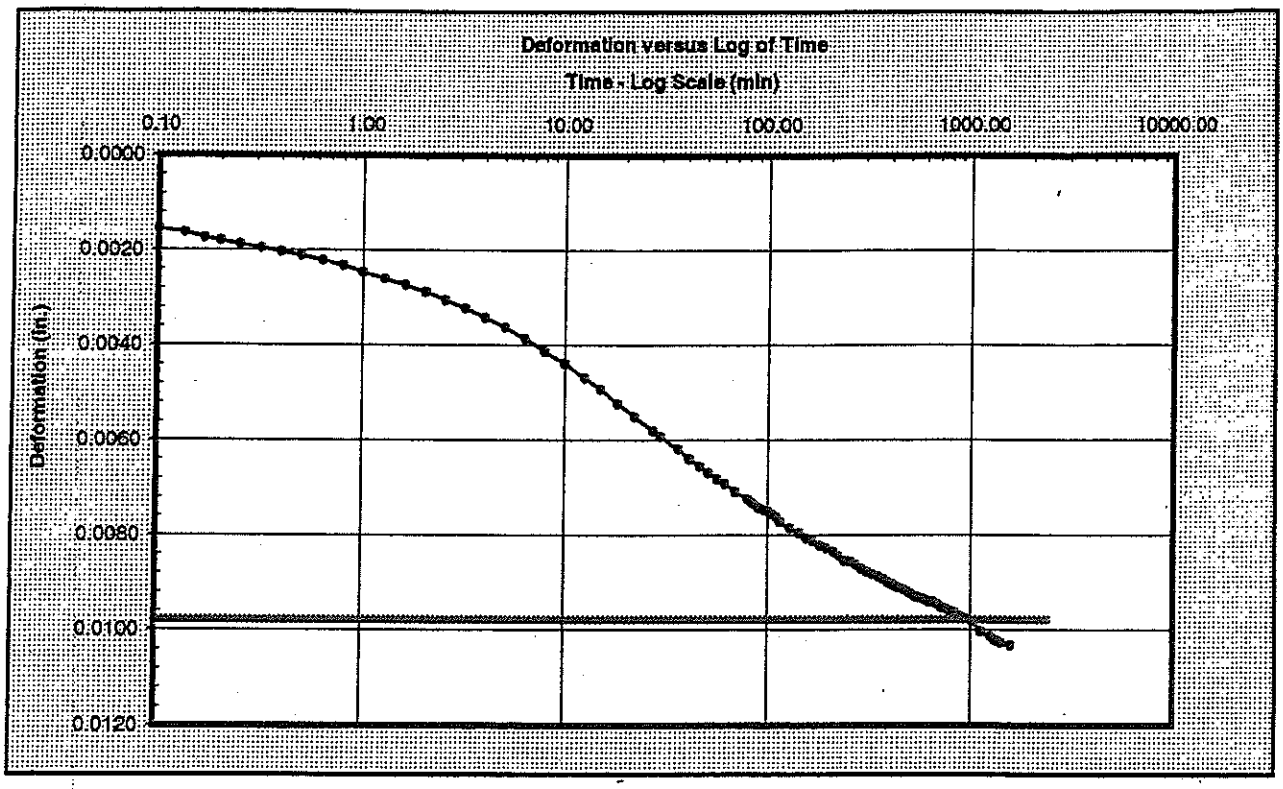

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

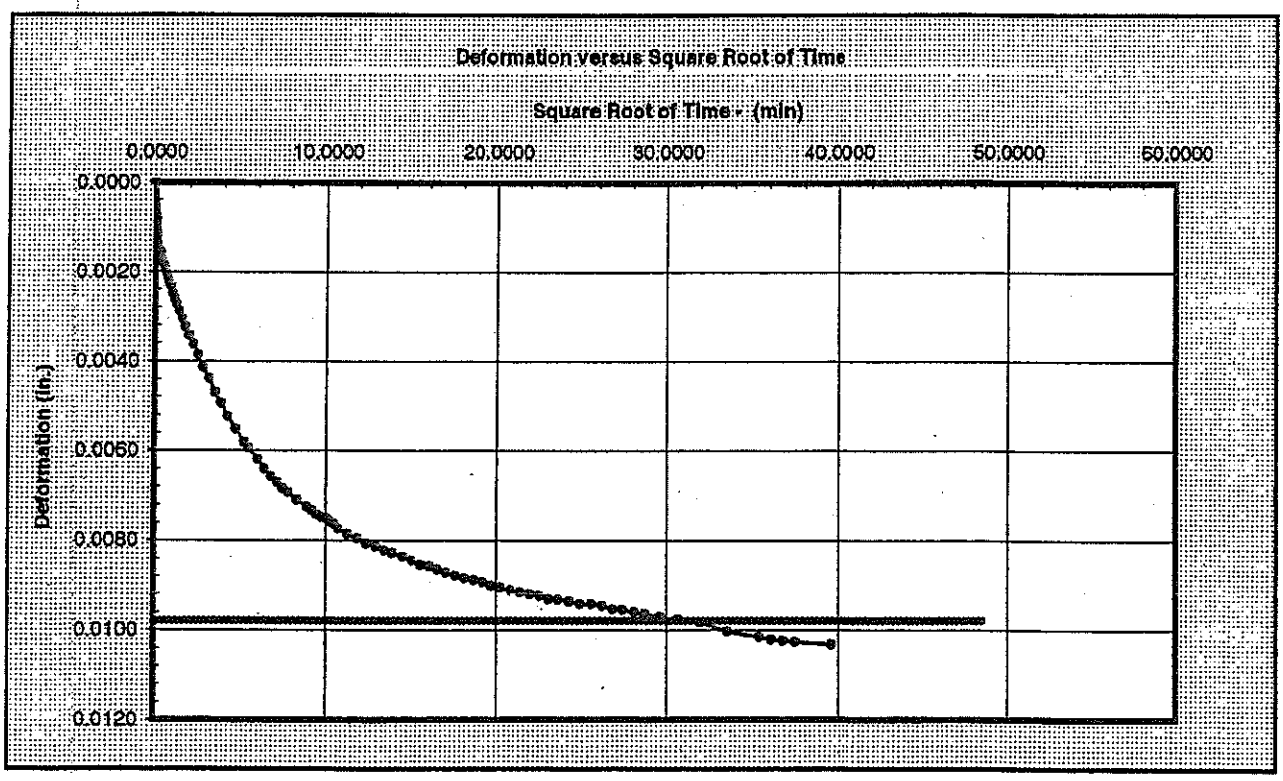
Ba tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
Deformation (in.)

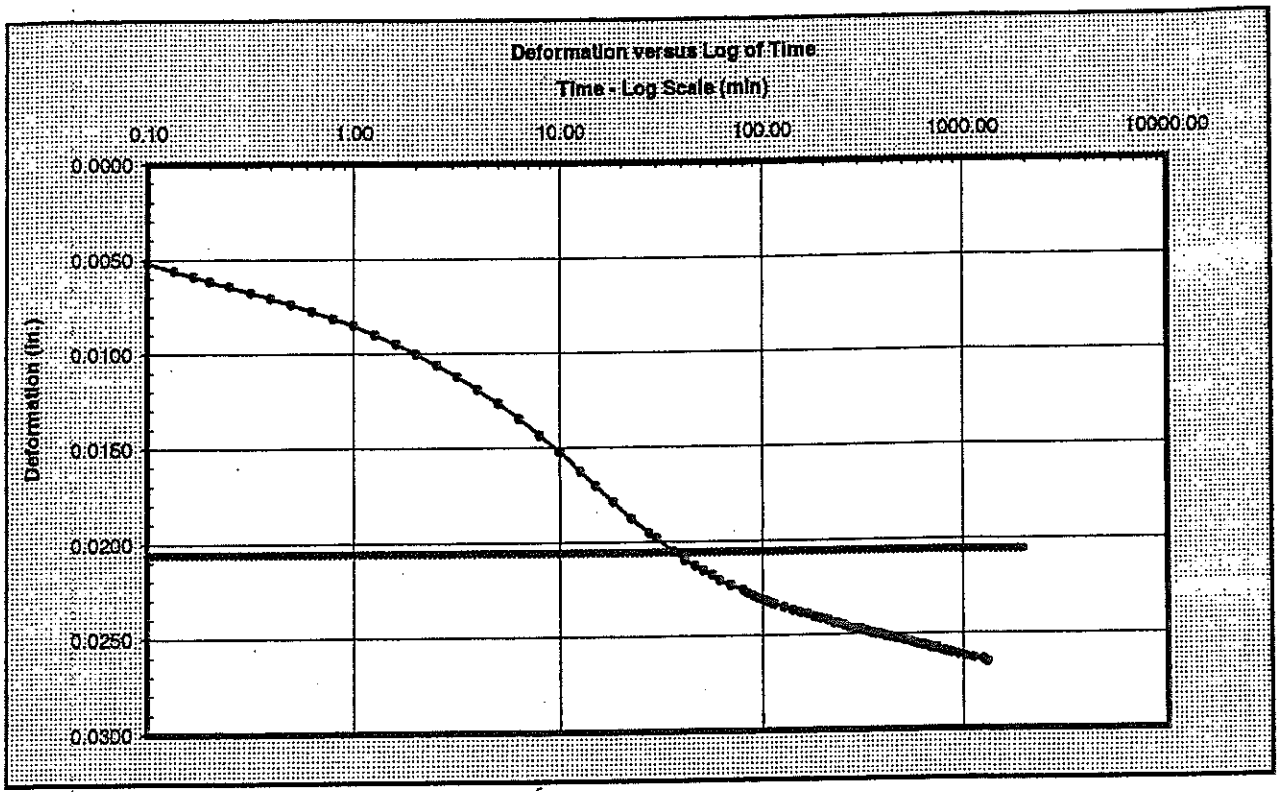

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
50.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
Deformation (in.)

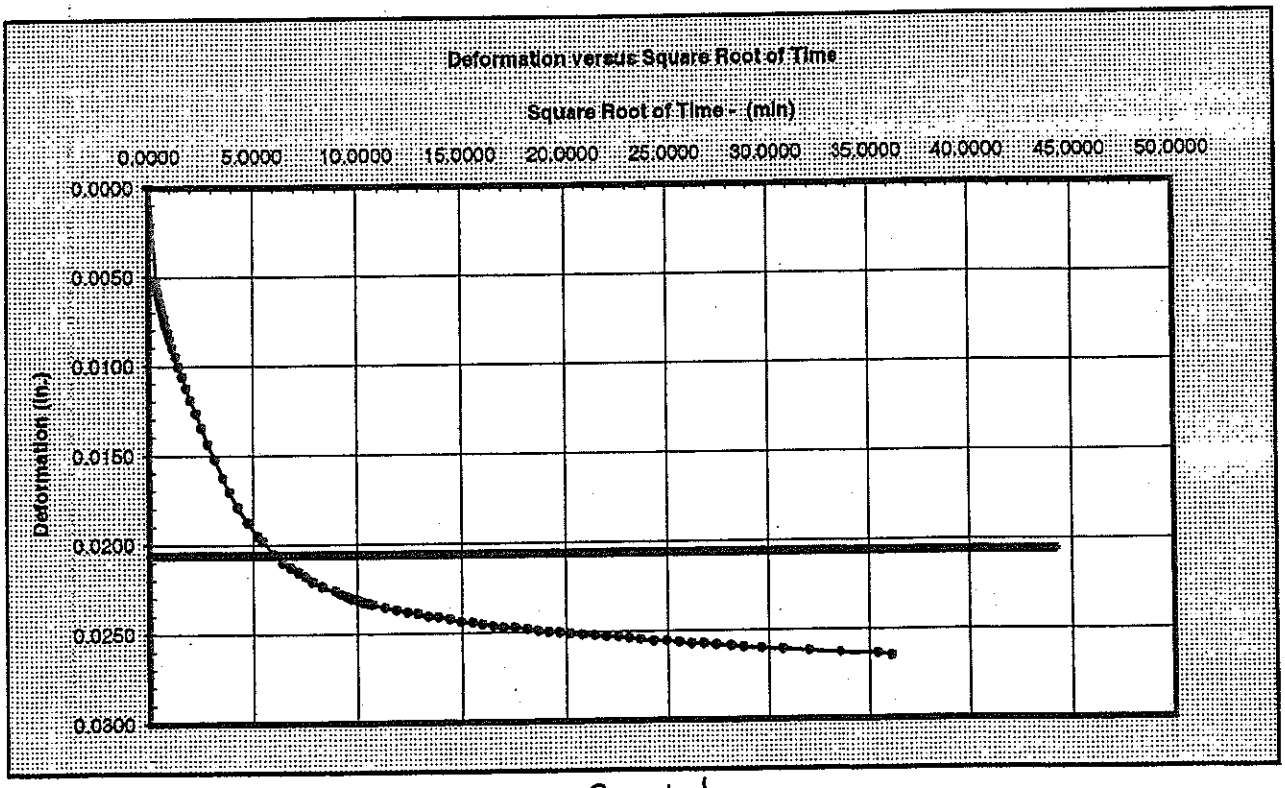
16 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

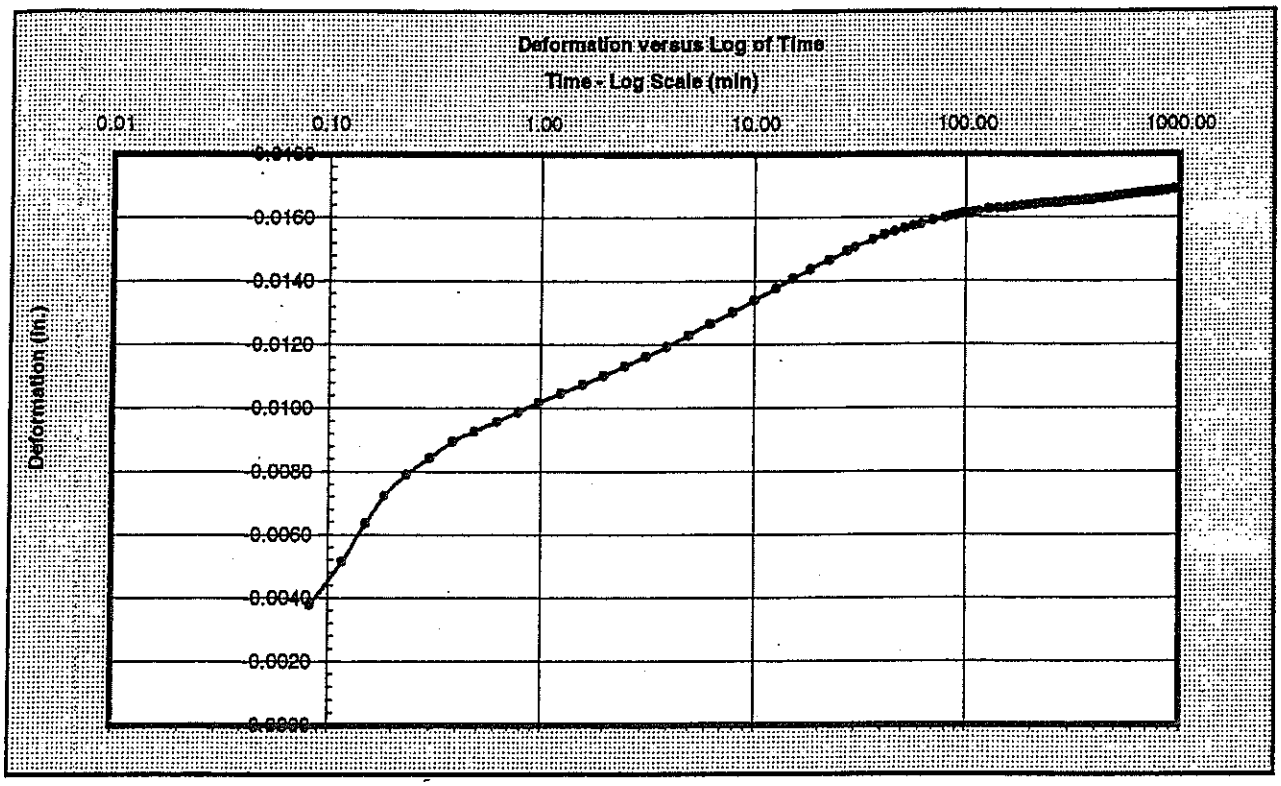

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
10.0000
20.0000
30.0000
40.0000
50.0000
60.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

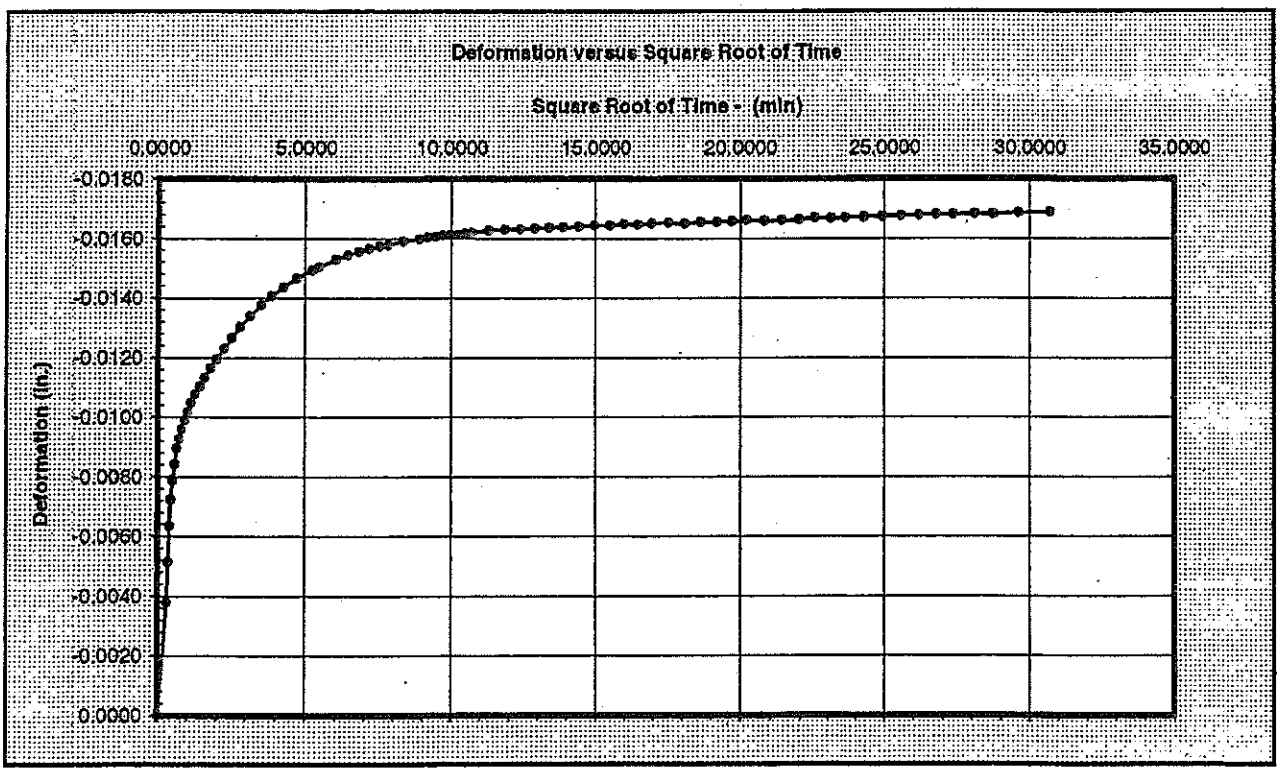
20 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
Deformation (in.)

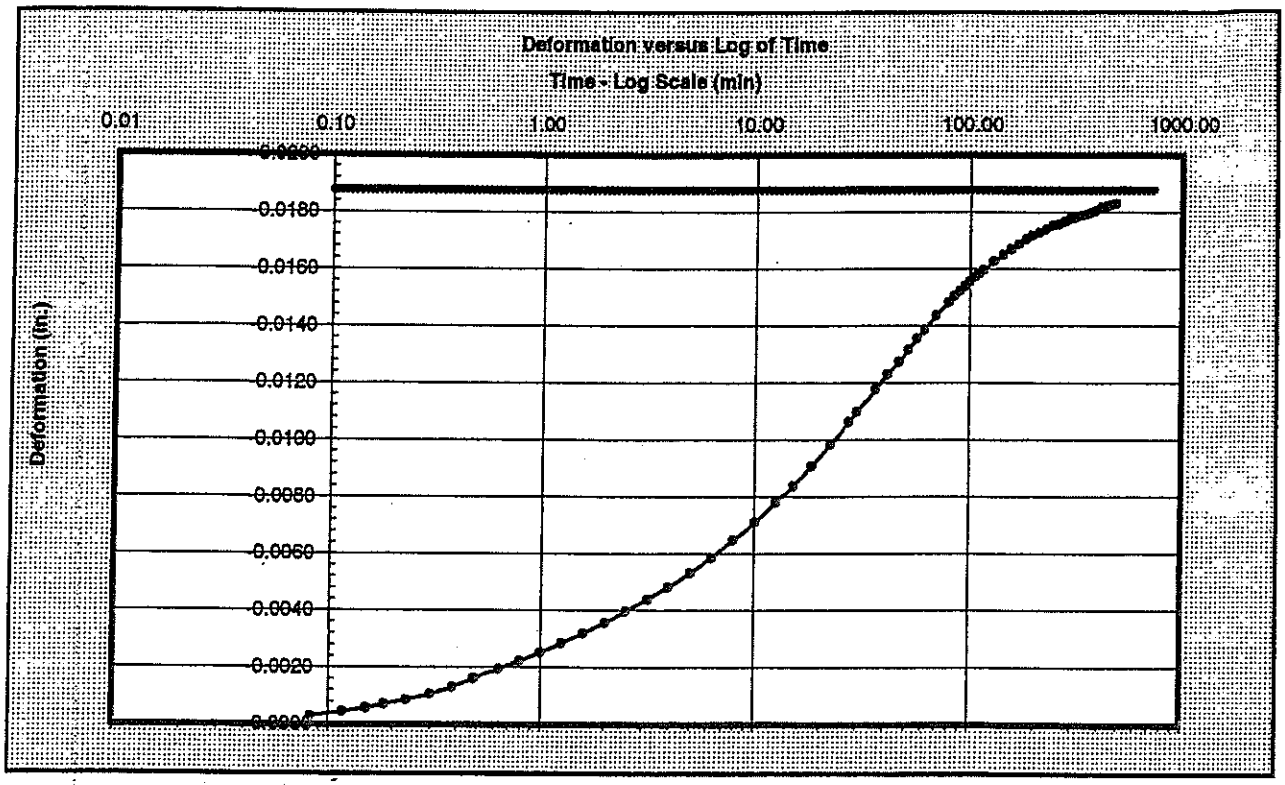

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
50.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
Deformation (in.)

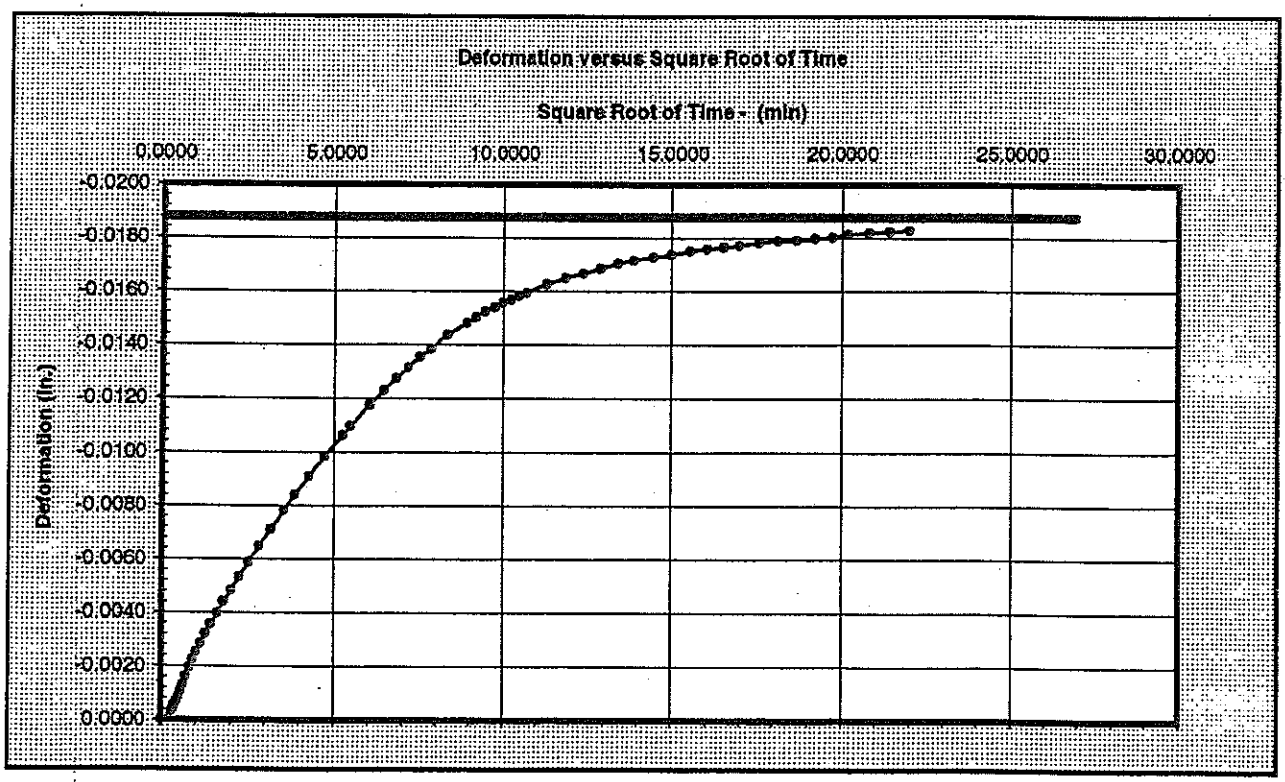
32 tst


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0160
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020

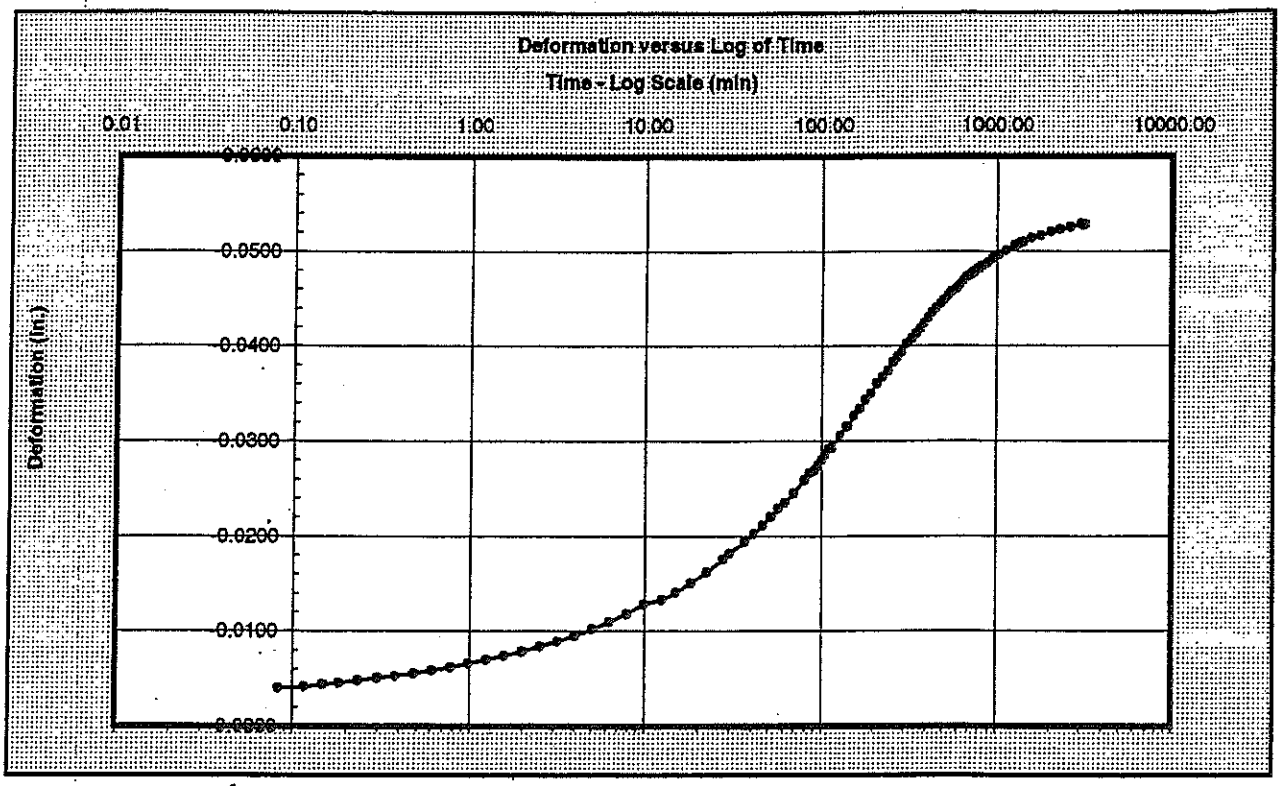

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
0.0180
0.0160
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020
0.0000

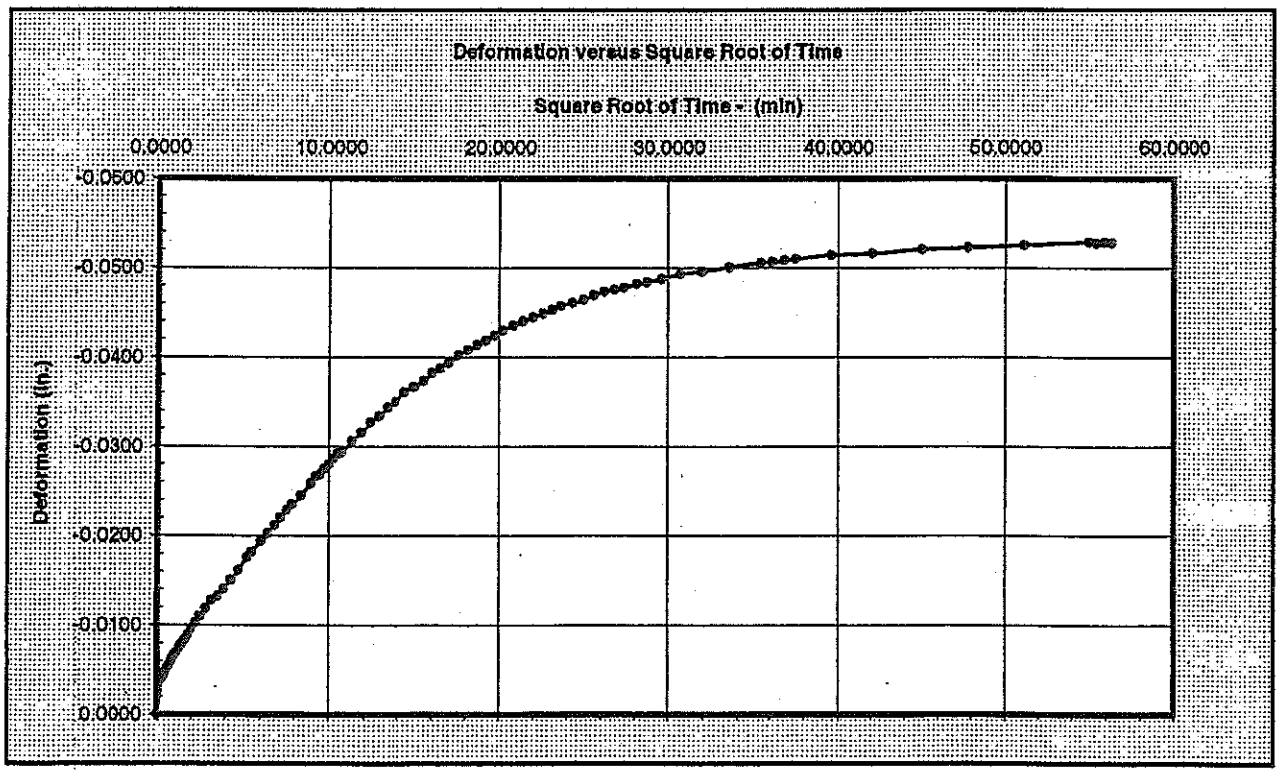
- Sa tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0180
0.0160
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020

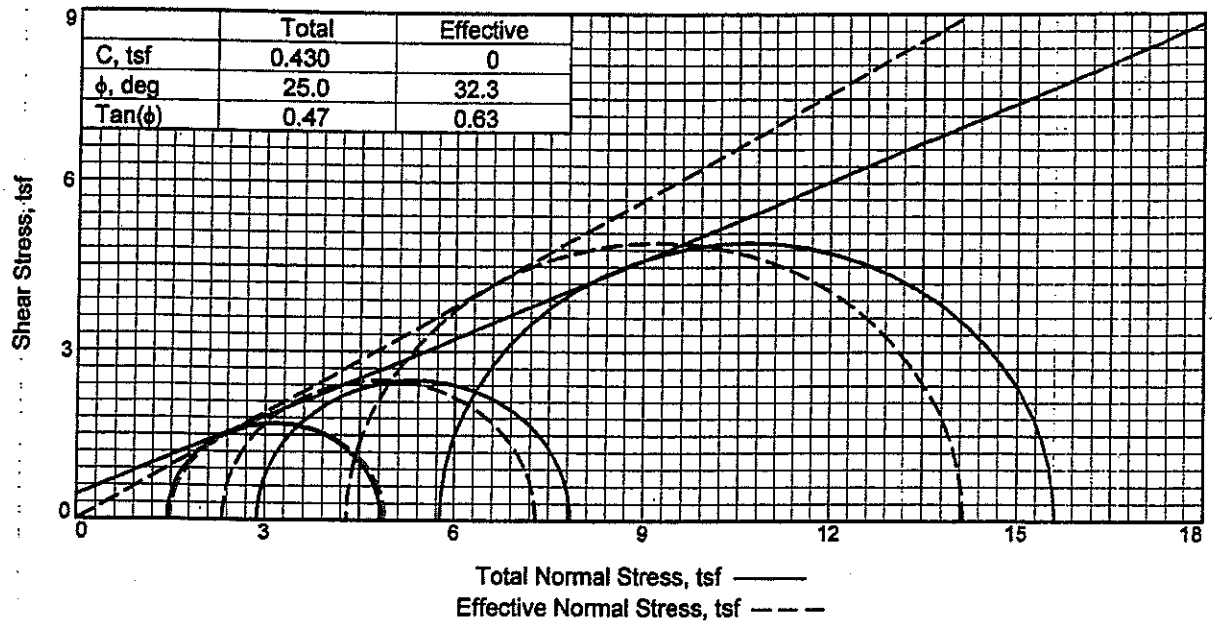

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
Deformation (in.)
-0.0200
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

-2a tst

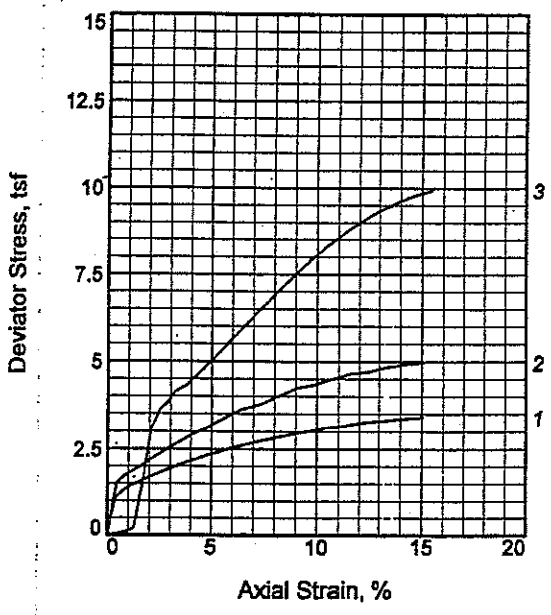

Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
Deformation (in.)


Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
10.0000
20.0000
30.0000
40.0000
50.0000
60.0000
-0.0500
-0.0500
-0.0400
-0.0300
-0.0200
-0.0100
0.0000
Deformation (in.)

-1/4 tsf



	Total	Effective
C, tsf	0.430	0
ϕ, deg	25.0	32.3
Tan(ϕ)	0.47	0.63



Sample No.		1	2	3
Initial	Water Content,	17.7	17.5	18.9
	Dry Density, pcf	113.2	113.9	111.8
	Saturation,	101.6	102.6	104.7
	Void Ratio	0.4617	0.4527	0.4791
	Diameter, in.	2.83	2.85	2.85
	Height, in.	5.30	4.75	4.88
At Test	Water Content,	17.4	17.1	18.1
	Dry Density, pcf	113.2	113.9	111.8
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.4617	0.4527	0.4791
	Diameter, in.	2.82	2.85	2.85
	Height, in.	5.30	4.75	4.88
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.6	3.6	1.4
Cell Pressure, tsf		5.0	6.5	7.2
Fail. Stress, tsf		3.4	5.0	9.9
Total Pore Pr., tsf		3.5	4.2	2.9
Ult. Stress, tsf		3.4	5.0	9.9
Total Pore Pr., tsf		3.5	4.2	2.9
$\bar{\sigma}_1$ Failure, tsf		4.9	7.3	14.2
$\bar{\sigma}_3$ Failure, tsf		1.5	2.3	4.3

Type of Test: CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown Mottled Gray Sandy CLAY to Clayey SAND

Assumed Specific Gravity= 2.65

Remarks:

Plate _____

Client: Williamson Energy

Project: Pond Creek Mine #1
Refuse Disposal Area

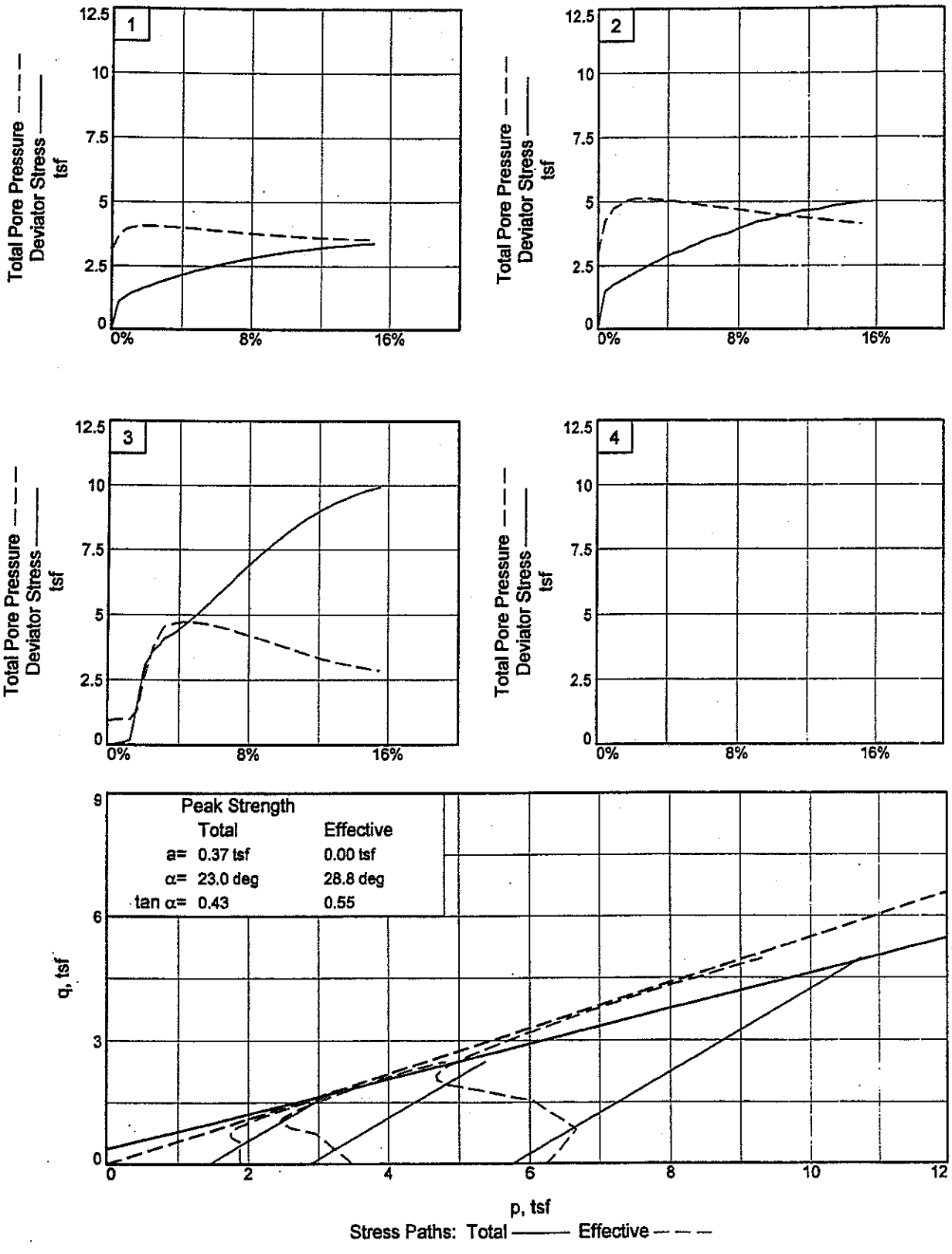
Location: Boring D-2 (13.5-16.0')

Proj. No.: H-08283 **Date:** 6/18/12

TRIAXIAL SHEAR TEST REPORT

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH



Client: Williamson Energy
Project: Pond Creek Mine #1
Location: Boring D-2 (13.5-16.0')
Project No.: H-08283

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

6/28/2012
7:25 PM

Date: 6/18/12
Client: Williamson Energy
Project: Pond Creek Mine #1
Refuse Disposal Area
Williamson County, Illinois
Location: Boring D-2 (13.5-16.0')
Description: Brown Mottled Gray Sandy CLAY to Clayey SAND
Remarks:
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	231.000			1289.300
Moisture content: Dry soil+tare, gms.	204.800			1128.400
Moisture content: Tare, gms.	56.800			140.300
Moisture, %	17.7	17.4	17.4	16.3
Moist specimen weight, gms.	1161.0			
Diameter, in.	2.83	2.83	2.82	
Area, in.^{2}	6.27	6.27	6.27	
Height, in.	5.30	5.30	5.30	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.2	132.9	132.9	
Dry density, pcf	113.2	113.2	113.2	
Void ratio	0.4617	0.4617	0.4617	
Saturation, %	101.6	100.0	100.0	

Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.403 tsf **at reading no.** 27
Ult. Stress = 3.403 tsf **at reading no.** 27

HOLCOMB FOUNDATION ENGINEERING CO.

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	1.886	1.886	1.00	43.80	1.886	0.000
1	0.0200	119.00	94.0	0.4	1.076	1.339	2.415	1.80	51.40	1.877	0.538
2	0.0410	139.80	114.8	0.8	1.308	1.094	2.403	2.20	54.80	1.749	0.654
3	0.0610	153.10	128.1	1.2	1.455	1.015	2.470	2.43	55.90	1.742	0.727
4	0.0820	163.10	138.1	1.5	1.562	0.972	2.534	2.61	56.50	1.753	0.781
5	0.1020	173.10	148.1	1.9	1.668	0.958	2.626	2.74	56.70	1.792	0.834
6	0.1230	183.10	158.1	2.3	1.774	0.958	2.732	2.85	56.70	1.845	0.887
7	0.1430	192.20	167.2	2.7	1.869	0.972	2.841	2.92	56.50	1.906	0.934
8	0.1640	200.60	175.6	3.1	1.955	0.986	2.941	2.98	56.30	1.964	0.977
9	0.1840	209.70	184.7	3.5	2.048	1.001	3.049	3.05	56.10	2.025	1.024
10	0.2040	218.00	193.0	3.9	2.132	1.022	3.154	3.08	55.80	2.088	1.066
11	0.2250	225.50	200.5	4.2	2.205	1.044	3.249	3.11	55.50	2.147	1.103
12	0.2450	233.90	208.9	4.6	2.289	1.058	3.347	3.16	55.30	2.203	1.144
13	0.2660	241.30	216.3	5.0	2.360	1.080	3.440	3.19	55.00	2.260	1.180
14	0.2860	248.00	223.0	5.4	2.423	1.102	3.525	3.20	54.70	2.313	1.212
15	0.3070	256.30	231.3	5.8	2.503	1.130	3.633	3.21	54.30	2.382	1.251
16	0.3480	269.60	244.6	6.6	2.625	1.166	3.792	3.25	53.80	2.479	1.313
17	0.3880	282.10	257.1	7.3	2.737	1.210	3.947	3.26	53.20	2.578	1.368
18	0.4290	293.80	268.8	8.1	2.838	1.253	4.090	3.27	52.60	2.672	1.419
19	0.4700	305.40	280.4	8.9	2.935	1.289	4.224	3.28	52.10	2.756	1.468
20	0.5110	316.20	291.2	9.6	3.022	1.325	4.347	3.28	51.60	2.836	1.511
21	0.5520	327.10	302.1	10.4	3.109	1.361	4.469	3.28	51.10	2.915	1.554
22	0.5930	334.60	309.6	11.2	3.158	1.390	4.548	3.27	50.70	2.969	1.579
23	0.6340	344.50	319.5	12.0	3.231	1.418	4.649	3.28	50.30	3.034	1.615
24	0.6750	352.00	327.0	12.7	3.278	1.440	4.718	3.28	50.00	3.079	1.639
25	0.7160	359.50	334.5	13.5	3.323	1.462	4.785	3.27	49.70	3.123	1.662
26	0.7560	367.00	342.0	14.3	3.368	1.476	4.844	3.28	49.50	3.160	1.684
27	0.7970	373.70	348.7	15.0	3.403	1.498	4.900	3.27	49.20	3.199	1.701

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	167.200			1137.200
Moisture content: Dry soil+tare, gms.	152.000			1000.100
Moisture content: Tare, gms.	65.300			92.400
Moisture, %	17.5	17.1	17.1	15.1
Moist specimen weight, gms.	1064.6			
Diameter, in.	2.85	2.85	2.85	
Area, in.²	6.38	6.38	6.38	
Height, in.	4.75	4.75	4.75	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.8	133.3	133.3	
Dry density, pcf	113.9	113.9	113.9	
Void ratio	0.4527	0.4527	0.4527	
Saturation, %	102.6	100.0	100.0	

Consolidation cell pressure = 90.00 psi (6.480 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.880 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.973 tsf **at reading no.** 24
Ult. Stress = 4.973 tsf **at reading no.** 24

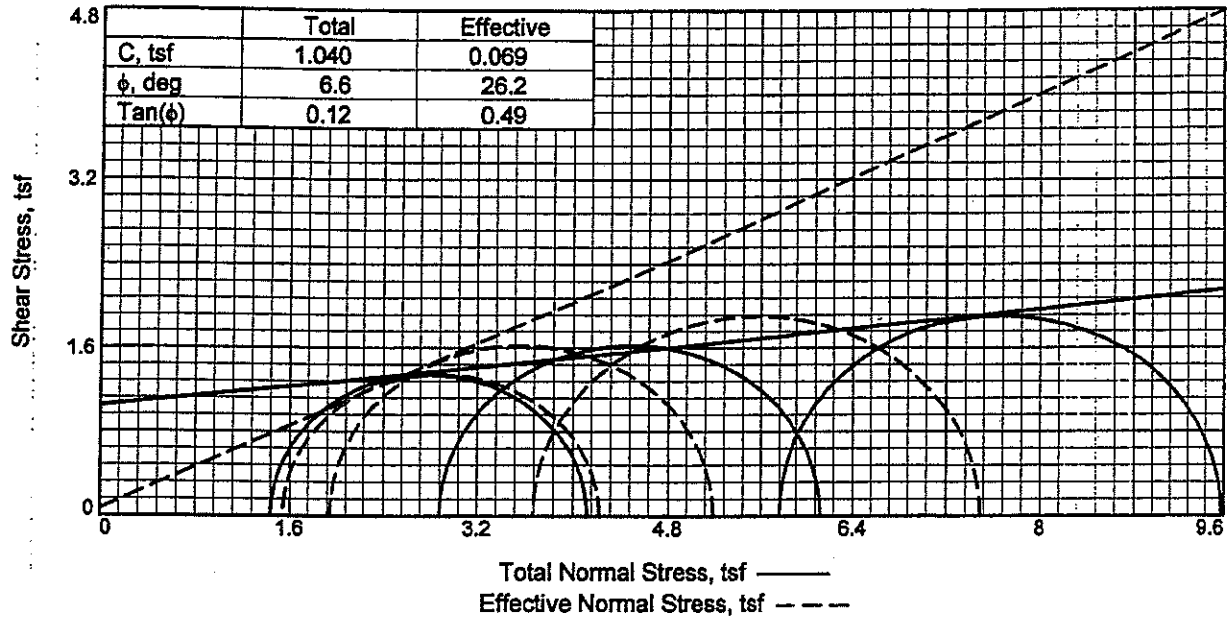
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	59.90	0.0	0.0	0.000	3.485	3.485	1.00	41.60	3.485	0.000
1	0.0200	193.10	133.2	0.4	1.497	2.203	3.700	1.68	59.40	2.952	0.749
2	0.0410	216.40	156.5	0.9	1.751	1.735	3.486	2.01	65.90	2.611	0.876
3	0.0820	246.30	186.4	1.7	2.067	1.418	3.486	2.46	70.30	2.452	1.034
4	0.1020	262.20	202.3	2.1	2.234	1.368	3.602	2.63	71.00	2.485	1.117
5	0.1230	277.10	217.2	2.6	2.388	1.361	3.749	2.75	71.10	2.555	1.194
6	0.1430	292.90	233.0	3.0	2.551	1.368	3.919	2.86	71.00	2.643	1.275
7	0.1640	307.90	248.0	3.5	2.702	1.390	4.092	2.94	70.70	2.741	1.351
8	0.1840	322.90	263.0	3.9	2.853	1.418	4.272	3.01	70.30	2.845	1.427
9	0.2040	336.20	276.3	4.3	2.984	1.447	4.432	3.06	69.90	2.939	1.492
10	0.2250	346.20	286.3	4.7	3.078	1.490	4.569	3.07	69.30	3.030	1.539
11	0.2450	362.00	302.1	5.2	3.234	1.526	4.760	3.12	68.80	3.143	1.617
12	0.2660	376.20	316.3	5.6	3.370	1.570	4.940	3.15	68.20	3.255	1.685
13	0.2860	390.30	330.4	6.0	3.504	1.613	5.117	3.17	67.60	3.365	1.752
14	0.3070	403.60	343.7	6.5	3.628	1.649	5.277	3.20	67.10	3.463	1.814
15	0.3480	420.30	360.4	7.3	3.770	1.721	5.490	3.19	66.10	3.606	1.885
16	0.3880	446.10	386.2	8.2	4.003	1.793	5.796	3.23	65.10	3.794	2.001
17	0.4290	471.90	412.0	9.0	4.230	1.872	6.102	3.26	64.00	3.987	2.115
18	0.4700	486.00	426.1	9.9	4.333	1.944	6.277	3.23	63.00	4.111	2.167
19	0.5110	507.70	447.8	10.8	4.510	2.016	6.526	3.24	62.00	4.271	2.255
20	0.5520	526.80	466.9	11.6	4.657	2.081	6.738	3.24	61.10	4.409	2.329
21	0.5930	536.00	476.1	12.5	4.703	2.146	6.848	3.19	60.20	4.497	2.351
22	0.6340	554.30	494.4	13.3	4.835	2.210	7.046	3.19	59.30	4.628	2.418
23	0.6750	567.60	507.7	14.2	4.916	2.268	7.184	3.17	58.50	4.726	2.458
24	0.7160	578.70	518.8	15.1	4.973	2.326	7.298	3.14	57.70	4.812	2.486

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	229.700			1184.900
Moisture content: Dry soil+tare, gms.	199.800			1044.600
Moisture content: Tare, gms.	41.800			134.900
Moisture, %	18.9	18.1	18.1	15.4
Moist specimen weight, gms.	1084.6			
Diameter, in.	2.85	2.85	2.85	
Area, in.^{2}	6.36	6.36	6.36	
Height, in.	4.88	4.88	4.88	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.0	132.1	132.1	
Dry density, pcf	111.8	111.8	111.8	
Void ratio	0.4791	0.4791	0.4791	
Saturation, %	104.7	100.0	100.0	

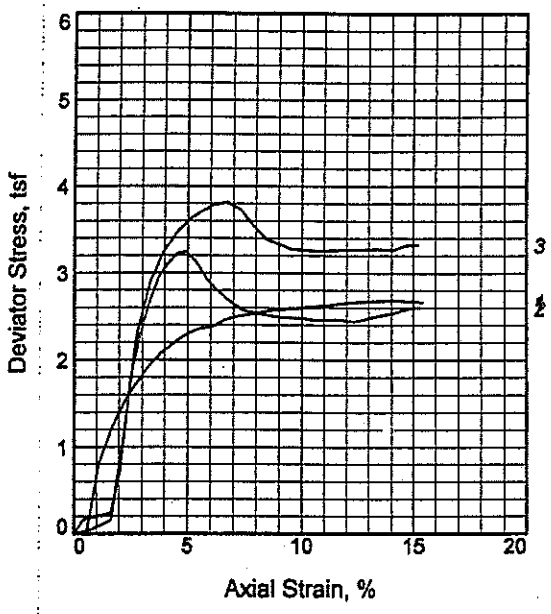
Consolidation cell pressure = 100.00 psi (7.200 tsf)
Consolidation back pressure = 20.00 psi (1.440 tsf)
Consolidation effective confining stress = 5.760 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 9.855 tsf **at reading no.** 26
Ult. Stress = 9.855 tsf **at reading no.** 26

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	39.90	0.0	0.0	0.000	6.278	6.278	1.00	12.80	6.278	0.000
1	0.0200	42.40	2.5	0.4	0.028	6.221	6.249	1.00	13.60	6.235	0.014
2	0.0410	47.40	7.5	0.8	0.084	6.214	6.298	1.01	13.70	6.256	0.042
3	0.0610	57.40	17.5	1.2	0.196	6.199	6.395	1.03	13.90	6.297	0.098
4	0.0820	189.70	149.8	1.7	1.667	5.832	7.499	1.29	19.00	6.665	0.833
5	0.1020	317.90	278.0	2.1	3.081	4.493	7.574	1.69	37.60	6.033	1.540
6	0.1230	367.80	327.9	2.5	3.618	3.449	7.067	2.05	52.10	5.258	1.809
7	0.1430	392.00	352.1	2.9	3.868	2.916	6.784	2.33	59.50	4.850	1.934
8	0.1540	413.60	373.7	3.2	4.096	2.650	6.746	2.55	63.20	4.698	2.048
9	0.1840	436.10	396.2	3.8	4.315	2.527	6.842	2.71	64.90	4.685	2.158
10	0.2040	459.40	419.5	4.2	4.550	2.477	7.026	2.84	65.60	4.752	2.275
11	0.2250	482.70	442.8	4.6	4.781	2.470	7.250	2.94	65.70	4.860	2.390
12	0.2450	507.70	467.8	5.0	5.029	2.491	7.520	3.02	65.40	5.006	2.514
13	0.2660	535.10	495.2	5.4	5.299	2.534	7.834	3.09	64.80	5.184	2.650
14	0.2860	562.60	522.7	5.9	5.569	2.592	8.161	3.15	64.00	5.377	2.785
15	0.3070	589.20	549.3	6.3	5.826	2.657	8.483	3.19	63.10	5.570	2.913
16	0.3480	645.00	605.1	7.1	6.360	2.808	9.168	3.27	61.00	5.988	3.180
17	0.3880	699.90	660.0	7.9	6.876	2.974	9.850	3.31	58.70	6.412	3.438
18	0.4290	755.70	715.8	8.8	7.390	3.154	10.543	3.34	56.20	6.848	3.695
19	0.4700	808.90	769.0	9.6	7.866	3.341	11.207	3.35	53.60	7.274	3.933
20	0.5110	860.50	820.6	10.5	8.316	3.528	11.844	3.36	51.00	7.686	4.158
21	0.5520	908.00	868.1	11.3	8.715	3.708	12.423	3.35	48.50	8.065	4.357
22	0.5930	949.60	909.7	12.1	9.046	3.881	12.926	3.33	46.10	8.404	4.523
23	0.6340	987.70	947.8	13.0	9.334	4.025	13.359	3.32	44.10	8.692	4.667
24	0.6750	1022.00	982.1	13.8	9.579	4.147	13.726	3.31	42.40	8.937	4.789
25	0.7160	1053.60	1013.7	14.7	9.791	4.255	14.046	3.30	40.90	9.151	4.895

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
26	0.7360	1065.20	1025.3	15.1	9.855	4.298	14.154	3.29	40.30	9.226	4.928
27	0.7560	1078.60	1038.7	15.5	9.936	4.334	14.270	3.29	39.80	9.302	4.968



	Total	Effective
C, tsf	1.040	0.069
ϕ, deg	6.6	26.2
Tan(ϕ)	0.12	0.49



Sample No.		1	2	3
Initial	Water Content,	28.3	21.5	27.6
	Dry Density, pcf	101.7	107.0	98.1
	Saturation,	120.0	104.3	106.4
	Void Ratio	0.6260	0.5465	0.6867
	Diameter, in.	2.80	2.82	2.83
	Height, in.	3.72	4.95	3.63
At Test	Water Content,	23.6	20.6	25.9
	Dry Density, pcf	101.7	107.0	98.1
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.6260	0.5465	0.6867
	Diameter, in.	2.80	2.82	2.82
	Height, in.	3.72	4.95	3.63
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	1.44
Cell Pressure, tsf		5.04	6.48	7.20
Fail. Stress, tsf		2.69	3.24	3.82
Total Pore Pr., tsf		3.50	4.54	3.53
Ult. Stress, tsf		2.67	2.60	3.32
Total Pore Pr., tsf		3.47	4.10	3.37
$\bar{\sigma}_1$ Failure, tsf		4.23	5.19	7.49
$\bar{\sigma}_3$ Failure, tsf		1.54	1.94	3.67

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:

Plate _____

Client: Williamson Energy

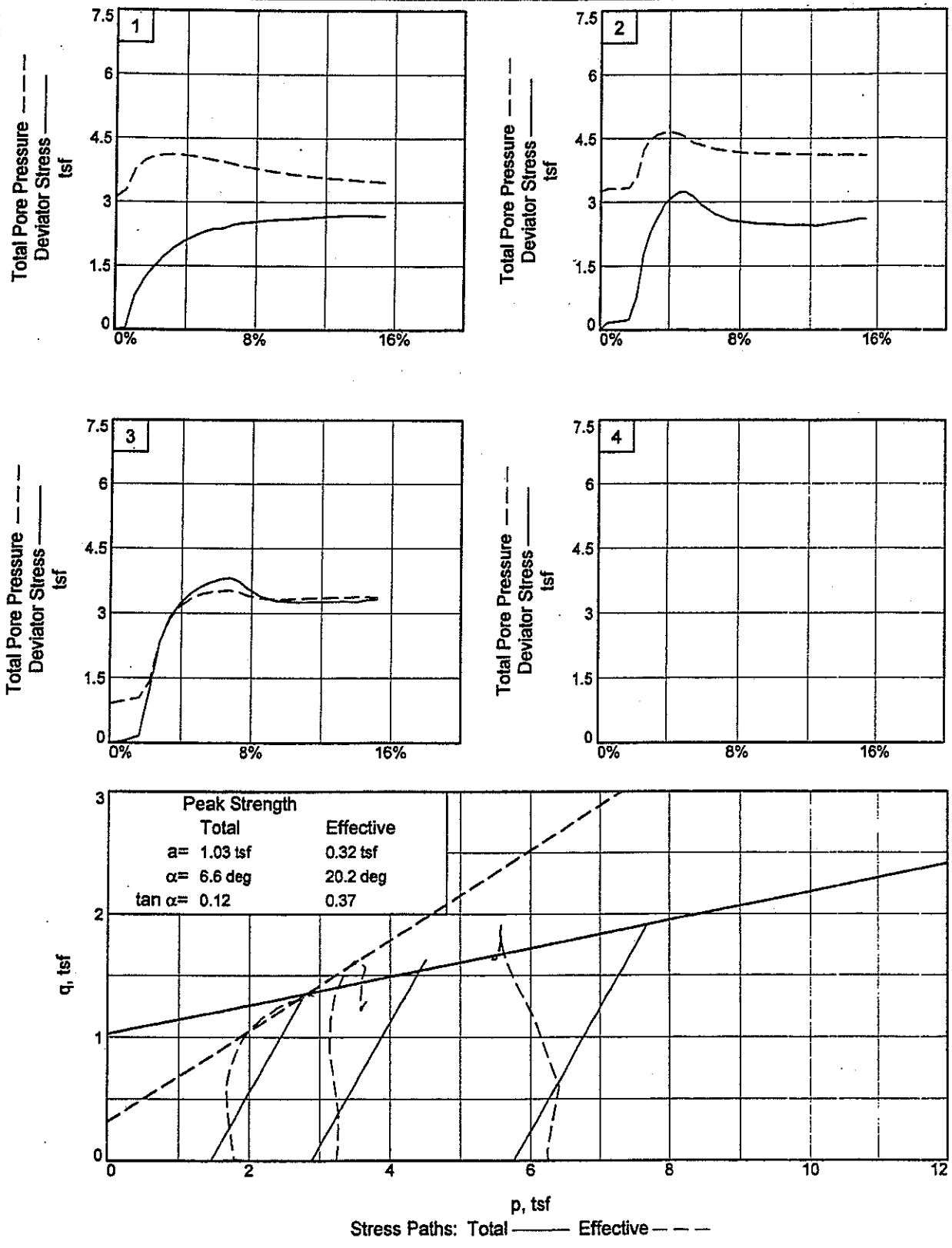
Project: Pond Creek Mine #1
Refuse Disposal Area
Location: Boring D-2 (18.5-21.0')

Proj. No.: H-08283 **Date:** 6-12-12

TRIAXIAL SHEAR TEST REPORT

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH



Client: Williamson Energy
Project: Pond Creek Mine #1
Location: Boring D-2 (18.5-21.0')
Project No.: H-08283

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

6/28/2012
7:48 PM

Date: 6-12-12
Client: Williamson Energy
Project: Pond Creek Mine #1
Refuse Disposal Area
Williamson County, Illinois
Location: Boring D-2 (18.5-21.0')
Description: Brown Mottled Gray Silty CLAY
Remarks:
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	120.000			887.700
Moisture content: Dry soil+tare, gms.	107.900			732.700
Moisture content: Tare, gms.	65.200			103.100
Moisture, %	28.3	23.6	23.6	24.6
Moist specimen weight, gms.	785.1			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	3.72	3.72	3.72	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.6	125.8	125.8	
Dry density, pcf	101.7	101.7	101.7	
Void ratio	0.6260	0.6260	0.6260	
Saturation, %	120.0	100.0	100.0	

Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.686 tsf **at reading no.** 21
Ult. Stress = 2.668 tsf **at reading no.** 23

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0020	21.60	0.0	0.0	0.000	1.937	1.937	1.00	43.10	1.937	0.000
1	0.0230	24.10	2.5	0.6	0.029	1.757	1.786	1.02	45.60	1.771	0.015
2	0.0430	91.50	69.9	1.1	0.808	1.274	2.083	1.63	52.30	1.679	0.404
3	0.0640	127.30	105.7	1.7	1.215	1.058	2.274	2.15	55.30	1.666	0.608
4	0.0840	153.10	131.5	2.2	1.504	0.965	2.469	2.56	56.60	1.717	0.752
5	0.1040	173.90	152.3	2.7	1.732	0.929	2.661	2.86	57.10	1.795	0.866
6	0.1250	192.20	170.6	3.3	1.929	0.922	2.850	3.09	57.20	1.886	0.964
7	0.1450	206.40	184.8	3.8	2.078	0.936	3.014	3.22	57.00	1.975	1.039
8	0.1660	218.00	196.4	4.4	2.195	0.972	3.167	3.26	56.50	2.070	1.098
9	0.1860	228.00	206.4	4.9	2.294	1.008	3.302	3.28	56.00	2.155	1.147
10	0.2070	235.50	213.9	5.5	2.363	1.058	3.422	3.23	55.30	2.240	1.182
11	0.2270	238.00	216.4	6.0	2.377	1.094	3.472	3.17	54.80	2.283	1.189
12	0.2480	247.20	225.6	6.6	2.463	1.145	3.608	3.15	54.10	2.377	1.232
13	0.2680	252.20	230.6	7.2	2.504	1.195	3.699	3.09	53.40	2.447	1.252
14	0.2880	255.50	233.9	7.7	2.525	1.231	3.756	3.05	52.90	2.494	1.262
15	0.3090	259.70	238.1	8.3	2.554	1.274	3.829	3.00	52.30	2.552	1.277
16	0.3290	263.00	241.4	8.8	2.575	1.310	3.885	2.96	51.80	2.598	1.287
17	0.3700	268.00	246.4	9.9	2.596	1.375	3.971	2.89	50.90	2.673	1.298
18	0.4110	273.80	252.2	11.0	2.625	1.426	4.050	2.84	50.20	2.738	1.312
19	0.4520	280.50	258.9	12.1	2.661	1.469	4.130	2.81	49.60	2.799	1.331
20	0.4930	285.50	263.9	13.2	2.678	1.505	4.183	2.78	49.10	2.844	1.339
21	0.5340	289.60	268.0	14.3	2.686	1.541	4.226	2.74	48.60	2.884	1.343
22	0.5540	290.40	268.8	14.8	2.677	1.555	4.232	2.72	48.40	2.894	1.338
23	0.5750	291.30	269.7	15.4	2.668	1.570	4.237	2.70	48.20	2.904	1.334

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	168.800			1180.800
Moisture content: Dry soil+tare, gms.	149.000			979.100
Moisture content: Tare, gms.	56.900			127.400
Moisture, %	21.5	20.6	20.6	23.7
Moist specimen weight, gms.	1053.2			
Diameter, in.	2.82	2.82	2.82	
Area, in.²	6.23	6.23	6.23	
Height, in.	4.95	4.95	4.95	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.0	129.0	129.0	
Dry density, pcf	107.0	107.0	107.0	
Void ratio	0.5465	0.5465	0.5465	
Saturation, %	104.3	100.0	100.0	

Consolidation cell pressure = 90.00 psi (6.480 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.880 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.244 tsf **at reading no.** 12
Ult. Stress = 2.598 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	25.80	0.0	0.0	0.000	3.240	3.240	1.00	45.00	3.240	0.000
1	0.0220	39.90	14.1	0.4	0.162	3.168	3.330	1.05	46.00	3.249	0.081
2	0.0420	42.40	16.6	0.8	0.190	3.168	3.358	1.06	46.00	3.263	0.095
3	0.0620	44.10	18.3	1.2	0.209	3.161	3.370	1.07	46.10	3.265	0.104
4	0.0830	47.40	21.6	1.7	0.245	3.139	3.385	1.08	46.40	3.262	0.123
5	0.1030	92.40	66.6	2.1	0.754	2.894	3.648	1.26	49.80	3.271	0.377
6	0.1240	183.10	157.3	2.5	1.772	2.254	4.026	1.79	58.70	3.140	0.886
7	0.1440	228.90	203.1	2.9	2.279	2.009	4.287	2.13	62.10	3.148	1.139
8	0.1650	263.00	237.2	3.3	2.649	1.886	4.536	2.40	63.80	3.211	1.325
9	0.1850	290.40	264.6	3.7	2.943	1.843	4.786	2.60	64.40	3.315	1.472
10	0.2060	307.10	281.3	4.1	3.115	1.836	4.951	2.70	64.50	3.394	1.558
11	0.2260	317.90	292.1	4.5	3.221	1.872	5.093	2.72	64.00	3.483	1.611
12	0.2460	321.20	295.4	4.9	3.244	1.944	5.188	2.67	63.00	3.566	1.622
13	0.2670	311.30	285.5	5.4	3.121	2.088	5.209	2.49	61.00	3.649	1.561
14	0.2870	296.30	270.5	5.8	2.944	2.131	5.076	2.38	60.40	3.603	1.472
15	0.3080	286.30	260.5	6.2	2.823	2.189	5.012	2.29	59.60	3.600	1.411
16	0.3280	278.00	252.2	6.6	2.721	2.232	4.953	2.22	59.00	3.593	1.361
17	0.3690	266.30	240.5	7.4	2.572	2.290	4.862	2.12	58.20	3.576	1.286
18	0.4100	264.60	238.8	8.3	2.531	2.326	4.856	2.09	57.70	3.591	1.265
19	0.4510	263.00	237.2	9.1	2.491	2.340	4.831	2.06	57.50	3.586	1.246
20	0.4920	264.60	238.8	9.9	2.485	2.347	4.832	2.06	57.40	3.590	1.243
21	0.5330	263.80	238.0	10.7	2.454	2.354	4.809	2.04	57.30	3.581	1.227
22	0.5740	267.10	241.3	11.6	2.465	2.362	4.827	2.04	57.20	3.594	1.233
23	0.6140	267.10	241.3	12.4	2.443	2.369	4.811	2.03	57.10	3.590	1.221
24	0.6550	274.60	248.8	13.2	2.495	2.369	4.864	2.05	57.10	3.616	1.247
25	0.6960	281.30	255.5	14.0	2.537	2.369	4.906	2.07	57.10	3.638	1.269

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
26	0.7370	289.60	263.8	14.9	2.595	2.376	4.971	2.09	57.00	3.673	1.297
27	0.7580	291.30	265.5	15.3	2.598	2.376	4.974	2.09	57.00	3.675	1.299

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	91.300			834.500
Moisture content: Dry soil+tare, gms.	80.600			689.300
Moisture content: Tare, gms.	41.800			96.300
Moisture, %	27.6	25.9	25.9	24.5
Moist specimen weight, gms.	746.5			
Diameter, in.	2.83	2.82	2.82	
Area, in.²	6.27	6.27	6.27	
Height, in.	3.63	3.63	3.63	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	125.1	123.5	123.5	
Dry density, pcf	98.1	98.1	98.1	
Void ratio	0.6867	0.6867	0.6867	
Saturation, %	106.4	100.0	100.0	

Consolidation cell pressure = 100.00 psi (7.200 tsf)
Consolidation back pressure = 20.00 psi (1.440 tsf)
Consolidation effective confining stress = 5.760 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.816 tsf **at reading no.** 12
Ult. Stress = 3.324 tsf **at reading no.** 22

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	41.60	0.0	0.0	0.000	6.293	6.293	1.00	12.60	6.293	0.000
1	0.0190	43.30	1.7	0.5	0.019	6.242	6.262	1.00	13.30	6.252	0.010
2	0.0400	49.10	7.5	1.1	0.085	6.199	6.284	1.01	13.90	6.242	0.043
3	0.0600	55.80	14.2	1.7	0.160	6.156	6.316	1.03	14.50	6.236	0.080
4	0.0810	149.00	107.4	2.2	1.206	5.796	7.002	1.21	19.50	6.399	0.603
5	0.1010	251.30	209.7	2.8	2.342	4.860	7.202	1.48	32.50	6.031	1.171
6	0.1220	302.90	261.3	3.4	2.901	4.334	7.235	1.67	39.80	5.785	1.450
7	0.1420	333.70	292.1	3.9	3.224	4.046	7.270	1.80	43.80	5.658	1.612
8	0.1620	356.20	314.6	4.5	3.452	3.874	7.326	1.89	46.20	5.600	1.726
9	0.1830	372.80	331.2	5.0	3.612	3.766	7.378	1.96	47.70	5.572	1.806
10	0.2030	383.70	342.1	5.6	3.710	3.715	7.425	2.00	48.40	5.570	1.855
11	0.2240	392.80	351.2	6.2	3.785	3.686	7.471	2.03	48.80	5.579	1.893
12	0.2440	397.80	356.2	6.7	3.816	3.672	7.488	2.04	49.00	5.580	1.908
13	0.2650	392.00	350.4	7.3	3.731	3.715	7.446	2.00	48.40	5.581	1.865
14	0.2850	377.00	335.4	7.9	3.550	3.802	7.352	1.93	47.20	5.577	1.775
15	0.3060	364.50	322.9	8.4	3.396	3.852	7.248	1.88	46.50	5.550	1.698
16	0.3460	357.00	315.4	9.5	3.277	3.881	7.158	1.84	46.10	5.519	1.639
17	0.3870	358.70	317.1	10.7	3.254	3.866	7.120	1.84	46.30	5.493	1.627
18	0.4280	363.70	322.1	11.8	3.263	3.852	7.115	1.85	46.50	5.484	1.632
19	0.4890	371.20	329.6	13.5	3.276	3.830	7.106	1.86	46.80	5.468	1.638

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
20	0.5100	372.00	330.4	14.1	3.261	3.823	7.085	1.85	46.90	5.454	1.631
21	0.5300	379.50	337.9	14.6	3.314	3.823	7.137	1.87	46.90	5.480	1.657
22	0.5510	382.80	341.2	15.2	3.324	3.830	7.154	1.87	46.80	5.492	1.662

UNIFIED SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		GRAVELS WITH FINES	GM	Silty gravels, gravels-sand silt mixtures
			GC	Clayey gravels, gravel-sand clay mixtures
		CLEAN SANDS	SW	Well-graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, clay-sand mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LOW PLASTICITY		ML	Inoganic silts of clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity
	SILTS AND CLAYS HIGH PLASTICITY		OL	Organic silts and organic silty clays of low plasticity
			MH	Inorganic clays of high plasticity
			CH	Organic clays of high plasticity
HIGHLY ORGANIC SOILS			OH	Organic clays of medium to high plasticity
			PT	Peat, humus, swamp soils with high organic contents

APPENDIX D

ANALYSIS OF 8-INCH GAS LINE

APPENDIX D

CALCULATION BRIEF
VOLUME 2 OF 2
PERMIT # 417
(MSHA SUBMITTAL PLAN)
PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 2
WILLIAMSON COUNTY, IL

TABLE OF CONTENTS

TOPIC	PAGE
Final Report, Analysis of Mach Mining, LLC's 8-inch Gas Gathering Line under the Proposed Number 1 Mine Coal Refuse Disposal Facility Expansion, Kiefner & Associates, Inc., December 12, 2012.	1
Section 5.2, Corrosion Control System Description, Operations, Maintenance & Emergency Procedures Manual, 8" Natural Gas Transmission & Gathering Pipeline for Keyrock Energy LLC Utility Safety & Design, Inc., January 26, 2012.	20
Shelby Tube Soil Samples – Pipeline Relocation Project, Mach Mine, Williamson County, Illinois, Holcomb Foundation Engineering Co., Inc, December 11, 2009.	22
DTE Gas Line Consolidation Analysis	58
References, Discussion, & Evaluation of Consolidation Tests Results	58
Construction of Virgin Consolidation Curve	61
Embankment Staging Information	62
Consolidation Computations	63
Summary of Results	66
Post-Mining Subsidence Determination	68
Gas Pipeline and Boring Locations, Drawing No. B12-495-E1	75
DTE Gas Line Anti-seep Diaphragm Design	76

Mach Mining, LLC

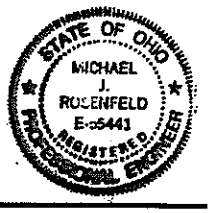
Final Report No. 12-193

Final Report

Analysis of Mach Mining, LLC's 8-inch Gas Gathering Line under the Proposed Number 1 Mine Coal Refuse Disposal Facility Expansion

Robert B Francini and Cara Macrory-Dalton, PE

December 12, 2012





Kiefner & Associates, Inc.
585 Scherers Court
Worthington, Ohio 43085

(614) 888-8220
www.kiefner.com

0546-1201

Intentionally blank

Final Report No. 12-193

Final Report

on

ANALYSIS OF MACH MINING, LLC'S 8-INCH GAS GATHERING LINE UNDER THE PROPOSED NUMBER 1 MINE COAL REFUSE DISPOSAL FACILITY EXPANSION

to

MACH MINING, LLC

December 12, 2012

by

Robert B Francini and Cara Macrory-Dalton, PE

Kiefner and Associates, Inc.
585 Scherers Court
Worthington, Ohio 43085

0546-1201

DISCLAIMER

This document presents findings and/ or recommendations based on engineering services performed by employees of Kiefner and Associates, Inc. The work addressed herein has been performed according to the authors' knowledge, information, and belief in accordance with commonly accepted procedures consistent with applicable standards of practice, and is not a guaranty or warranty, either expressed or implied.

The analysis and conclusions provided in this report are for the sole use and benefit of the Client. No information or representations contained herein are for the use or benefit of any party other than the party contracting with KAI. The scope of use of the information presented herein is limited to the facts as presented and examined, as outlined within the body of this document. No additional representations are made as to matters not specifically addressed within this report. Any additional facts or circumstances in existence but not described or considered within this report may change the analysis, outcomes and representations made in this report.

TABLE OF CONTENTS

INTRODUCTION 1
CONCLUSIONS AND RECOMMENDATIONS 1
STRESS ANALYSIS 1
Existing Stresses 2
Subsidence Residual Stress 3
Coal Refuse Disposal Facility Overburden Stress 3
Coal Refuse Disposal Facility Consolidation Stress 5
ASME B31.8 Design Stress Analysis 5

LIST OF FIGURES

Figure 1. Profile of the mine subsidence at the western edge of longwall Panel 3 used to calculate subsidence stress 9
Figure 2. Bending stress calculated from the subsidence profile shown in Figure 1 9
Figure 3. Consolidation profile under west side of refuse facility 10
Figure 4. Idealized soil spring model used to analyze buried pipe-soil interaction 10
Figure 5a. FEA model used for consolidation stress analysis 11
Figure 5b. Close-up view of soil springs in FEA model for consolidation stress analysis (arrows show soil springs) 11
Figure 6. Consolidation stresses on 8-inch pipe 12
Figure 7a. Total longitudinal, hoop and combined stresses at 0 psig 12
Figure 7b. Total longitudinal, hoop and combined stresses at 300 psig 13

LIST OF TABLES

Table 1 Stresses on the pipe from the refuse facility surface loading 8
Table 2. Soil properties used for consolidation stress analysis 8
Table 3. Peak hoop, longitudinal and equivalent stresses from Figures 7a and 7b 8

Intentionally blank

Analysis of Mach Mining, LLC's 8-inch Gas Gathering Line under the Proposed Number 1 Mine Coal Refuse Disposal Facility Expansion

Robert B Francini and Cara Macrory-Dalton, PE

INTRODUCTION

Mach Mining, LLC has purchased the former DTE coal bed methane processing facility and the associated gathering lines that are part of this facility. Mach Mining is in the process of designing an expansion to its existing coal refuse disposal facility that will be constructed over the 8-inch inlet line for the processing facility. Mach Mining asked Kiefner to review the design of the proposed expansion to ensure that the integrity of the pipeline is not compromised by the increased overburden and settlement from the expansion. The analysis is complicated by the fact that the line was subsided by Panel 3 of the Number 1 mine. The results of the stress analysis due to these combined stress sources as well as recommendations for maintaining the stress levels within the acceptable design stress levels of ASME B31.8[1] are contained herein.

CONCLUSIONS AND RECOMMENDATIONS

- The results of a stress analysis of the 8-inch inlet line which includes current and anticipated loadings shows that the stresses are within the stress limits of ASME B31.8.
- Based on the results of this analysis Mach Mining, LLC should be able to construct the coal refuse disposal facility over the 8-inch pipeline without compromising the integrity of the pipeline.
    - Mach Mining, LLC should be aware that, once the facility is constructed, access to the pipeline will be limited should future integrity issues arise.

STRESS ANALYSIS

The stress analysis of the proposed expansion requires the calculation of the following stress components:

1. The existing stress on the pipe from internal pressure and thermal expansion,
2. The residual stress on the pipe from the longwall mine subsidence,

[1] ASME B31.8-2010, Gas Transmission and Distribution Piping Systems, American Society of Mechanical Engineers

3. The stress on the pipe from the refuse facility overburden, and
4. The stress on the pipe from the consolidation of the soil under the refuse facility.

Since the analysis being performed is a linear elastic analysis, each of the 4 stresses can be calculated separately and summed in the end. Care must be taken when summing the stresses because they are a combination of uniform hoop and axial stresses that are constant through the wall of the pipe (existing stresses), beam bending stresses that are constant through the wall of the pipe but vary from compression on one side of the pipe and tension on the other side of the pipe (subsidence and settlement) and through-wall bending in the hoop and axial directions (overburden loading).

Existing Stresses

The hoop stress from pressure is:

$$SH_{Pressure}=\frac{PD}{2t} \quad (1)$$

where

P is the internal pressure, psi,
D is the pipe diameter, in, and
t is the pipe wall thickness, in.

The longitudinal stress from pressure is:

$$SL_{Pressure}=\upsilon SH_{Pressure} \quad (2)$$

where

υ is Poisson's ratio for steel, 0.3.

The longitudinal stress from thermal expansion for restrained pipe is:

$$SL_{Thermal}=\alpha E(T_1-T_2) \quad (3)$$

where

α is the coefficient of thermal expansion for steel, 6.5×10^{-6} in/in/F,
E is the modulus of elasticity for steel, 30×10^{6} psi,
T_1 is the temperature of the pipe when it was installed, F, and
T_2 is the operating temperature of the pipe, F.

The pipe diameter is 8.625 inches, the wall thickness is 0.406 inch and the grade is API 5L X42. The operating pressure for the pipe is 300 psig. The hoop stress at operating pressure ($SH_{Pressure}$) is 3,187 psi. The resulting longitudinal stress from pressure ($SL_{Pressure}$) is 956 psi. In order to calculate the thermal stress it was assumed that the pipeline was constructed during the warmer months and that it operates at near the ground temperature which resulted in a temperature differential (T_1-T_2) of 30 F. The resulting thermal stress is 5,850 psi.

Subsidence Residual Stress

The segment of the pipeline that will be under the coal refuse disposal facility was previously subsided during the mining of Panel 3 of the Number 1 mine. The western edge of the longwall panel will be under the disposal facility. There are residual stresses at the edge of the longwall panel from the mine subsidence that need to be included in the stress analysis. Since the pipe at the edge of the panel was exposed during the subsidence, the only longitudinal stresses are bending stresses. If we assume that the pipe conforms to the subsidence profile of the ground surface, the bending stresses can be calculated from the curvature of the surface. Figure 1 shows a graph of the surface profile at the western edge of longwall Panel 3. The survey data shown as the points in Figure 1 was interpolated to a uniformly spaced series of points that were 5 feet apart in order to estimate the curvature. The curvature was calculated from the interpolated data over 75-foot intervals using a cubic curve fit. The curvature at the center of the interval was calculated using the following equation:

$$\kappa = \frac{\frac{d^2y}{dx^2}}{\left(1+\left(\frac{dy}{dx}\right)^2\right)^{3/2}} \qquad (4)$$

where y is the cubic curve fit. The stress can then be calculated using the following formula:

$$SL_{Subsidence} = \frac{ED\kappa}{2} \qquad (5)$$

Figure 2 shows a graph of the subsidence stresses that were calculated from Equations (4) and (5). The peak subsidence stress of ±11,079 psi occurs at survey location 6+55 feet. This compares well with the stress measured from strain gauges on the pipe during subsidence. The measured bending stress was 9,177 psi. The calculated stress was used for our analysis because the single strain gauge measurement site may not have been located exactly at the peak stress location.

Coal Refuse Disposal Facility Overburden Stress

The disposal facility will result in stress on the pipeline as a result of the increased overburden loading. Kiefner used the loading information found in Alliance Consulting, Inc.'s analysis of the loading dated 5/31/2012 for project number B12-218-1413. The relevant parameters were an average overburden density of 139 pounds per cubic foot (pcf) and an effective height of 162 feet. This was considered the worst case for the overburden loading by Alliance Consulting and was assumed to be the same over the entire length of pipe under the refuse facility.

The external load on the pipeline from the increased overburden causes a deflection in the pipe cross section and local circumferential and longitudinal stresses that combine with the circumferential and longitudinal stresses that are present under normal operating conditions.

Kiefner based its analysis of the stress in the pipe from the overburden in the 'CEPA' equation[2]. The 'CEPA' equation effectively combines the internal pressure and lateral soil restraint deflection resistance terms into a single equation for circumferential bending stress.

The load at pipeline depth due to a load at the surface can be calculated using Boussinesq's equation:

$$W_l = \frac{3FD}{2\pi C^2\left[1+\left(\frac{d}{C}\right)^2\right]^{2.5}} \qquad (6)$$

where

F is the point load at the surface (lb)

D is the diameter of the pipe (in)

C is the depth of soil cover (in)

d is the offset distance from the pipe to the line of application of the surface load (in)

Using this equation any load with a known contact area can be represented by a series of point loads at the surface and the total load on the pipe is calculated as the summation of the individual loads.

The fill soil load above the pipeline is calculated as the weight a prism of soil having a width equal to the diameter of the pipe and height equal to the depth of cover:

$$W_f = \rho DC \qquad (7)$$

where

ρ = density of fill (lb/in^3)

The CEPA equation combines the pressure stiffening and soil restraint terms into the following equation for circumferential bending stress:

$$SH_{Surface} = \frac{6K_b W \cdot E \cdot t \cdot r}{Et^3 + 24 \cdot K_z P \cdot r^3 + 0.732Et^3} \qquad (8)$$

where

K_b = soil parameter

W = sum of live and fill loads at pipeline depth (lb/in)

E = Young modulus for steel (30×10^6 psi)

t = wall thickness (in)

r = pipe radius (in)

K_z = soil parameter

[2] Warman, D. J. and Hart, J.D. "Development of a Pipeline Surface Loading Screening Process & Assessment of Surface Loading Dispersing Methods," Final Report 05-44 to the Canadian Energy Pipeline Association (CEPA). June 17, 2005

P = internal pressure (psig)
E' = modulus of soil reaction (psi)

Since the overburden loading is assumed to be uniform over the length of the pipe the longitudinal load from the overburden is a result of Poisson contraction and is:

$$SL_{Surface} = \upsilon SH_{Surface} \quad (9)$$

The hoop and longitudinal stresses from the surface loading were calculated at the operating pressure and at 0 psig pressure in the event the pipeline is shut down. The results of the analysis are shown in Table 1.

Coal Refuse Disposal Facility Consolidation Stress

The surface loading from the refuse disposal facility will result in consolidation of the soil under the facility. This consolidation will result in additional permanent stresses on the pipeline similar to the stresses caused by subsidence. Kiefner used the results of Alliance Consulting, Inc. consolidation analysis dated 8/2/2012 for project number B12-218-1413. Figure 3 shows the consolidation profile that was used for the analysis. The consolidation profile is from the west end of the refuse facility. Since the consolidation on the west end of the facility will be greater than on the east end it was used for the analysis.

The buried pipe consolidation stresses were analyzed in a finite element analysis (FEA) using the soil spring model outlined in the Guidelines for the Design of Buried Steel Pipe[3]. The model used nonlinear springs to represent the soil-pipe interaction. Figure 4 shows a schematic of the soil spring model. The execution of the soil spring model requires the soil density, cohesion and friction angle for inputs. The results from soil testing performed by Mach Mining were used for the soil property inputs in the analysis. Table 2 shows the results of the soil testing. Figures 5a and 5b show an overview of the FEA model and close-up view of the soil springs used for the analysis. The results of the stress analysis are shown in Figure 6. The peak consolidation stress of ±2,979 psi occurs at survey location 4+65 feet.

ASME B31.8 Design Stress Analysis

The components of the hoop and longitudinal stress analyses must be combined to obtain the total hoop (SH) and longitudinal (SL) stresses. The existing hoop and longitudinal stresses are approximately uniform stresses through the thickness of the pipe wall. The subsidence and consolidations stresses are longitudinal pipe bending stresses that are tensile on one side of the

[3] Guidelines for the Design of Buried Steel Pipe, July 2001 (with addenda through February 2005), AmericanLifelinesAlliance, American Society of Civil Engineers

pipe and compressive on the other side of the pipe but are relatively uniform through-wall stresses. Finally, the overburden stresses are through-wall bending that vary from compression on one side of the wall to compression on the other side of the wall. These stresses do not usually occur at the same location of the pipe circumference for a given survey position. The conservative convention is to assume that the individual stress components all occur at the same circumferential location and sum the results. The combined stress (Seq) is calculated from the total hoop and longitudinal stresses using the following formula:

$$Seq=\sqrt{SH^2-SH\cdot SL+SL^2} \qquad (10)$$

The results for the total longitudinal, hoop and combined stress are shown in Figures 7a and 7b. Figure 7a shows the stresses at 0 psig internal pressure and Figure 7b shows the stresses at 300 psig. The peak stresses are summarized in Table 3.

There is no requirement that an existing pipeline meet the stress limits of ASME B31.8 so long as it can be shown that they are operating safely. However, if the pipe is in good condition and the pipeline has been constructed in accordance with sound construction practices, then it can be stated that the pipeline is operating safely if it meets the B31.8 requirements. The following paragraph is the integrity review of the pipeline from Kiefner report number 10-028 that was performed as part of the longwall subsidence mitigation plan for DTE, the former owners of the pipeline.

"The DTE Sales and Inlet Lines went into service in 2002. The welds were inspected in accordance with API Standard 1104[4] for welding pipelines. The inlet line has a 7-10 mil internal corrosion prevention coating. DTE has an internal corrosion monitoring plan in place for the inlet line and has not found evidence of ongoing internal corrosion. The sales and inlet lines are FBE coated and have cathodic protection. To date, DTE has not experienced issues with external corrosion. Based on this analysis and the recent construction of the lines, we conclude that it is appropriate to use the stress limits given in ASME B31.8 as the stress limits during the subsidence of the pipelines."

ASME B31.8 limits the hoop stress from pressure and local stresses to 0.9 SMYS in Paragraph 833.9(b). The absolute value of the sum of the longitudinal stresses is limited to 0.9 SMYS in Paragraph 833.3(b) and the combined stress is limited to 0.9 SMYS in Paragraph 833.4(b). The stress limits for ASME B31.8 are shown in Table 3 and as the 0.9 SMYS lines in Figures 7a and 7b. Total longitudinal, hoop and combined stresses at 0 psig is in 7a and at 300 psig is in 7b. All of the stresses are within the limits of ASME B31.8 based on this analysis. Based on the results

[4] API Standard 1104, Welding of Pipelines and Related Facilities, 19th Edition, September 1999, American Petroleum Institute

of this analysis Mach Mining, LLC should be able to construct the coal refuse disposal facility over the 8-inch pipeline without compromising the integrity of the pipeline. Mach Mining, LLC should be aware that, once the facility is constructed, future access to the pipeline will be limited should future integrity issues arise.

Table 1 Stresses on the pipe from the refuse facility surface loading

Pressure, psig	$SH_{Surface}$, psi	$SL_{Surface}$, psi
0	27,756	8,327
300	27,097	8,129

Table 2. Soil properties used for consolidation stress analysis

Specimen no.	Northing	Easting	Elevation, ft	C, tsf	φ, deg	Dens. 1, lcf	Dens. 2, lcf	Dens. 3, lcf	Ave. dens., lcf
1	426979.808	360391.353	469.13	0.115	31.0	129.0	129.5	128.1	128.9
2	426915.196	362865.063	470.51	0.000	30.7	128.5	130.8	134.7	131.3
3	426872.850	364429.708	476.96	0.000	30.4	124.5	128.7	131.8	128.3
4	426851.754	365685.028	480.56	0.029	29.7	132.9	132.8	132.5	132.7
5	427055.027	367932.856	527.60	0.000	31.2	123.6	126.8	127.0	125.8
Average				**0.029**	**30.6**		**129.4**		

Table 3. Peak hoop, longitudinal and equivalent stresses from Figures 7a and 7b

Stress Component	Internal pressure, 0 psig		Internal pressure, 300 psig		ASME B31.8 Limit
	psi	/SMYS	psi	/SMYS	/SMYS
SH	27,756	0.66	30,284	0.72	0.9*
|SL|	26,615	0.63	26,418	0.63	0.9
SL compressive	-13,003	-0.31	-12,806	-0.30	>SMYS**
Seq	33,855	0.81	30,296	0.72	0.9
* Combined stress due to pressure and local through wall bending					
** 2/3 of critical buckling limit					

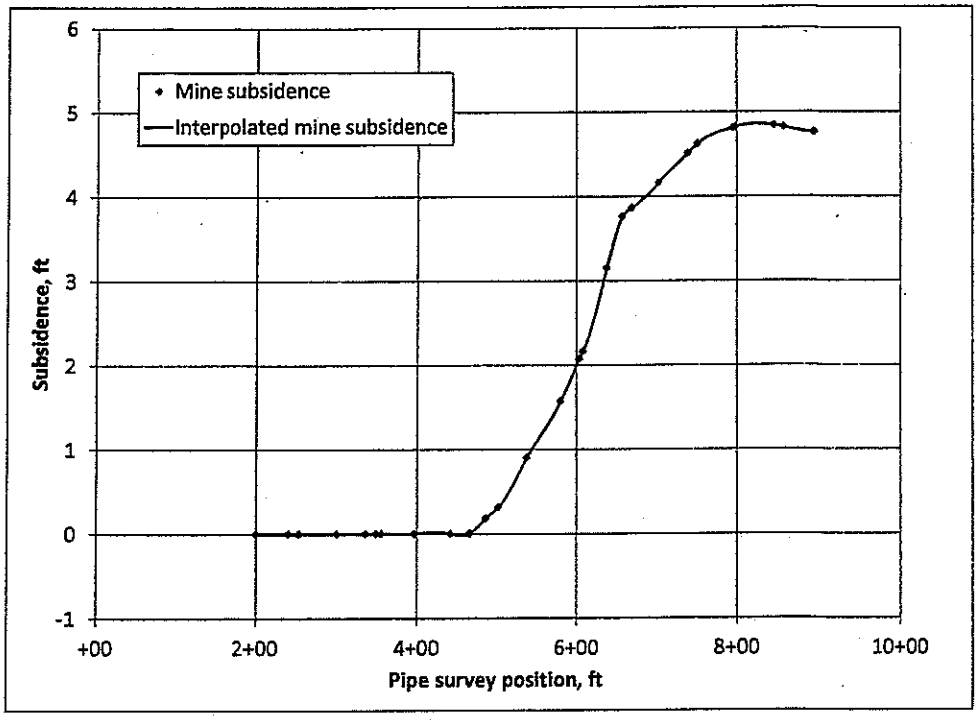


Figure 1. Profile of the mine subsidence at the western edge of longwall Panel 3 used to calculate subsidence stress

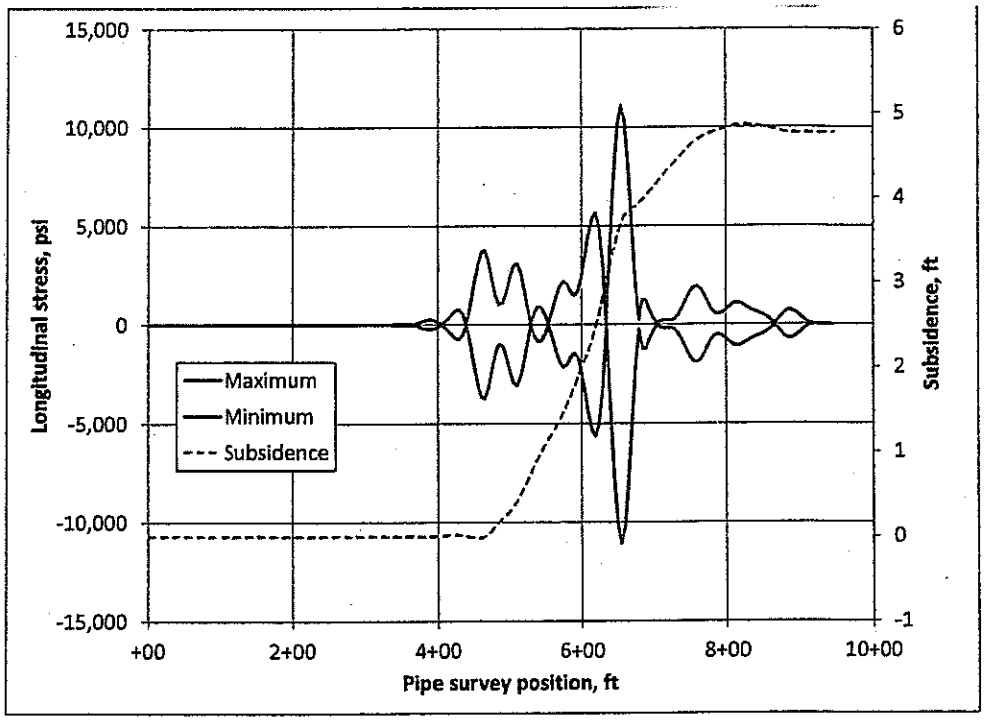


Figure 2. Bending stress calculated from the subsidence profile shown in Figure 1

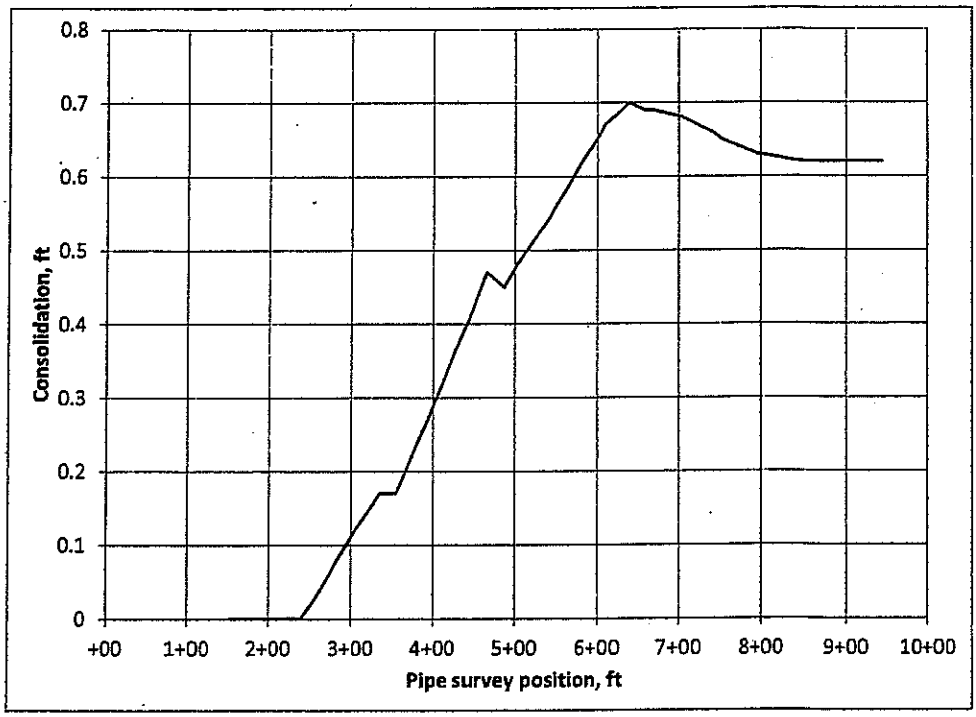
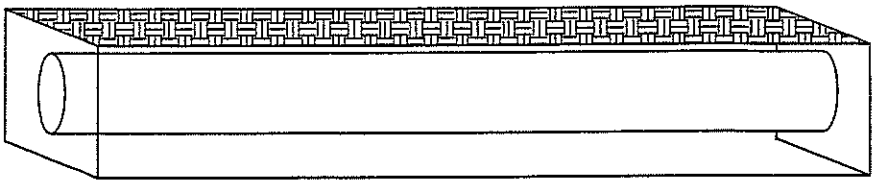
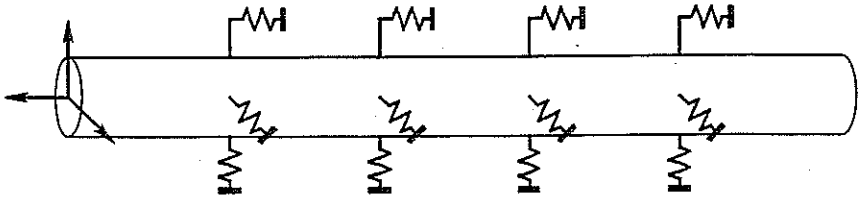


Figure 3. Consolidation profile under west side of refuse facility



a) Actual 3-Dimensional Soil Restraint on Pipeline



b) Idealized Restraint of Soil with Discrete Springs

Figure 4. Idealized soil spring model used to analyze buried pipe-soil interaction

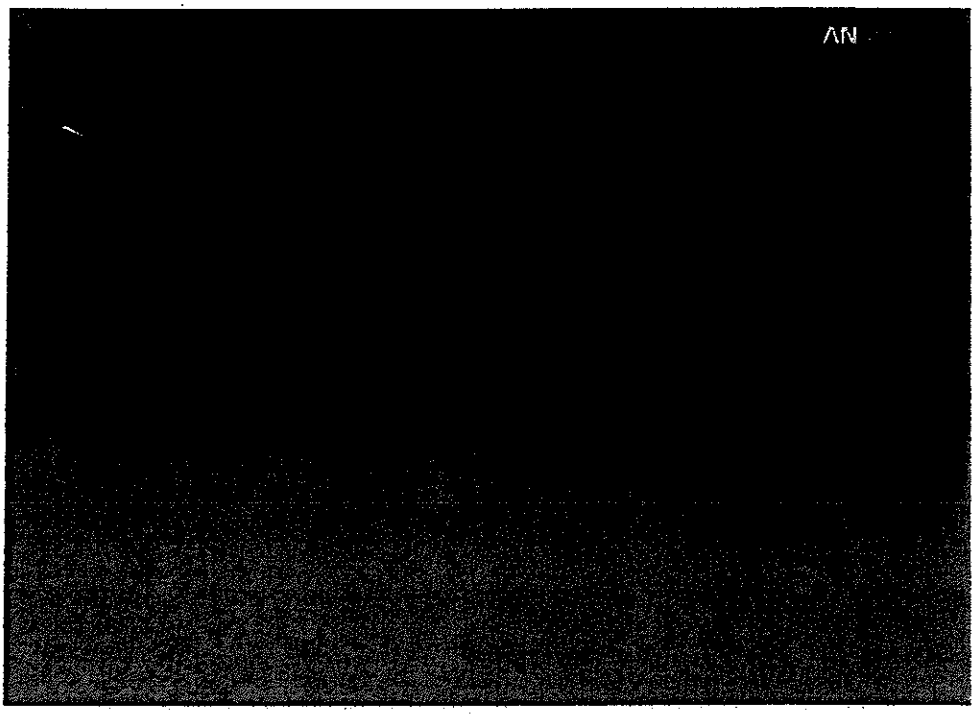


Figure 5a. FEA model used for consolidation stress analysis

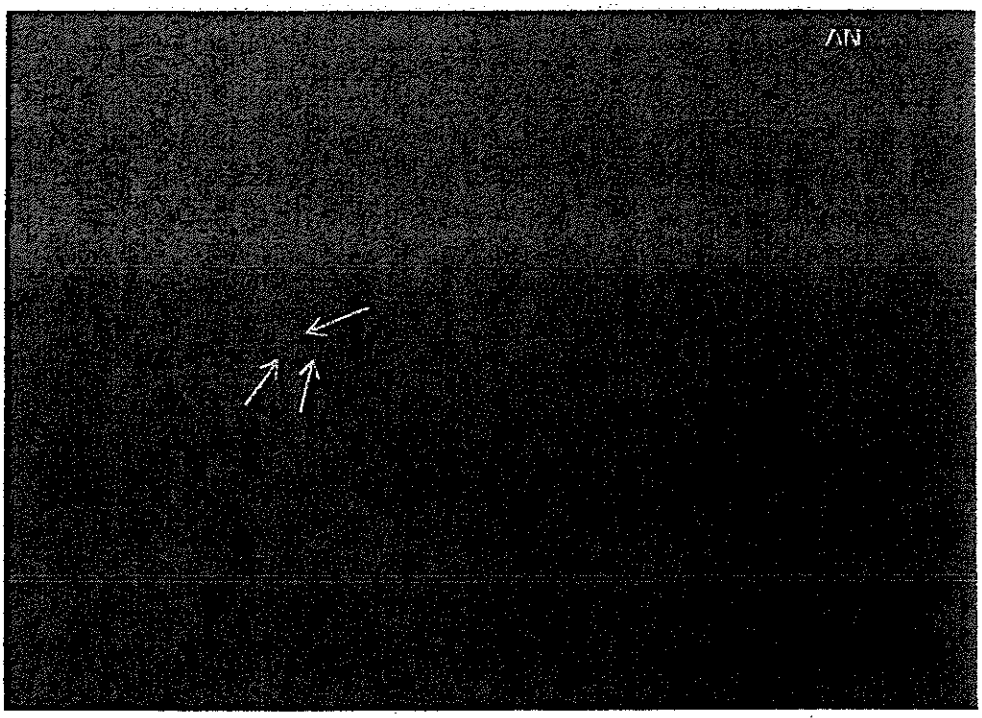


Figure 5b. Close-up view of soil springs in FEA model for consolidation stress analysis (arrows show soil springs)

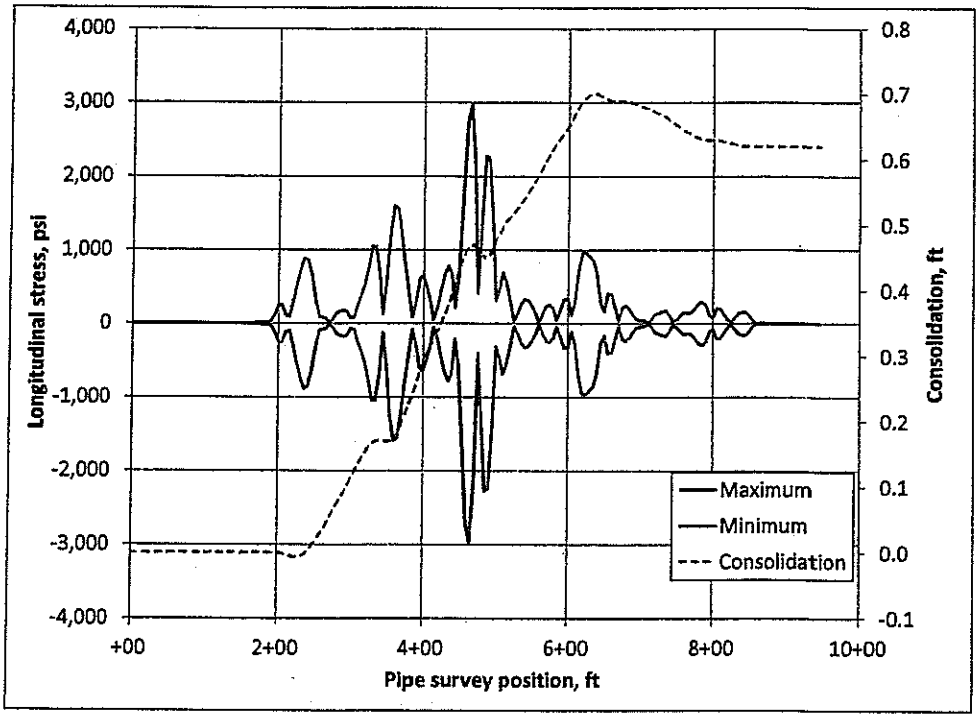


Figure 6. Consolidation stresses on 8-inch pipe

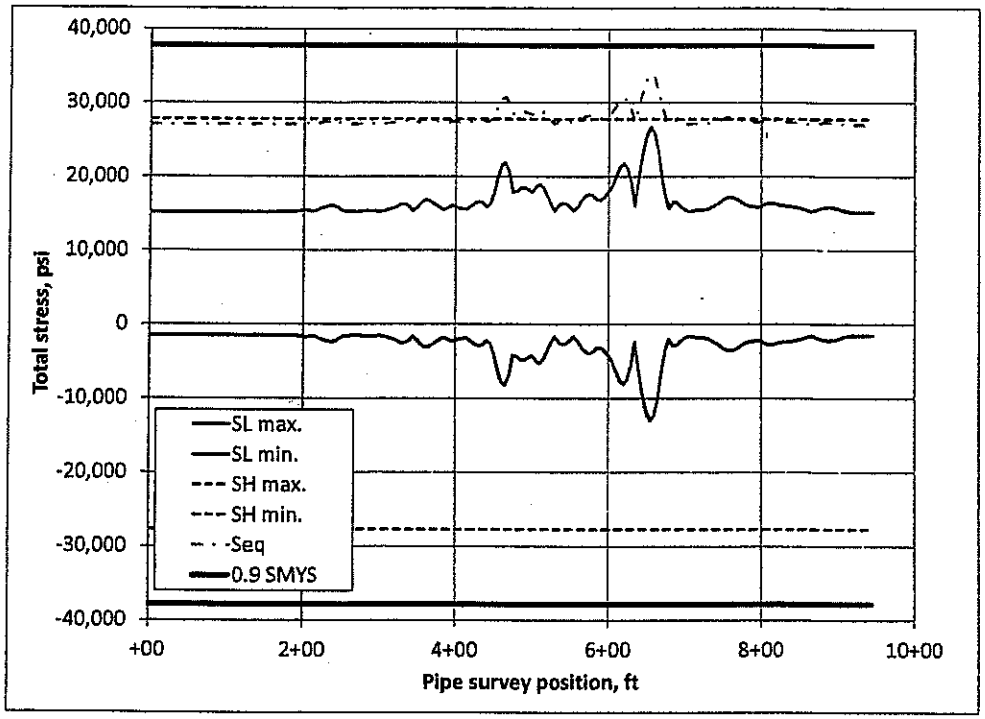


Figure 7a. Total longitudinal, hoop and combined stresses at 0 psig

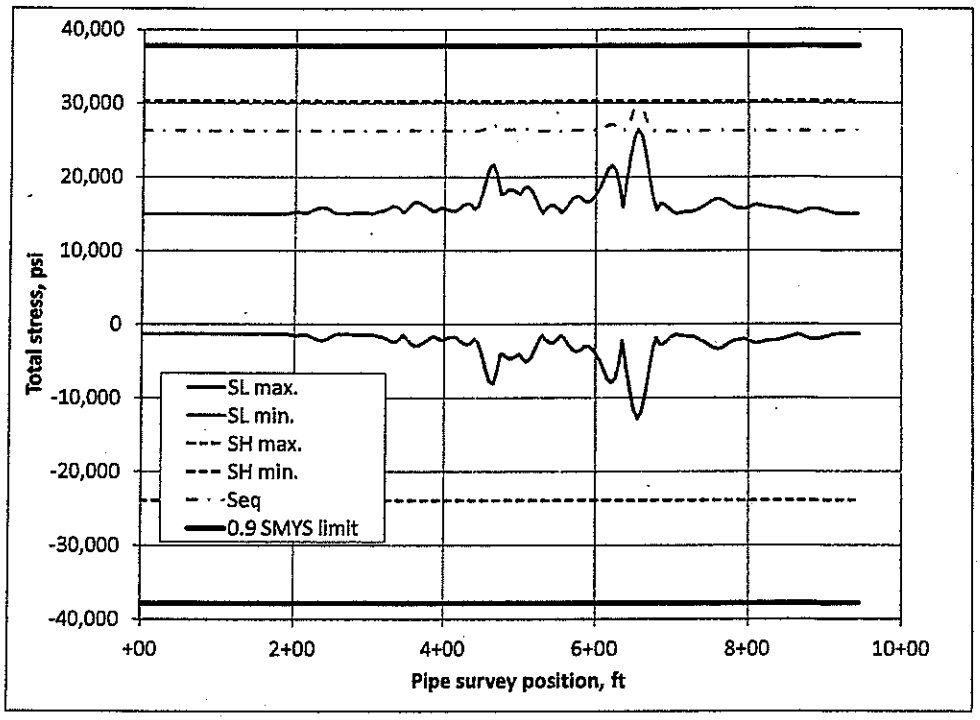


Figure 7b. Total longitudinal, hoop and combined stresses at 300 psig -

OPERATIONS, MAINTENANCE & EMERGENCY PROCEDURES MANUAL

8" NATURAL GAS TRANSMISSION & GATHERING PIPELINE

For

Keyrock Energy LLC

January 26, 2012

Prepared By:

Utility Safety & Design, Inc.
1927 Miller Drive
Olney, IL 62450
(618) 392-5502

5.2 CORROSION CONTROL SYSTEM DESCRIPTION

EXTERNAL COATING FOR BURIED PIPING

All steel pipe used had a fusion bonded epoxy coating (12-14 mil). All roadway bore pipe had an additional Lilly 2040 coating. Refer to as built drawings ICBM-LN-001 through 012 for additional information.

INTERNAL COATING FOR GATHERING PIPELINE

Provision is also made to inject corrosion inhibitors provided by Baker- Petrolite at each field compressor station into the main gathering lines to control internal corrosion. The recommended program is included at the end of this section.

The 8-inch steel line is internally coated with an epoxy 9-12 mil thick to further control internal corrosion. The epoxy is Plastite 7159XV coating installed by In Situ Pipeline Services, Inc.

Because poly pipe is corrosion resistant no additional corrosion control material has been added to these gathering lines.

CATHODIC PROTECTION ANODES

The buried piping is cathodically protected by a sacrificial anode system. High potential sacrificial magnesium anodes were installed during construction of the pipeline. The system consists of nine sacrificial anode ground beds. Each bed contains six-32 pound magnesium anodes located by design from a soils resistively survey along the main gathering line.

ELECTRICAL ISOLATION

The pipeline is electrically isolated from above ground connections by the installation of flange type insulation kits. The field compressors are insulated from the mainline to provide protection to buried piping at the compressor station. Insulating flanges are provided at the pipeline outlet facilities to electrically isolate the gathering line from the plant facilities.

TEST STATIONS

Test stations used to test and monitor the cathodic protection and electrical isolation were installed on the system. A total of 2 test stations are utilized on the transmission (sales) pipeline. A total of 36 test stations are utilized on the gathering pipeline.

EXTERNAL COATING FOR ABOVE GROUND PIPING

All above ground piping is externally coated with a paint system to protect against atmospheric corrosion. Above ground piping shall be primed and painted.

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
93 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

December 11, 2009

Williamson Energy
PO Box 1829
Marion, Illinois 62959

Attention: Mr. James Plumley

Re: Shelby Tube Soil Samples - Pipeline Relocation Project
Mach Mine
Williamson County, Illinois
HFE File H-08265
Williamson Energy PO #14173

Dear Sir:

On November 13, 2009, we sampled the subsoils adjacent to the existing pipeline at Mach Mine near Johnston City, Illinois. Five Shelby tubes were taken at locations as indicated on the enclosed Triaxial Shear Test Report forms. The soil samples were extruded from the Shelby tubes and subjected to consolidated-undrained triaxial tests. Results of the tests are attached. The Triaxial Test Report forms are enclosed.

If you should have any questions, please feel free to contact us at your convenience.

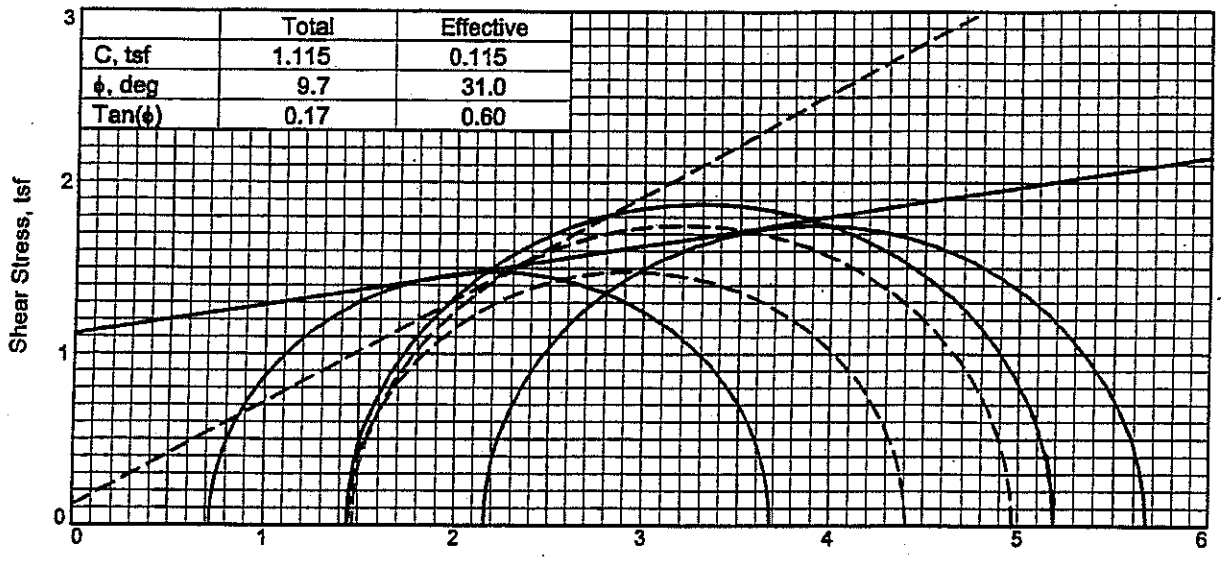
Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

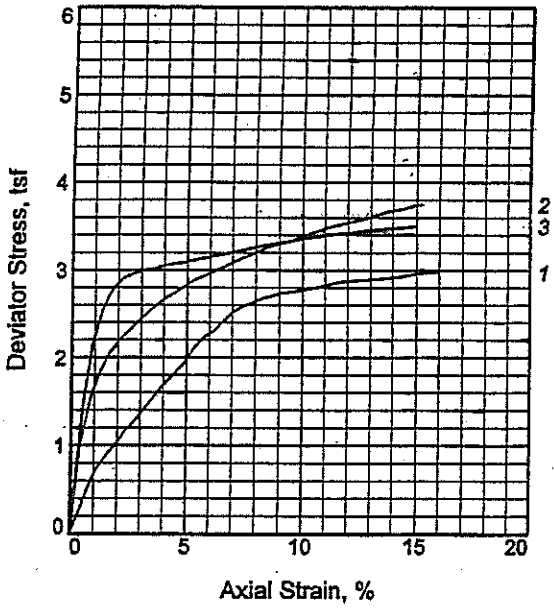
Timothy J. Holcomb, P.E.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY J.
HOLCOMB
062-042149
Exp 11-30-11
ILLINOIS

	Total	Effective
C, tsf	1.115	0.115
ϕ, deg	9.7	31.0
Tan(ϕ)	0.17	0.60



Total Normal Stress, tsf ———
Effective Normal Stress, tsf — — —



Sample No.		1	2	3
Initial	Water Content,	19.5	15.8	16.8
	Dry Density, pcf	107.9	111.8	109.6
	Saturation,	97.0	87.5	87.6
	Void Ratio	0.5333	0.4799	0.5095
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.82	4.95	4.66
At Test	Water Content,	20.1	18.1	19.2
	Dry Density, pcf	107.9	111.8	109.6
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5333	0.4799	0.5095
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.82	4.95	4.66
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		2.96	3.75	3.50
Total Pore Pr., tsf		2.87	3.60	4.29
Ult. Stress, tsf		2.96	3.75	3.50
Total Pore Pr., tsf		2.87	3.60	4.29
$\bar{\sigma}_1$ Failure, tsf		4.41	5.19	4.97
$\bar{\sigma}_3$ Failure, tsf		1.45	1.44	1.47

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Silty CLAY w/ sand

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426979.808 E 360391.353
Ground Elev: 469.13

Plate _____

Client: Mach Mine

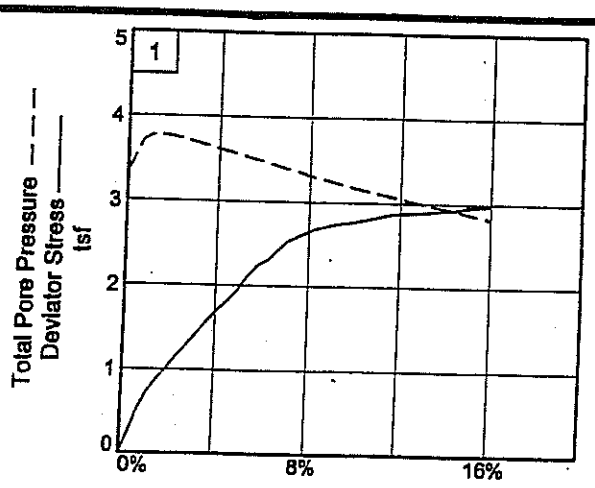
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #1

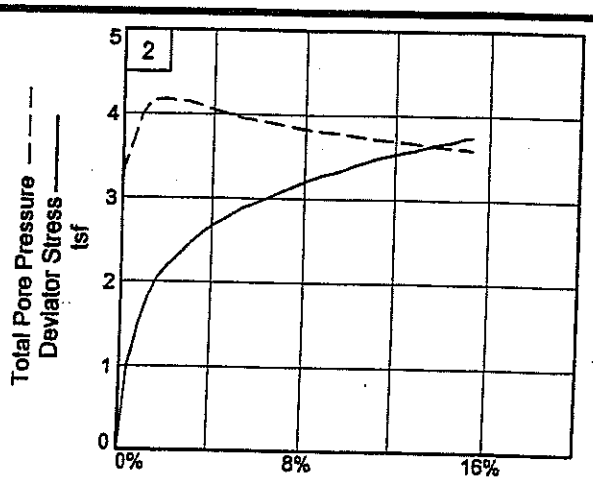
Proj. No.: H-08265 **Date:**

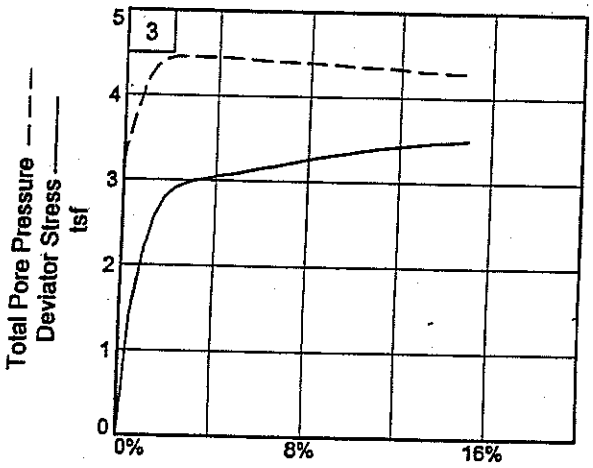
TRIAXIAL SHEAR TEST REPORT

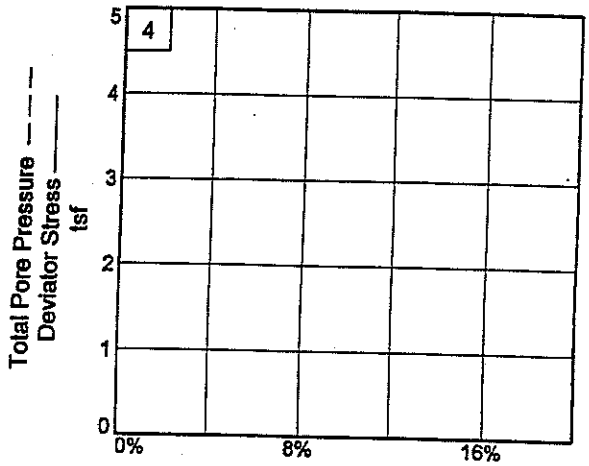
HOLCOMB FOUNDATION ENGINEERING CO.

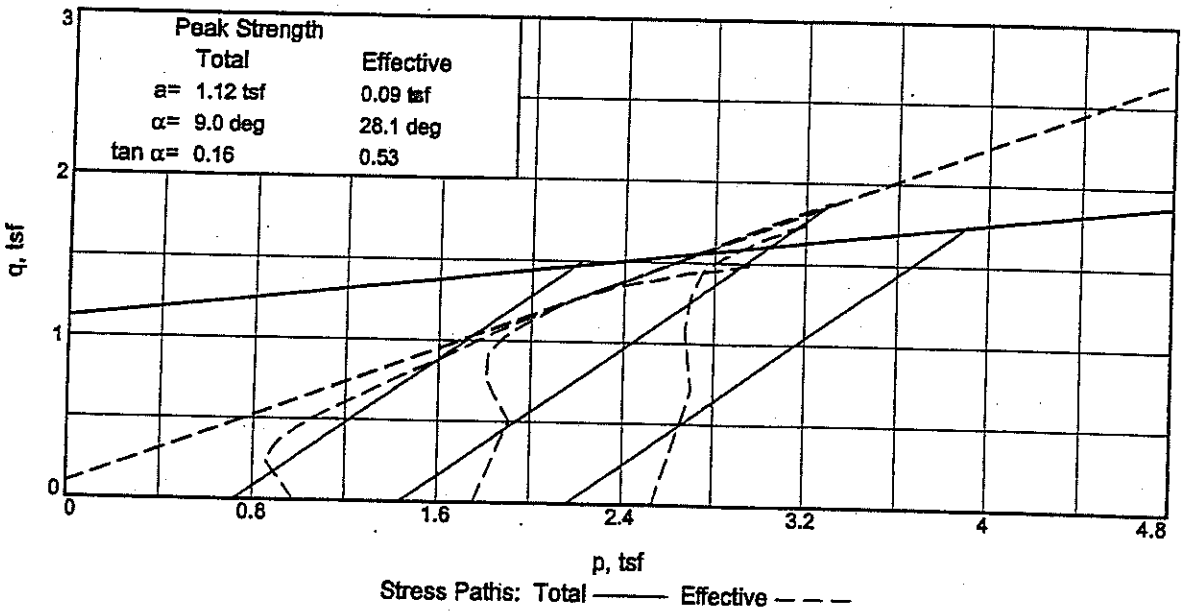
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #1
Project No.: H-08265 **Plate** _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:27 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #1
Description: Brown Silty CLAY w/ sand
Remarks:
Location: N 426979.808 E 360391.363
Ground Elev: 469.13
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	215.200			1098.100
Moisture content: Dry soil+tare, gms.	202.100			935.000
Moisture content: Tare, gms.	135.000			104.200
Moisture, %	19.5	20.1	20.1	19.6
Moist specimen weight, gms.	1003.6			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	4.82	4.82	4.82	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	129.0	129.6	129.6	
Dry density, pcf	107.9	107.9	107.9	
Void ratio	0.5333	0.5333	0.5333	
Saturation, %	97.0	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.960 tsf **at reading no.** 27
Ult. Stress = 2.960 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	22.50	0.0	0.0	0.000	0.979	0.979	1.00	46.40	0.979	0.000
1	0.0330	64.10	41.6	0.7	0.483	0.612	1.095	1.79	51.50	0.854	0.242
2	0.0530	84.90	62.4	1.1	0.722	0.547	1.269	2.32	52.40	0.908	0.361
3	0.0740	99.00	76.5	1.5	0.881	0.547	1.428	2.61	52.40	0.988	0.440
4	0.0940	110.70	88.2	1.9	1.011	0.554	1.566	2.82	52.30	1.060	0.506
5	0.1150	124.80	102.3	2.4	1.168	0.583	1.751	3.00	51.90	1.167	0.584
6	0.1350	135.70	113.2	2.8	1.287	0.612	1.899	3.10	51.50	1.255	0.643
7	0.1560	149.80	127.3	3.2	1.441	0.641	2.081	3.25	51.10	1.361	0.720
8	0.1760	162.30	139.8	3.6	1.575	0.670	2.245	3.35	50.70	1.457	0.788
9	0.1960	173.90	151.4	4.0	1.699	0.706	2.404	3.41	50.20	1.555	0.849
10	0.2170	185.60	163.1	4.5	1.822	0.734	2.556	3.48	49.80	1.645	0.911
11	0.2370	197.20	174.7	4.9	1.943	0.763	2.706	3.55	49.40	1.735	0.971
12	0.2580	213.70	191.2	5.3	2.116	0.799	2.916	3.65	48.90	1.857	1.058
13	0.2780	225.20	202.7	5.8	2.234	0.828	3.062	3.70	48.50	1.945	1.117
14	0.2990	232.20	209.7	6.2	2.300	0.864	3.164	3.66	48.00	2.014	1.150
15	0.3190	243.80	221.3	6.6	2.417	0.900	3.317	3.69	47.50	2.108	1.208
16	0.3400	254.30	231.8	7.0	2.520	0.929	3.448	3.71	47.10	2.189	1.260
17	0.3600	261.20	238.7	7.5	2.583	0.958	3.541	3.70	46.70	2.249	1.292
18	0.3800	266.70	244.2	7.9	2.631	0.994	3.624	3.65	46.20	2.309	1.315
19	0.4010	272.50	250.0	8.3	2.680	1.022	3.703	3.62	45.80	2.363	1.340
20	0.4420	280.30	257.8	9.2	2.738	1.087	3.826	3.52	44.90	2.456	1.369
21	0.4830	285.40	262.9	10.0	2.766	1.145	3.911	3.42	44.10	2.528	1.383
22	0.5240	292.80	270.3	10.9	2.817	1.195	4.013	3.36	43.40	2.604	1.409
23	0.5640	300.10	277.6	11.7	2.866	1.246	4.112	3.30	42.70	2.679	1.433
24	0.6050	304.50	282.0	12.5	2.884	1.296	4.180	3.23	42.00	2.738	1.442
25	0.6460	308.70	286.2	13.4	2.898	1.346	4.245	3.15	41.30	2.796	1.449
26	0.6870	313.60	291.1	14.2	2.919	1.390	4.308	3.10	40.70	2.849	1.459
27	0.7280	320.70	298.2	15.1	2.960	1.447	4.408	3.05	39.90	2.927	1.480
28	0.7690	325.50	303.0	16.0	2.978	1.505	4.483	2.98	39.10	2.994	1.489

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	238.700			1158.600
Moisture content: Dry soil+tare, gms.	224.500			992.700
Moisture content: Tare, gms.	134.900			102.600
Moisture, %	15.8	18.1	18.1	18.6
Moist specimen weight, gms.	1035.9			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.95	4.95	4.95	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	129.5	132.0	132.0	
Dry density, pcf	111.8	111.8	111.8	
Void ratio	0.4799	0.4799	0.4799	
Saturation, %	87.5	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.752 tsf **at reading no.** 27
Ult. Stress = 3.752 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	1.757	1.757	1.00	45.60	1.757	0.000
1	0.0190	111.50	86.5	0.4	1.008	1.404	2.412	1.72	50.50	1.908	0.504
2	0.0400	155.60	130.6	0.8	1.515	1.051	2.566	2.44	55.40	1.809	0.757
3	0.0600	183.10	158.1	1.2	1.826	0.900	2.726	3.03	57.50	1.813	0.913
4	0.0810	203.10	178.1	1.6	2.048	0.864	2.912	3.37	58.00	1.888	1.024
5	0.1010	216.40	191.4	2.0	2.192	0.864	3.056	3.54	58.00	1.960	1.096
6	0.1220	226.40	201.4	2.5	2.297	0.886	3.183	3.59	57.70	2.034	1.148
7	0.1420	237.20	212.2	2.9	2.410	0.893	3.303	3.70	57.60	2.098	1.205
8	0.1620	247.20	222.2	3.3	2.513	0.922	3.435	3.73	57.20	2.178	1.257
9	0.1830	256.30	231.3	3.7	2.605	0.958	3.562	3.72	56.70	2.260	1.302
10	0.2030	264.60	239.6	4.1	2.687	0.994	3.680	3.70	56.20	2.337	1.343
11	0.2240	271.30	246.3	4.5	2.750	1.022	3.772	3.69	55.80	2.397	1.375
12	0.2440	278.80	253.8	4.9	2.821	1.058	3.880	3.67	55.30	2.469	1.411
13	0.2650	286.30	261.3	5.4	2.892	1.087	3.979	3.66	54.90	2.533	1.446
14	0.2850	291.30	266.3	5.8	2.935	1.102	4.036	3.66	54.70	2.569	1.467
15	0.3060	297.10	272.1	6.2	2.985	1.123	4.108	3.66	54.40	2.616	1.492
16	0.3460	308.80	283.8	7.0	3.086	1.159	4.246	3.66	53.90	2.702	1.543
17	0.3870	320.40	295.4	7.8	3.184	1.202	4.386	3.65	53.30	2.794	1.592
18	0.4280	331.20	306.2	8.6	3.271	1.231	4.502	3.66	52.90	2.867	1.635
19	0.4690	339.50	314.5	9.5	3.329	1.253	4.582	3.66	52.60	2.917	1.664
20	0.5100	350.40	325.4	10.3	3.413	1.289	4.702	3.65	52.10	2.995	1.706
21	0.5510	360.40	335.4	11.1	3.485	1.318	4.803	3.65	51.70	3.060	1.743

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	368.70	343.7	12.0	3.538	1.339	4.877	3.64	51.40	3.108	1.769
23	0.6330	377.00	352.0	12.8	3.589	1.361	4.950	3.64	51.10	3.156	1.795
24	0.6730	387.00	362.0	13.6	3.657	1.390	5.047	3.63	50.70	3.218	1.829
25	0.7140	394.50	369.5	14.4	3.697	1.418	5.116	3.61	50.30	3.267	1.849
26	0.7350	400.30	375.3	14.9	3.737	1.426	5.162	3.62	50.20	3.294	1.868
27	0.7550	403.60	378.6	15.3	3.752	1.440	5.192	3.61	50.00	3.316	1.876

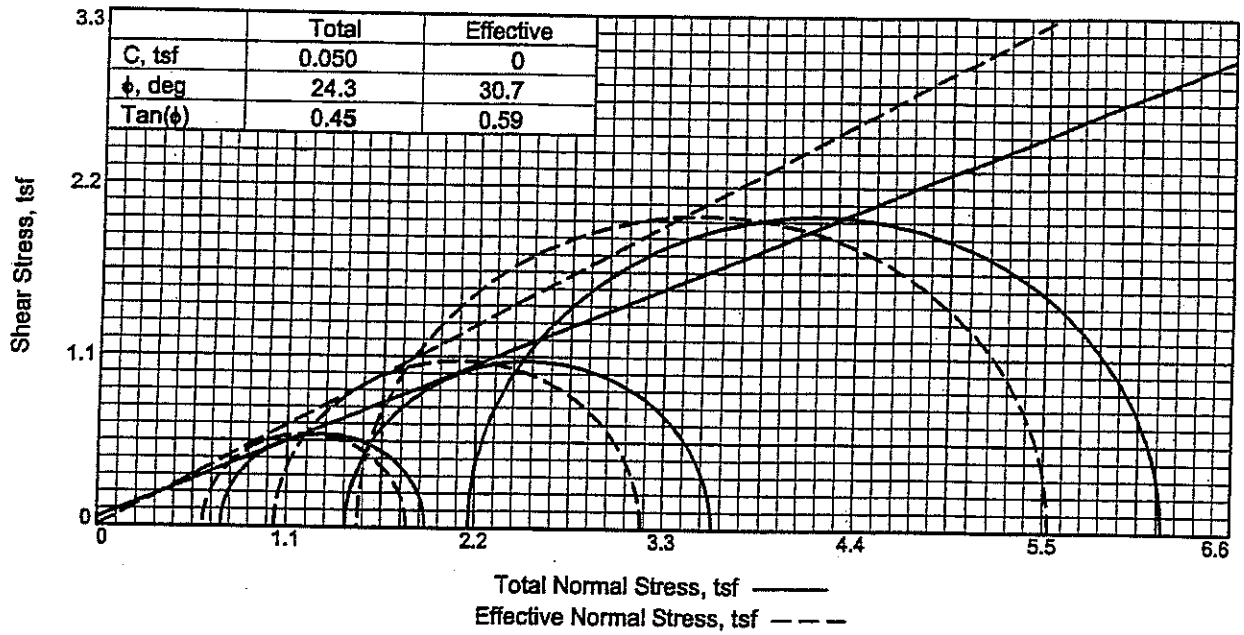
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	195.800			1096.200
Moisture content: Dry soil+tare, gms.	187.800			933.200
Moisture content: Tare, gms.	140.300			115.600
Moisture, %	16.8	19.2	19.2	19.9
Moist specimen weight, gms.	963.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.66	4.66	4.66	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.1	130.7	130.7	
Dry density, pcf	109.6	109.6	109.6	
Void ratio	0.5095	0.5095	0.5095	
Saturation, %	87.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.502 tsf **at reading no.** 25
Ult. Stress = 3.502 tsf **at reading no.** 25

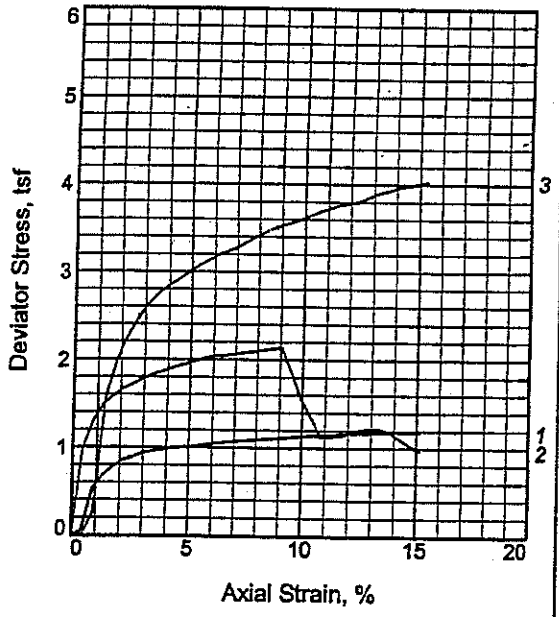
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	29.10	0.0	0.0	0.000	2.534	2.534	1.00	44.80	2.534	0.000
1	0.0230	151.50	122.4	0.5	1.424	1.987	3.412	1.72	52.40	2.699	0.712
2	0.0430	214.70	185.6	0.9	2.151	1.591	3.742	2.35	57.90	2.667	1.075
3	0.0640	251.30	222.2	1.4	2.563	1.411	3.974	2.82	60.40	2.693	1.282
4	0.0840	272.10	243.0	1.8	2.791	1.332	4.123	3.10	61.50	2.727	1.395
5	0.1040	283.00	253.9	2.2	2.903	1.303	4.206	3.23	61.90	2.755	1.452
6	0.1250	288.80	259.7	2.7	2.956	1.303	4.259	3.27	61.90	2.781	1.478
7	0.1450	293.80	264.7	3.1	2.999	1.303	4.303	3.30	61.90	2.803	1.500
8	0.1660	296.30	267.2	3.5	3.014	1.310	4.324	3.30	61.80	2.817	1.507
9	0.1860	300.40	271.3	4.0	3.046	1.310	4.357	3.32	61.80	2.834	1.523
10	0.2070	303.80	274.7	4.4	3.070	1.310	4.380	3.34	61.80	2.845	1.535
11	0.2270	306.30	277.2	4.9	3.084	1.318	4.402	3.34	61.70	2.860	1.542

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
12	0.2480	310.40	281.3	5.3	3.115	1.325	4.440	3.35	61.60	2.882	1.557
13	0.2680	313.70	284.6	5.7	3.137	1.332	4.469	3.36	61.50	2.900	1.568
14	0.2880	317.10	288.0	6.2	3.160	1.339	4.499	3.36	61.40	2.919	1.580
15	0.3090	320.40	291.3	6.6	3.181	1.346	4.527	3.36	61.30	2.937	1.590
16	0.3500	327.90	298.8	7.5	3.232	1.354	4.586	3.39	61.20	2.970	1.616
17	0.3910	335.40	306.3	8.4	3.282	1.368	4.650	3.40	61.00	3.009	1.641
18	0.4320	342.00	312.9	9.3	3.320	1.382	4.702	3.40	60.80	3.042	1.660
19	0.4720	348.70	319.6	10.1	3.359	1.404	4.763	3.39	60.50	3.083	1.679
20	0.5130	355.40	326.3	11.0	3.396	1.411	4.807	3.41	60.40	3.109	1.698
21	0.5540	361.20	332.1	11.9	3.422	1.418	4.840	3.41	60.30	3.129	1.711
22	0.5950	367.00	337.9	12.8	3.447	1.447	4.894	3.38	59.90	3.171	1.723
23	0.6360	372.80	343.7	13.6	3.471	1.454	4.925	3.39	59.80	3.190	1.735
24	0.6770	377.80	348.7	14.5	3.485	1.469	4.954	3.37	59.60	3.211	1.743
25	0.6970	381.20	352.1	15.0	3.502	1.469	4.970	3.38	59.60	3.220	1.751

R10440



	Total	Effective
C, tsf	0.050	0
ϕ, deg	24.3	30.7
Tan(ϕ)	0.45	0.59



Sample No.		1	2	3
Initial	Water Content,	22.3	21.7	19.3
	Dry Density, pcf	105.1	107.5	112.9
	Saturation,	102.8	106.4	109.9
	Void Ratio	0.5747	0.5392	0.4659
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.85	4.72	4.67
At Test	Water Content,	21.7	20.3	17.6
	Dry Density, pcf	105.1	107.5	112.9
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5747	0.5392	0.4659
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.85	4.72	4.67
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.18	2.14	4.03
Total Pore Pr., tsf		3.71	4.01	4.26
Ult. Stress, tsf		1.18	0.97	4.03
Total Pore Pr., tsf		3.71	4.58	4.26
$\bar{\sigma}_1$ Failure, tsf		1.80	3.17	5.53
$\bar{\sigma}_3$ Failure, tsf		0.61	1.03	1.50

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Silty CLAY w/ sand

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426915.196 E 362865.063
Ground Elev. 470.51

Plate _____

Client: Mach Mine

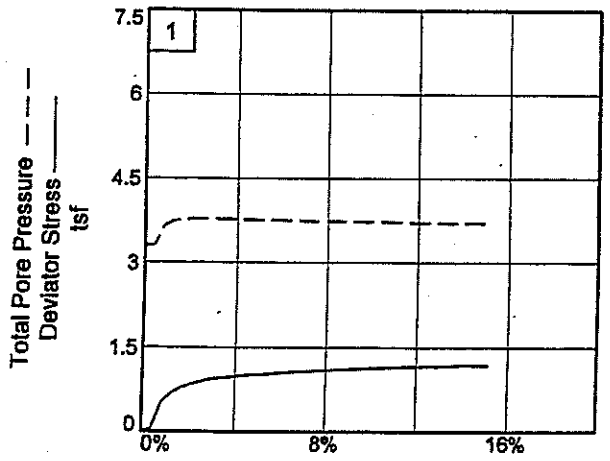
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #2

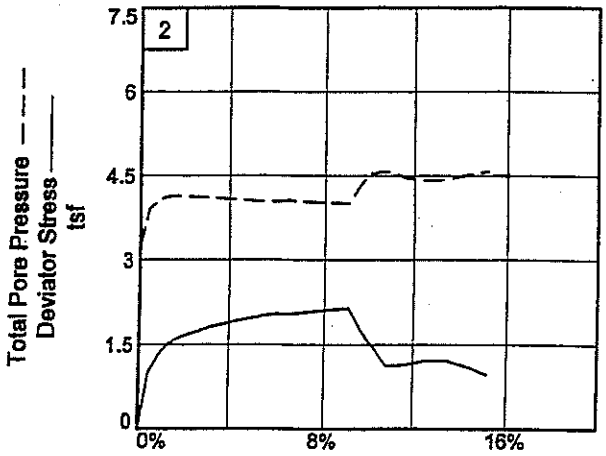
Proj. No.: H-08265 **Date:**

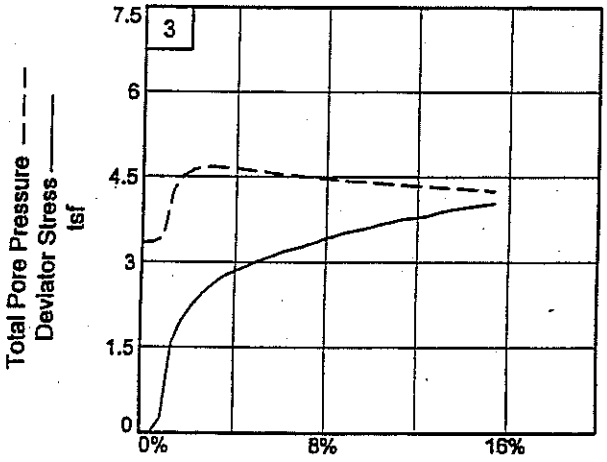
TRIAXIAL SHEAR TEST REPORT

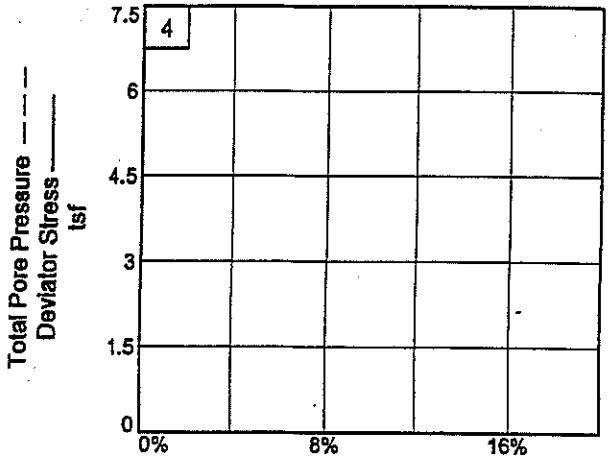
HOLCOMB FOUNDATION ENGINEERING CO.

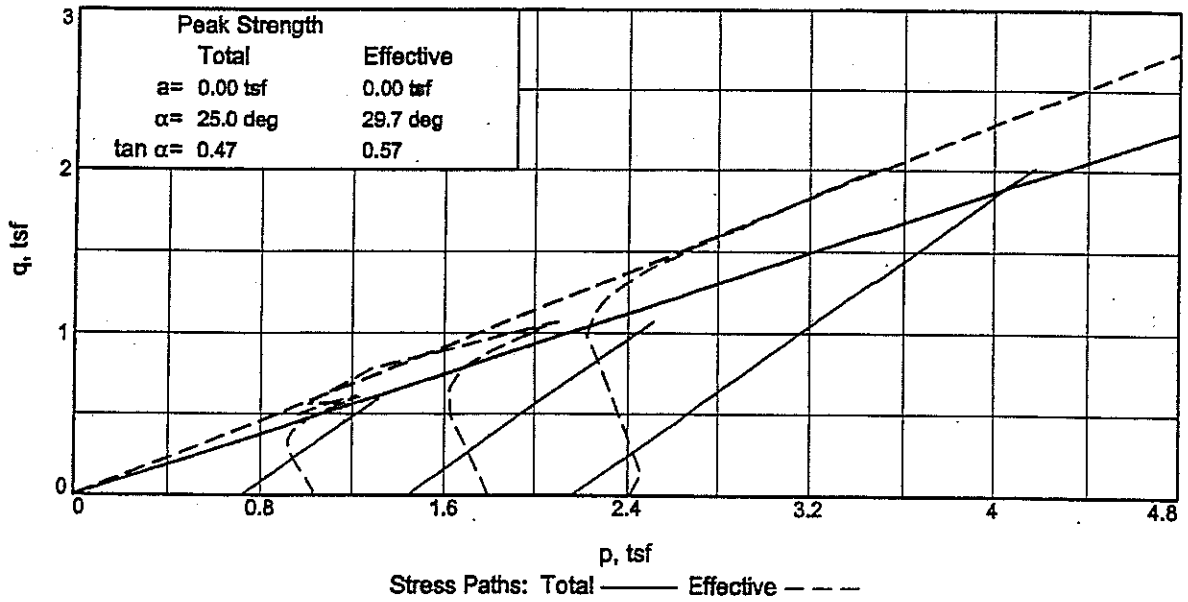
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #2
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

12/11/2009
11:31 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #2
Description: Brown Silty CLAY w/ sand
Remarks:
N 426915.196 E362865.063
Ground Elev. 470.51
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	174.500			1130.900
Moisture content: Dry soil+tare, gms.	154.600			962.700
Moisture content: Tare, gms.	65.300			140.100
Moisture, %	22.3	21.7	21.7	20.4
Moist specimen weight, gms.	1007.9			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	4.85	4.85	4.85	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.5	127.8	127.8	
Dry density, pcf	105.1	105.1	105.1	
Void ratio	0.5747	0.5747	0.5747	
Saturation, %	102.8	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.185 tsf **at reading no.** 25
Ult. Stress = 1.181 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	24.10	0.0	0.0	0.000	1.030	1.030	1.00	45.70	1.030	0.000
1	0.0190	29.10	5.0	0.4	0.052	1.008	1.060	1.05	46.00	1.034	0.026
2	0.0400	69.10	45.0	0.8	0.522	0.670	1.191	1.78	50.70	0.931	0.261
3	0.0600	82.40	58.3	1.2	0.673	0.583	1.256	2.15	51.90	0.920	0.337
4	0.0810	91.50	67.4	1.7	0.775	0.554	1.329	2.40	52.30	0.942	0.387
5	0.1010	97.40	73.3	2.1	0.839	0.547	1.386	2.53	52.40	0.967	0.420
6	0.1220	101.50	77.4	2.5	0.882	0.547	1.429	2.61	52.40	0.988	0.441
7	0.1420	105.70	81.6	2.9	0.926	0.540	1.466	2.72	52.50	1.003	0.463
8	0.1620	108.20	84.1	3.3	0.951	0.547	1.498	2.74	52.40	1.022	0.475
9	0.1830	109.90	85.8	3.8	0.965	0.547	1.513	2.76	52.40	1.030	0.483
10	0.2030	112.40	88.3	4.2	0.989	0.554	1.544	2.78	52.30	1.049	0.495
11	0.2240	114.00	89.9	4.6	1.003	0.554	1.557	2.81	52.30	1.056	0.501
12	0.2440	114.80	90.7	5.0	1.007	0.562	1.569	2.79	52.20	1.065	0.504
13	0.2650	116.50	92.4	5.5	1.021	0.562	1.583	2.82	52.20	1.072	0.511
14	0.2850	118.20	94.1	5.9	1.036	0.562	1.597	2.84	52.20	1.079	0.518
15	0.3060	119.80	95.7	6.3	1.048	0.569	1.617	2.84	52.10	1.093	0.524
16	0.3260	121.50	97.4	6.7	1.062	0.576	1.638	2.84	52.00	1.107	0.531
17	0.3670	124.00	99.9	7.6	1.080	0.583	1.663	2.85	51.90	1.123	0.540
18	0.4080	126.50	102.4	8.4	1.097	0.583	1.680	2.88	51.90	1.132	0.548
19	0.4490	129.00	104.9	9.3	1.113	0.590	1.704	2.89	51.80	1.147	0.557
20	0.4890	131.50	107.4	10.1	1.129	0.598	1.727	2.89	51.70	1.162	0.565
21	0.5300	134.00	109.9	10.9	1.145	0.598	1.742	2.92	51.70	1.170	0.572
22	0.5710	136.50	112.4	11.8	1.160	0.605	1.764	2.92	51.60	1.185	0.580
23	0.6120	138.10	114.0	12.6	1.165	0.605	1.770	2.93	51.60	1.187	0.582
24	0.6530	139.80	115.7	13.5	1.171	0.612	1.783	2.91	51.50	1.197	0.585
25	0.6940	142.30	118.2	14.3	1.185	0.612	1.797	2.94	51.50	1.204	0.592
26	0.7140	142.30	118.2	14.7	1.179	0.612	1.791	2.93	51.50	1.201	0.589
27	0.7350	143.10	119.0	15.1	1.181	0.612	1.793	2.93	51.50	1.202	0.590

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	164.100			1116.300
Moisture content: Dry soil+tare, gms.	145.000			945.500
Moisture content: Tare, gms.	56.800			119.600
Moisture, %	21.7	20.3	20.3	20.7
Moist specimen weight, gms.	997.1			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.72	4.72	4.72	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.8	129.3	129.3	
Dry density, pcf	107.5	107.5	107.5	
Void ratio	0.5392	0.5392	0.5392	
Saturation, %	106.4	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.141 tsf at reading no. 18
Ult. Stress = 0.967 tsf at reading no. 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	39.10	0.0	0.0	0.000	1.800	1.800	1.00	45.00	1.800	0.000
1	0.0190	123.20	84.1	0.4	0.979	1.138	2.117	1.86	54.20	1.627	0.490
2	0.0400	152.30	113.2	0.8	1.312	0.965	2.277	2.36	56.60	1.621	0.656
3	0.0600	168.90	129.8	1.3	1.498	0.914	2.413	2.64	57.30	1.664	0.749
4	0.0810	178.10	139.0	1.7	1.597	0.900	2.497	2.77	57.50	1.699	0.799
5	0.1010	184.80	145.7	2.1	1.667	0.907	2.574	2.84	57.40	1.741	0.834
6	0.1220	190.60	151.5	2.6	1.726	0.914	2.640	2.89	57.30	1.777	0.863
7	0.1420	196.40	157.3	3.0	1.784	0.922	2.706	2.94	57.20	1.814	0.892
8	0.1620	201.40	162.3	3.4	1.833	0.936	2.769	2.96	57.00	1.852	0.916
9	0.1830	205.60	166.5	3.9	1.871	0.950	2.822	2.97	56.80	1.886	0.936
10	0.2030	209.70	170.6	4.3	1.909	0.958	2.867	2.99	56.70	1.912	0.954
11	0.2240	213.90	174.8	4.7	1.947	0.972	2.919	3.00	56.50	1.945	0.973
12	0.2440	217.20	178.1	5.2	1.975	0.986	2.961	3.00	56.30	1.974	0.987
13	0.2650	221.40	182.3	5.6	2.012	0.994	3.006	3.02	56.20	2.000	1.006
14	0.2850	224.70	185.6	6.0	2.039	1.001	3.040	3.04	56.10	2.020	1.020
15	0.3060	225.50	186.4	6.5	2.038	0.979	3.017	3.08	56.40	1.998	1.019
16	0.3460	230.50	191.4	7.3	2.074	1.001	3.075	3.07	56.10	2.038	1.037
17	0.3870	235.50	196.4	8.2	2.108	1.015	3.123	3.08	55.90	2.069	1.054
18	0.4280	240.50	201.4	9.1	2.141	1.030	3.171	3.08	55.70	2.100	1.071
19	0.4690	187.30	148.2	9.9	1.561	0.504	2.065	4.10	63.00	1.284	0.780
20	0.5100	146.50	107.4	10.8	1.120	0.454	1.574	3.47	63.70	1.014	0.560
21	0.5510	149.00	109.9	11.7	1.135	0.576	1.711	2.97	62.00	1.143	0.567

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	157.30	118.2	12.5	1.209	0.626	1.835	2.93	61.30	1.231	0.604
23	0.6330	159.80	120.7	13.4	1.222	0.605	1.827	3.02	61.60	1.216	0.611
24	0.6730	149.80	110.7	14.3	1.110	0.526	1.635	3.11	62.70	1.080	0.555
25	0.7140	136.50	97.4	15.1	0.967	0.461	1.427	3.10	63.60	0.944	0.483

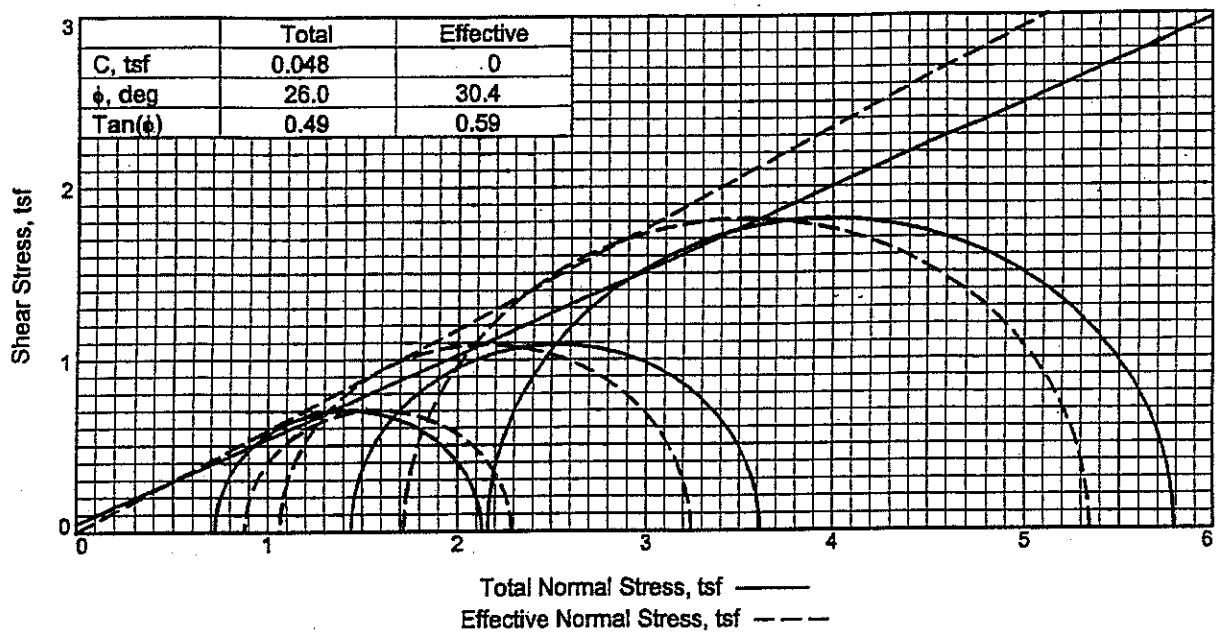
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	197.400			1113.000
Moisture content: Dry soil+tare, gms.	172.200			956.600
Moisture content: Tare, gms.	41.800			104.200
Moisture, %	19.3	17.6	17.6	18.3
Moist specimen weight, gms.	1015.4			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.67	4.67	4.67	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	134.7	132.7	132.7	
Dry density, pcf	112.9	112.9	112.9	
Void ratio	0.4659	0.4659	0.4659	
Saturation, %	109.9	100.0	100.0	

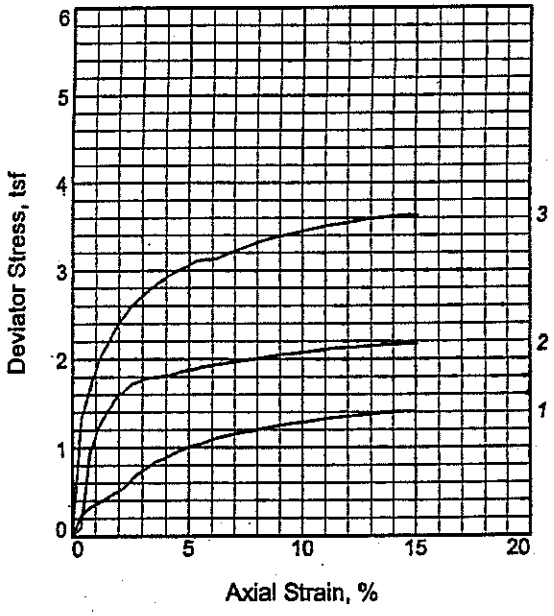
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.029 tsf **at reading no.** 25
Ult. Stress = 4.029 tsf **at reading no.** 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0190	29.10	0.0	0.0	0.000	2.412	2.412	1.00	46.50	2.412	0.000
1	0.0400	30.80	1.7	0.5	0.012	2.405	2.417	1.01	46.60	2.411	0.006
2	0.0600	53.30	24.2	0.9	0.266	2.326	2.591	1.11	47.70	2.458	0.133
3	0.0810	164.80	135.7	1.3	1.566	1.505	3.070	2.04	59.10	2.288	0.783
4	0.1010	200.60	171.5	1.8	1.970	1.238	3.209	2.59	62.80	2.223	0.985
5	0.1220	224.70	195.6	2.2	2.237	1.138	3.374	2.97	64.20	2.256	1.118
6	0.1420	243.80	214.7	2.6	2.444	1.094	3.539	3.23	64.80	2.317	1.222
7	0.1620	258.80	229.7	3.1	2.604	1.087	3.691	3.39	64.90	2.389	1.302
8	0.1830	272.10	243.0	3.5	2.742	1.094	3.836	3.51	64.80	2.465	1.371
9	0.2030	281.30	252.2	3.9	2.833	1.109	3.941	3.55	64.60	2.525	1.416
10	0.2240	288.80	259.7	4.4	2.903	1.130	4.034	3.57	64.30	2.582	1.452
11	0.2440	297.10	268.0	4.8	2.983	1.152	4.135	3.59	64.00	2.643	1.491
12	0.2650	305.40	276.3	5.3	3.060	1.166	4.227	3.62	63.80	2.697	1.530
13	0.2850	312.10	283.0	5.7	3.120	1.195	4.316	3.61	63.40	2.755	1.560

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
14	0.3060	319.60	290.5	6.2	3.188	1.210	4.397	3.64	63.20	2.804	1.594
15	0.3460	330.40	301.3	7.0	3.276	1.253	4.529	3.62	62.60	2.891	1.638
16	0.3870	345.40	316.3	7.9	3.407	1.289	4.696	3.64	62.10	2.992	1.703
17	0.4280	357.90	328.8	8.8	3.508	1.325	4.832	3.65	61.60	3.079	1.754
18	0.4690	367.80	338.7	9.6	3.578	1.346	4.925	3.66	61.30	3.136	1.789
19	0.5100	380.30	351.2	10.5	3.674	1.375	5.050	3.67	60.90	3.212	1.837
20	0.5510	392.00	362.9	11.4	3.759	1.404	5.163	3.68	60.50	3.284	1.880
21	0.5920	399.50	370.4	12.3	3.799	1.426	5.225	3.66	60.20	3.325	1.900
22	0.6330	412.80	383.7	13.2	3.896	1.447	5.343	3.69	59.90	3.395	1.948
23	0.6730	422.80	393.7	14.0	3.958	1.469	5.427	3.69	59.60	3.448	1.979
24	0.7140	431.10	402.0	14.9	4.000	1.490	5.491	3.68	59.30	3.491	2.000
25	0.7350	436.10	407.0	15.3	4.029	1.505	5.533	3.68	59.10	3.519	2.014

	Total	Effective
C, tsf	0.048	0
ϕ, deg	26.0	30.4
Tan(ϕ)	0.49	0.59





Sample No.		1	2	3
Initial	Water Content,	18.2	19.2	18.6
	Dry Density, pcf	105.3	108.0	111.2
	Saturation,	84.6	95.6	100.8
	Void Ratio	0.5714	0.5315	0.4884
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.20	5.55	4.99
At Test	Water Content,	21.6	20.1	18.4
	Dry Density, pcf	105.3	108.0	111.2
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5714	0.5315	0.4884
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.20	5.55	4.99
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.41	2.17	3.63
Total Pore Pr., tsf		3.44	3.97	4.04
Ult. Stress, tsf		1.41	2.17	3.63
Total Pore Pr., tsf		3.44	3.97	4.04
$\bar{\sigma}_1$ Failure, tsf		2.29	3.24	5.35
$\bar{\sigma}_3$ Failure, tsf		0.88	1.07	1.72

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Sandy CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426872.850 E 364429.708
Ground Elev. 476.96

Plate _____

Client: Mach Mine

Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #3

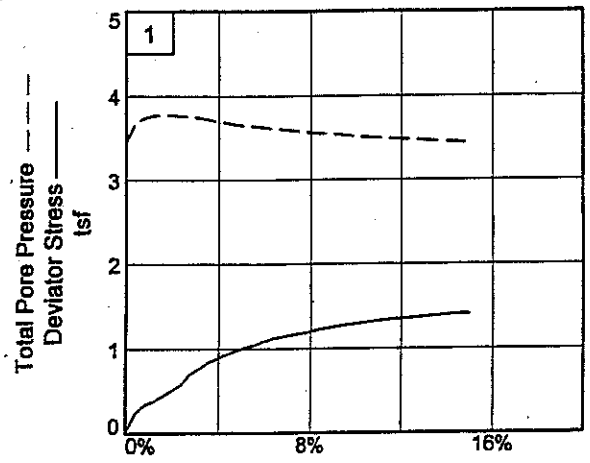
Proj. No.: H-08265 **Date:**

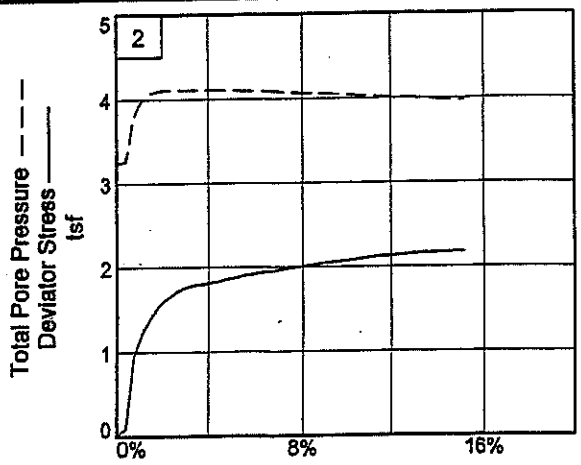
TRIAXIAL SHEAR TEST REPORT

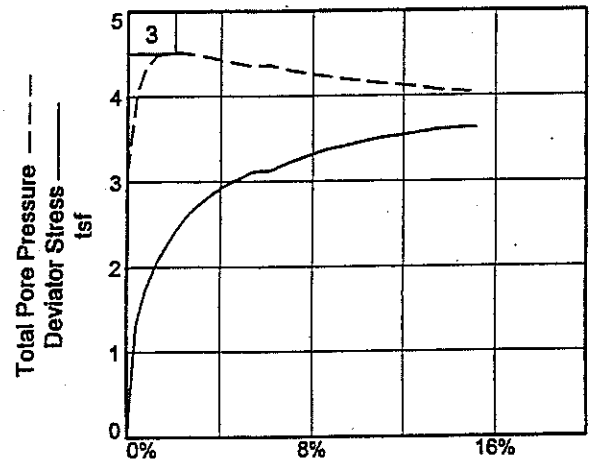
HOLCOMB FOUNDATION ENGINEERING CO.

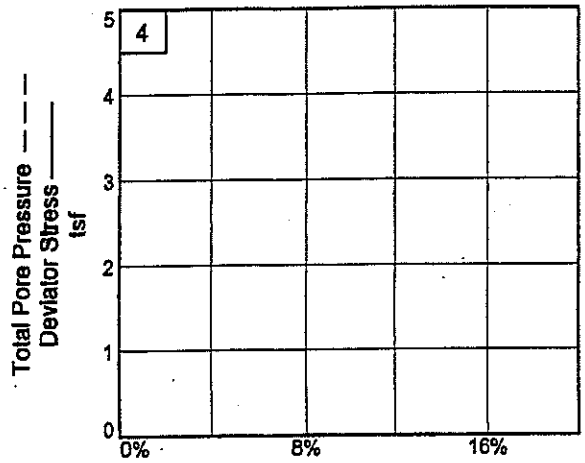
Tested By: LC **Checked By:** TH

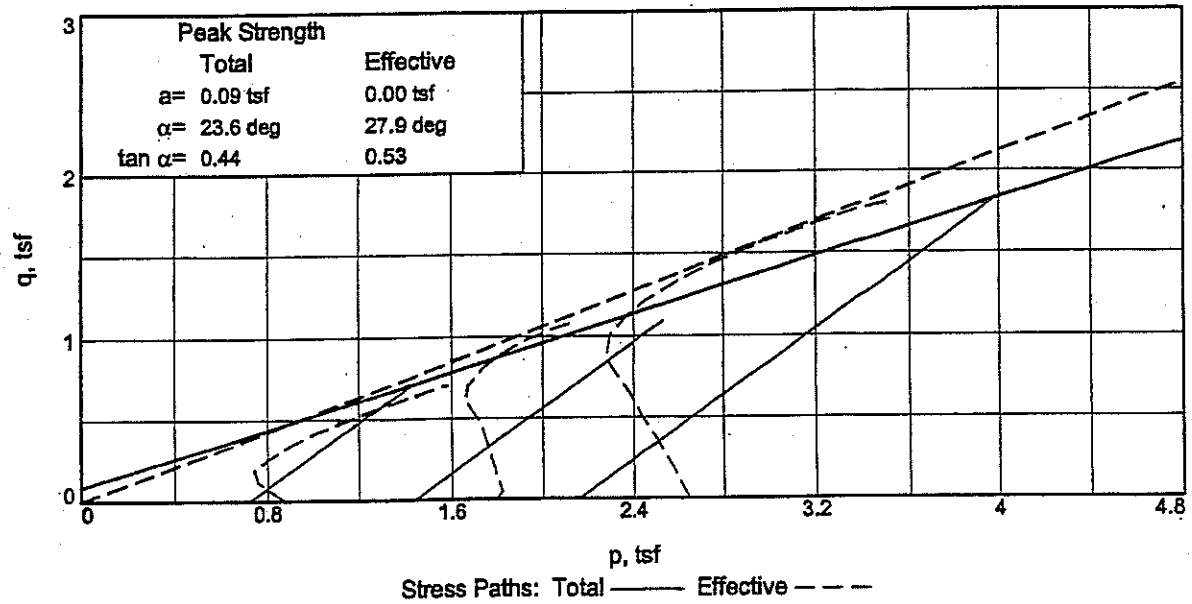
R10448











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #3
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

12/11/2009
11:33 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #3
Description: Brown Mottled Gray Sandy CLAY
Remarks:
Location: N 426872.850 E 364429.708
Ground Elev. 476.957
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	292.100			1169.300
Moisture content: Dry soil+tare, gms.	258.000			998.300
Moisture content: Tare, gms.	71.000			115.600
Moisture, %	18.2	21.6	21.6	19.4
Moist specimen weight, gms.	1045.2			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.20	5.20	5.20	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	124.5	128.0	128.0	
Dry density, pcf	105.3	105.3	105.3	
Void ratio	0.5714	0.5714	0.5714	
Saturation, %	84.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.407 tsf **at reading no.** 28
Ult. Stress = 1.407 tsf **at reading no.** 28

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	51.60	0.0	0.0	0.000	0.878	0.878	1.00	47.80	0.878	0.000
1	0.0200	71.60	20.0	0.4	0.233	0.641	0.874	1.36	51.10	0.757	0.116
2	0.0410	79.90	28.3	0.8	0.328	0.583	0.912	1.56	51.90	0.747	0.164
3	0.0610	85.70	34.1	1.2	0.374	0.554	0.929	1.67	52.30	0.741	0.187
4	0.0820	92.40	40.8	1.6	0.443	0.547	0.990	1.81	52.40	0.769	0.221
5	0.1020	98.20	46.6	2.0	0.501	0.547	1.048	1.92	52.40	0.798	0.250
6	0.1230	104.90	53.3	2.4	0.575	0.554	1.129	2.04	52.30	0.842	0.287
7	0.1430	112.40	60.8	2.8	0.691	0.562	1.253	2.23	52.20	0.907	0.346
8	0.1640	119.00	67.4	3.2	0.763	0.576	1.339	2.33	52.00	0.958	0.382
9	0.1840	125.70	74.1	3.5	0.836	0.598	1.433	2.40	51.70	1.015	0.418
10	0.2040	129.80	78.2	3.9	0.878	0.619	1.498	2.42	51.40	1.058	0.439
11	0.2250	134.80	83.2	4.3	0.931	0.634	1.564	2.47	51.20	1.099	0.465
12	0.2450	139.00	87.4	4.7	0.974	0.655	1.629	2.49	50.90	1.142	0.487
13	0.2660	143.10	91.5	5.1	1.015	0.670	1.685	2.52	50.70	1.177	0.508
14	0.2860	145.60	94.0	5.5	1.039	0.677	1.715	2.53	50.60	1.196	0.519
15	0.3070	149.80	98.2	5.9	1.080	0.691	1.772	2.56	50.40	1.231	0.540
16	0.3270	153.10	101.5	6.3	1.112	0.706	1.818	2.58	50.20	1.262	0.556
17	0.3680	158.10	106.5	7.1	1.157	0.727	1.884	2.59	49.90	1.306	0.579
18	0.4090	162.30	110.7	7.9	1.193	0.756	1.949	2.58	49.50	1.352	0.596
19	0.4500	167.30	115.7	8.7	1.236	0.770	2.006	2.60	49.30	1.388	0.618
20	0.4910	171.40	119.8	9.5	1.268	0.785	2.053	2.62	49.10	1.419	0.634
21	0.5320	174.80	123.2	10.2	1.293	0.806	2.099	2.60	48.80	1.453	0.647
22	0.5720	178.90	127.3	11.0	1.325	0.821	2.145	2.61	48.60	1.483	0.662
23	0.6130	182.30	130.7	11.8	1.348	0.835	2.183	2.61	48.40	1.509	0.674
24	0.6540	184.80	133.2	12.6	1.361	0.842	2.204	2.62	48.30	1.523	0.681
25	0.6950	188.10	136.5	13.4	1.383	0.857	2.239	2.61	48.10	1.548	0.691
26	0.7360	191.40	139.8	14.2	1.403	0.864	2.267	2.62	48.00	1.566	0.702
27	0.7560	192.20	140.6	14.6	1.405	0.871	2.276	2.61	47.90	1.574	0.702
28	0.7770	193.10	141.5	15.0	1.407	0.878	2.285	2.60	47.80	1.582	0.704

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	180.600			1279.200
Moisture content: Dry soil+tare, gms.	163.200			1088.900
Moisture content: Tare, gms.	72.500			115.600
Moisture, %	19.2	20.1	20.1	19.6
Moist specimen weight, gms.	1154.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.55	5.55	5.55	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.7	129.7	129.7	
Dry density, pcf	108.0	108.0	108.0	
Void ratio	0.5315	0.5315	0.5315	
Saturation, %	95.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.174 tsf **at reading no.** 28
Ult. Stress = 2.173 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	21.60	0.0	0.0	0.000	1.800	1.800	1.00	45.00	1.800	0.000
1	0.0220	30.00	8.4	0.4	0.091	1.778	1.870	1.05	45.30	1.824	0.046
2	0.0420	102.40	80.8	0.7	0.938	1.260	2.198	1.74	52.50	1.729	0.469
3	0.0620	126.50	104.9	1.1	1.213	1.058	2.272	2.15	55.30	1.665	0.607
4	0.0830	143.10	121.5	1.5	1.400	0.972	2.372	2.44	56.50	1.672	0.700
5	0.1030	156.50	134.9	1.8	1.548	0.943	2.492	2.64	56.90	1.717	0.774
6	0.1240	164.80	143.2	2.2	1.637	0.929	2.566	2.76	57.10	1.747	0.819
7	0.1440	172.30	150.7	2.6	1.717	0.929	2.646	2.85	57.10	1.787	0.858
8	0.1650	176.40	154.8	3.0	1.757	0.929	2.685	2.89	57.10	1.807	0.878
9	0.1850	179.80	158.2	3.3	1.788	0.929	2.717	2.93	57.10	1.823	0.894
10	0.2060	181.40	159.8	3.7	1.800	0.936	2.736	2.92	57.00	1.836	0.900
11	0.2260	183.10	161.5	4.1	1.812	0.929	2.741	2.95	57.10	1.835	0.906
12	0.2460	185.60	164.0	4.4	1.833	0.929	2.762	2.97	57.10	1.845	0.916
13	0.2670	188.90	167.3	4.8	1.862	0.936	2.798	2.99	57.00	1.867	0.931
14	0.2870	190.60	169.0	5.2	1.874	0.936	2.810	3.00	57.00	1.873	0.937
15	0.3080	193.90	172.3	5.5	1.903	0.943	2.846	3.02	56.90	1.895	0.952
16	0.3490	198.10	176.5	6.3	1.934	0.943	2.878	3.05	56.90	1.910	0.967
17	0.3900	202.20	180.6	7.0	1.964	0.958	2.921	3.05	56.70	1.939	0.982
18	0.4300	206.40	184.8	7.7	1.994	0.972	2.966	3.05	56.50	1.969	0.997
19	0.4710	210.60	189.0	8.5	2.023	0.979	3.002	3.07	56.40	1.991	1.011
20	0.5120	214.70	193.1	9.2	2.050	0.986	3.036	3.08	56.30	2.011	1.025
21	0.5530	218.00	196.4	9.9	2.068	0.994	3.062	3.08	56.20	2.028	1.034

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5940	222.20	200.6	10.7	2.095	1.008	3.103	3.08	56.00	2.055	1.047
23	0.6350	226.40	204.8	11.4	2.121	1.022	3.144	3.07	55.80	2.083	1.061
24	0.6760	228.90	207.3	12.2	2.129	1.030	3.159	3.07	55.70	2.094	1.065
25	0.7170	232.20	210.6	12.9	2.145	1.037	3.182	3.07	55.60	2.109	1.072
26	0.7580	235.50	213.9	13.6	2.160	1.051	3.211	3.05	55.40	2.131	1.080
27	0.7980	238.00	216.4	14.4	2.167	1.058	3.225	3.05	55.30	2.142	1.083
28	0.8190	239.70	218.1	14.7	2.174	1.066	3.240	3.04	55.20	2.153	1.087
29	0.8390	240.50	218.9	15.1	2.173	1.066	3.239	3.04	55.20	2.152	1.087

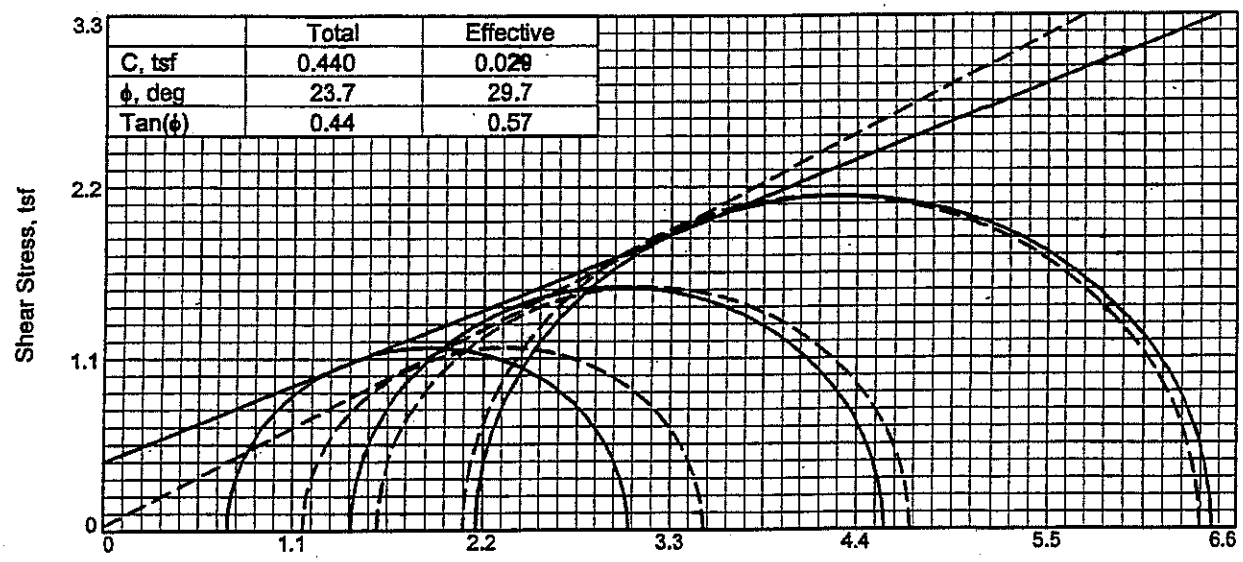
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	324.600			1159.400
Moisture content: Dry soil+tare, gms.	287.300			994.700
Moisture content: Tare, gms.	86.600			104.100
Moisture, %	18.6	18.4	18.4	18.5
Moist specimen weight, gms.	1063.3			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	4.99	4.99	4.99	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	131.8	131.6	131.6	
Dry density, pcf	111.2	111.2	111.2	
Void ratio	0.4884	0.4884	0.4884	
Saturation, %	100.8	100.0	100.0	

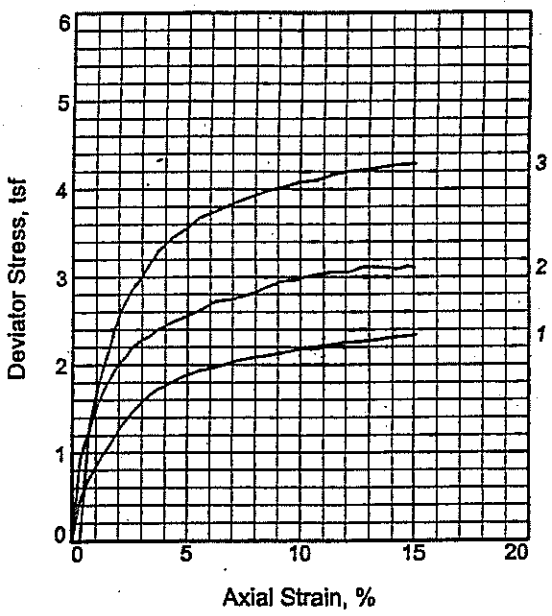
Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.626 tsf **at reading no.** 27
Ult. Stress = 3.626 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	31.60	0.0	0.0	0.000	2.650	2.650	1.00	43.20	2.650	0.000
1	0.0190	145.60	114.0	0.4	1.328	1.714	3.042	1.77	56.20	2.378	0.664
2	0.0400	181.40	149.8	0.8	1.738	1.411	3.149	2.23	60.40	2.280	0.869
3	0.0600	206.40	174.8	1.2	2.019	1.289	3.308	2.57	62.10	2.298	1.010
4	0.0810	226.40	194.8	1.6	2.241	1.253	3.494	2.79	62.60	2.373	1.120
5	0.1010	242.20	210.6	2.0	2.413	1.246	3.658	2.94	62.70	2.452	1.206
6	0.1220	256.30	224.7	2.4	2.563	1.253	3.816	3.05	62.60	2.534	1.282
7	0.1420	267.10	235.5	2.8	2.675	1.267	3.943	3.11	62.40	2.605	1.338
8	0.1620	276.30	244.7	3.2	2.768	1.289	4.057	3.15	62.10	2.673	1.384
9	0.1830	285.50	253.9	3.7	2.860	1.310	4.170	3.18	61.80	2.740	1.430

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
10	0.2030	292.90	261.3	4.1	2.931	1.339	4.270	3.19	61.40	2.805	1.466
11	0.2240	299.60	268.0	4.5	2.993	1.361	4.354	3.20	61.10	2.857	1.497
12	0.2440	305.40	273.8	4.9	3.045	1.382	4.427	3.20	60.80	2.905	1.523
13	0.2650	312.10	280.5	5.3	3.106	1.404	4.510	3.21	60.50	2.957	1.553
14	0.2850	314.80	283.2	5.7	3.122	1.404	4.526	3.22	60.50	2.965	1.561
15	0.3060	316.20	284.6	6.1	3.124	1.397	4.521	3.24	60.60	2.959	1.562
16	0.3460	327.10	295.5	6.9	3.216	1.454	4.670	3.21	59.80	3.062	1.608
17	0.3870	337.10	305.5	7.8	3.295	1.498	4.793	3.20	59.20	3.145	1.648
18	0.4280	346.20	314.6	8.6	3.363	1.526	4.890	3.20	58.80	3.208	1.682
19	0.4690	353.70	322.1	9.4	3.412	1.562	4.975	3.18	58.30	3.269	1.706
20	0.5100	361.20	329.6	10.2	3.460	1.584	5.044	3.18	58.00	3.314	1.730
21	0.5510	368.70	337.1	11.0	3.507	1.613	5.119	3.17	57.60	3.366	1.753
22	0.5920	374.50	342.9	11.9	3.534	1.634	5.168	3.16	57.30	3.401	1.767
23	0.6330	381.20	349.6	12.7	3.569	1.656	5.225	3.16	57.00	3.441	1.785
24	0.6730	387.80	356.2	13.5	3.603	1.692	5.295	3.13	56.50	3.494	1.802
25	0.7140	392.80	361.2	14.3	3.619	1.706	5.326	3.12	56.30	3.516	1.810
26	0.7350	395.30	363.7	14.7	3.626	1.714	5.340	3.12	56.20	3.527	1.813
27	0.7550	397.00	365.4	15.1	3.626	1.721	5.347	3.11	56.10	3.534	1.813

	Total	Effective
C, tsf	0.440	0.029
ϕ, deg	23.7	29.7
Tan(ϕ)	0.44	0.57





Sample No.		1	2	3
Initial	Water Content,	20.3	19.1	18.4
	Dry Density, pcf	110.4	111.5	111.9
	Saturation,	108.2	104.8	102.0
	Void Ratio	0.4984	0.4831	0.4778
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.54	5.55	5.54
At Test	Water Content,	18.8	18.2	18.0
	Dry Density, pcf	110.4	111.5	111.9
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.4984	0.4831	0.4778
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.54	5.55	5.54
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		2.34	3.12	4.29
Total Pore Pr., tsf		3.16	3.45	3.67
Ult. Stress, tsf		2.34	3.11	4.29
Total Pore Pr., tsf		3.16	3.46	3.67
$\bar{\sigma}_1$ Failure, tsf		3.50	4.71	6.38
$\bar{\sigma}_3$ Failure, tsf		1.16	1.59	2.09

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426851.754 E 365685.028
Ground Elev. 480.56

Plate _____

Client: Mach Mine

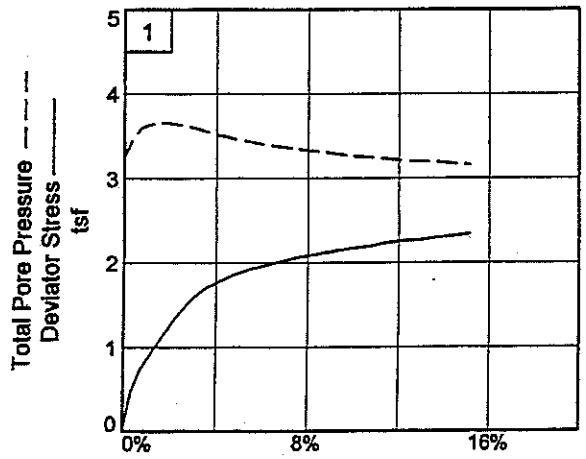
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #4

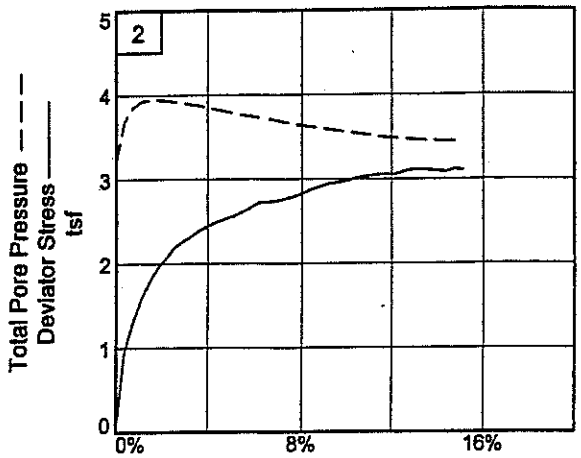
Proj. No.: H-08265 **Date:**

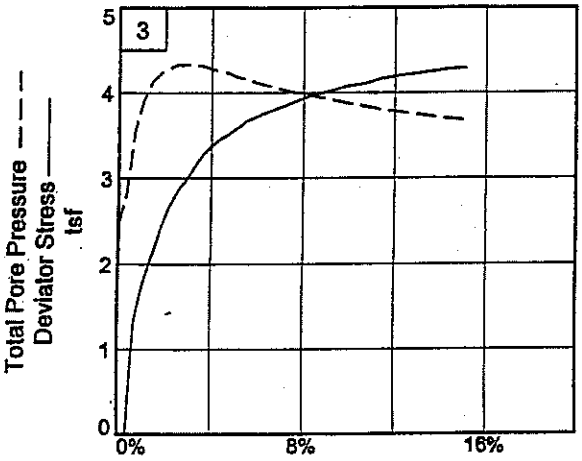
TRIAXIAL SHEAR TEST REPORT

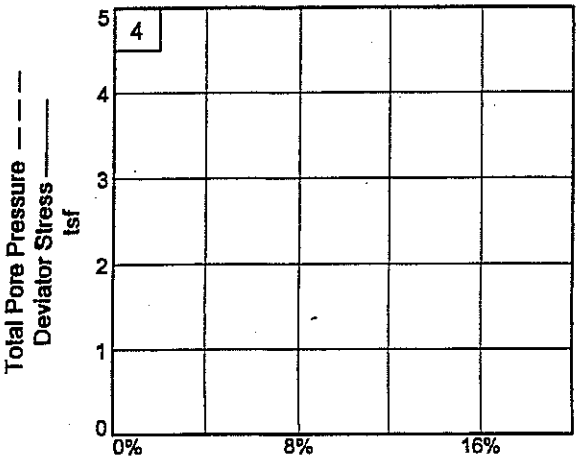
HOLCOMB FOUNDATION ENGINEERING CO.

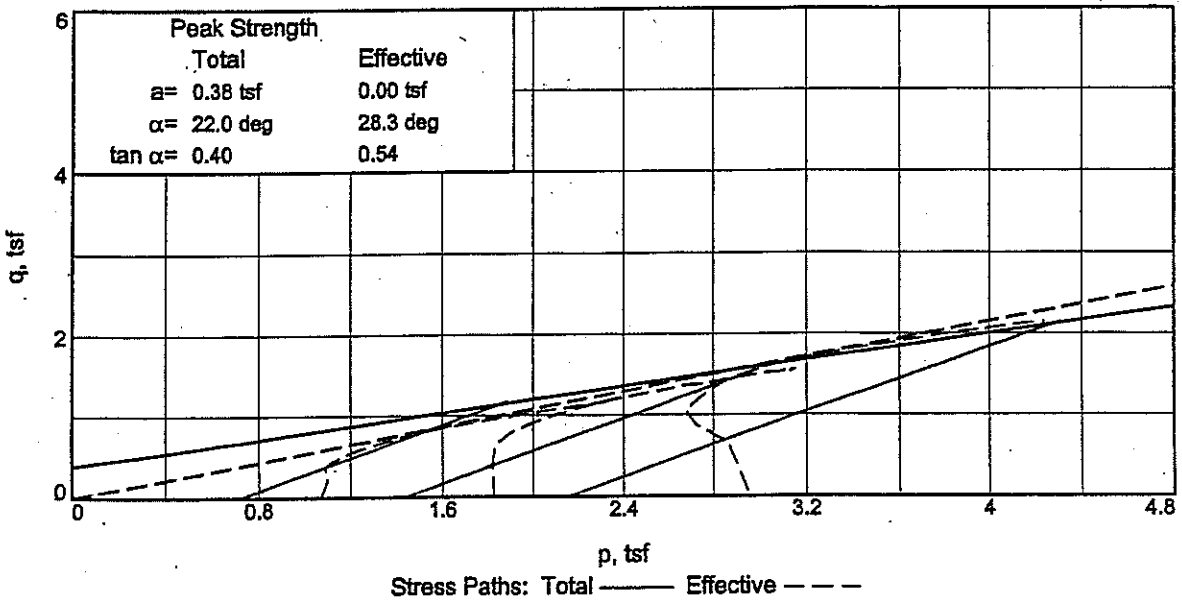
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #4
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

12/11/2009
11:35 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #4
Description: Brown Mottled Gray Silty CLAY
Remarks:
Location: N 426851.754 E 365685.028
Ground Elev. 480.56
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	231.100			1298.800
Moisture content: Dry soil+tare, gms.	199.100			1101.600
Moisture content: Tare, gms.	41.800			102.500
Moisture, %	20.3	18.8	18.8	19.7
Moist specimen weight, gms.	1189.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.54	5.54	5.54	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.9	131.2	131.2	
Dry density, pcf	110.4	110.4	110.4	
Void ratio	0.4984	0.4984	0.4984	
Saturation, %	108.2	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.338 tsf **at reading no.** 29
Ult. Stress = 2.338 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.80	0.0	0.0	0.000	1.073	1.073	1.00	45.10	1.073	0.000
1	0.0190	65.70	39.9	0.3	0.465	0.871	1.336	1.53	47.90	1.104	0.232
2	0.0400	87.40	61.6	0.7	0.715	0.734	1.449	1.97	49.80	1.092	0.358
3	0.0600	101.50	75.7	1.1	0.876	0.684	1.560	2.28	50.50	1.122	0.438
4	0.0810	115.70	89.9	1.5	1.036	0.662	1.698	2.56	50.80	1.180	0.518
5	0.1010	129.00	103.2	1.8	1.185	0.655	1.840	2.81	50.90	1.248	0.592
6	0.1220	142.30	116.5	2.2	1.332	0.670	2.002	2.99	50.70	1.336	0.666
7	0.1420	153.10	127.3	2.6	1.450	0.684	2.134	3.12	50.50	1.409	0.725
8	0.1620	163.10	137.3	2.9	1.558	0.713	2.271	3.19	50.10	1.492	0.779
9	0.1830	172.30	146.5	3.3	1.656	0.742	2.398	3.23	49.70	1.570	0.828
10	0.2030	178.10	152.3	3.7	1.716	0.770	2.486	3.23	49.30	1.628	0.858
11	0.2240	183.10	157.3	4.0	1.765	0.799	2.564	3.21	48.90	1.682	0.882
12	0.2440	188.10	162.3	4.4	1.814	0.821	2.635	3.21	48.60	1.728	0.907
13	0.2650	193.10	167.3	4.8	1.863	0.850	2.712	3.19	48.20	1.781	0.931
14	0.2850	196.40	170.6	5.1	1.892	0.864	2.756	3.19	48.00	1.810	0.946
15	0.3060	200.60	174.8	5.5	1.931	0.886	2.817	3.18	47.70	1.851	0.966
16	0.3460	205.60	179.8	6.2	1.971	0.922	2.893	3.14	47.20	1.907	0.986
17	0.3870	212.20	186.4	7.0	2.027	0.950	2.978	3.13	46.80	1.964	1.014
18	0.4280	218.00	192.2	7.7	2.074	0.979	3.053	3.12	46.40	2.016	1.037
19	0.4690	222.20	196.4	8.5	2.102	1.001	3.103	3.10	46.10	2.052	1.051
20	0.5100	227.20	201.4	9.2	2.138	1.022	3.161	3.09	45.80	2.091	1.069
21	0.5510	232.20	206.4	9.9	2.173	1.051	3.225	3.07	45.40	2.138	1.087
22	0.5920	235.50	209.7	10.7	2.190	1.066	3.256	3.06	45.20	2.161	1.095
23	0.6330	241.30	215.5	11.4	2.232	1.087	3.319	3.05	44.90	2.203	1.116
24	0.6730	245.50	219.7	12.2	2.257	1.109	3.366	3.04	44.60	2.237	1.128
25	0.7140	248.00	222.2	12.9	2.263	1.123	3.386	3.02	44.40	2.255	1.132
26	0.7550	253.00	227.2	13.6	2.295	1.123	3.418	3.04	44.40	2.270	1.147
27	0.7960	257.20	231.4	14.4	2.317	1.145	3.462	3.02	44.10	2.303	1.158
28	0.8170	258.80	233.0	14.7	2.323	1.152	3.475	3.02	44.00	2.313	1.161
29	0.8370	261.30	235.5	15.1	2.338	1.159	3.497	3.02	43.90	2.328	1.169

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	171.800			1310.000
Moisture content: Dry soil+tare, gms.	150.700			1115.500
Moisture content: Tare, gms.	40.200			115.700
Moisture, %	19.1	18.2	18.2	19.5
Moist specimen weight, gms.	1192.6			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.55	5.55	5.55	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.8	131.9	131.9	
Dry density, pcf	111.5	111.5	111.5	
Void ratio	0.4831	0.4831	0.4831	
Saturation, %	104.8	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.121 tsf **at reading no.** 28
Ult. Stress = 3.107 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	29.10	0.0	0.0	0.000	1.829	1.829	1.00	44.60	1.829	0.000
1	0.0190	109.00	79.9	0.3	0.931	1.361	2.292	1.68	51.10	1.826	0.466
2	0.0400	139.80	110.7	0.7	1.285	1.195	2.480	2.08	53.40	1.838	0.643
3	0.0600	163.90	134.8	1.1	1.559	1.123	2.682	2.39	54.40	1.903	0.780
4	0.0810	183.90	154.8	1.5	1.784	1.094	2.878	2.63	54.80	1.986	0.892
5	0.1010	198.90	169.8	1.8	1.949	1.094	3.044	2.78	54.80	2.069	0.975
6	0.1220	209.70	180.6	2.2	2.065	1.102	3.167	2.87	54.70	2.134	1.033
7	0.1420	221.40	192.3	2.6	2.191	1.116	3.307	2.96	54.50	2.212	1.096
8	0.1620	228.90	199.8	2.9	2.268	1.130	3.399	3.01	54.30	2.264	1.134
9	0.1830	234.70	205.6	3.3	2.325	1.152	3.477	3.02	54.00	2.314	1.162
10	0.2030	241.30	212.2	3.7	2.391	1.166	3.557	3.05	53.80	2.362	1.195
11	0.2240	247.20	218.1	4.0	2.447	1.195	3.643	3.05	53.40	2.419	1.224
12	0.2440	252.20	223.1	4.4	2.494	1.210	3.704	3.06	53.20	2.457	1.247
13	0.2650	256.30	227.2	4.8	2.530	1.231	3.761	3.05	52.90	2.496	1.265
14	0.2850	260.50	231.4	5.1	2.567	1.253	3.820	3.05	52.60	2.536	1.283
15	0.3060	265.50	236.4	5.5	2.612	1.274	3.886	3.05	52.30	2.580	1.306
16	0.3460	277.10	248.0	6.2	2.719	1.310	4.030	3.08	51.80	2.670	1.360
17	0.3870	281.30	252.2	7.0	2.743	1.346	4.090	3.04	51.30	2.718	1.372
18	0.4280	287.90	258.8	7.7	2.793	1.390	4.183	3.01	50.70	2.786	1.396
19	0.4690	297.90	268.8	8.4	2.878	1.418	4.296	3.03	50.30	2.857	1.439
20	0.5100	306.30	277.2	9.2	2.944	1.447	4.391	3.03	49.90	2.919	1.472
21	0.5510	311.30	282.2	9.9	2.972	1.476	4.448	3.01	49.50	2.962	1.486

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	318.70	289.6	10.7	3.025	1.505	4.530	3.01	49.10	3.017	1.513
23	0.6330	323.70	294.6	11.4	3.052	1.534	4.586	2.99	48.70	3.060	1.526
24	0.6730	326.20	297.1	12.1	3.053	1.555	4.608	2.96	48.40	3.082	1.527
25	0.7140	334.60	305.5	12.9	3.113	1.570	4.683	2.98	48.20	3.126	1.556
26	0.7550	337.10	308.0	13.6	3.112	1.584	4.696	2.96	48.00	3.140	1.556
27	0.7960	337.10	308.0	14.3	3.085	1.591	4.676	2.94	47.90	3.134	1.543
28	0.8170	342.00	312.9	14.7	3.121	1.591	4.712	2.96	47.90	3.151	1.560
29	0.8370	342.00	312.9	15.1	3.107	1.584	4.691	2.96	48.00	3.138	1.554

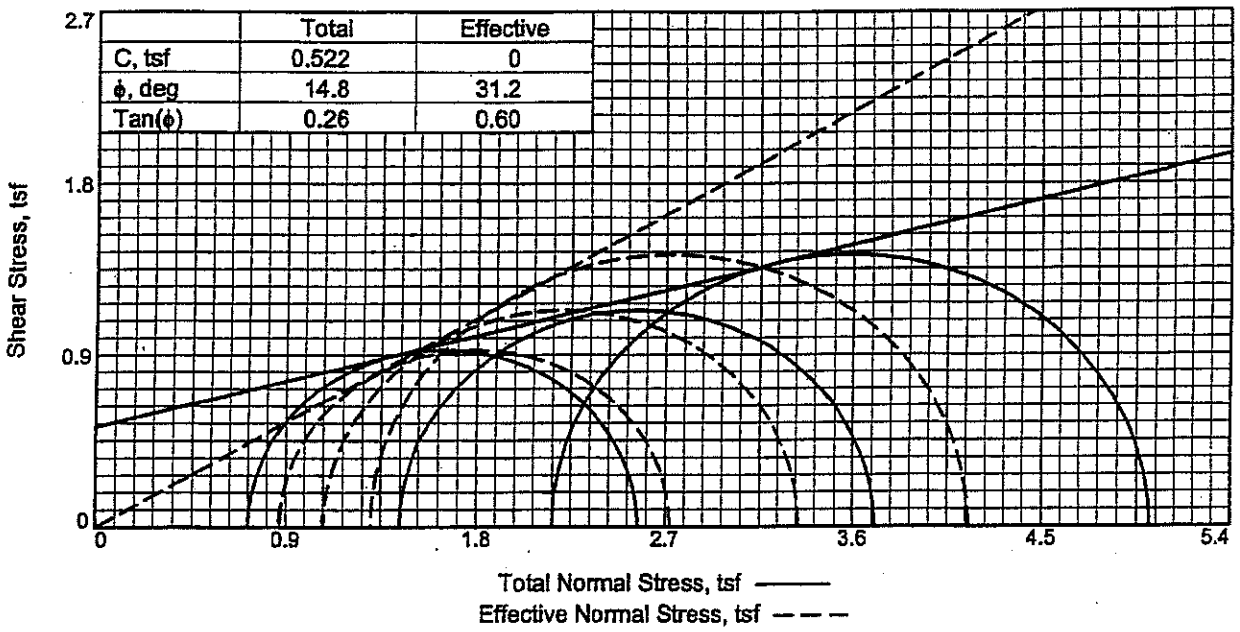
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	313.400			1293.600
Moisture content: Dry soil+tare, gms.	274.900			1108.600
Moisture content: Tare, gms.	65.500			107.600
Moisture, %	18.4	18.0	18.0	18.5
Moist specimen weight, gms.	1186.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.54	5.54	5.54	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.5	132.1	132.1	
Dry density, pcf	111.9	111.9	111.9	
Void ratio	0.4778	0.4778	0.4778	
Saturation, %	102.0	100.0	100.0	

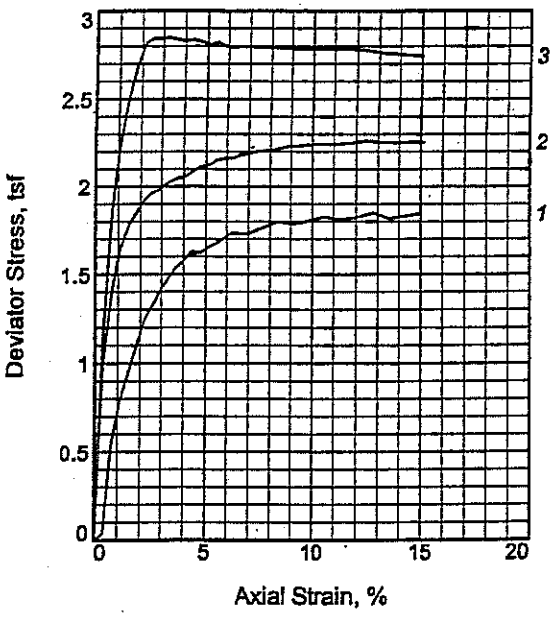
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.287 tsf **at reading no.** 29
Ult. Stress = 4.287 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	36.60	0.0	0.0	0.000	3.298	3.298	1.00	34.20	3.298	0.000
1	0.0190	36.60	0.0	0.3	0.000	2.959	2.959	1.00	38.90	2.959	0.000
2	0.0400	150.60	114.0	0.7	1.323	2.203	3.527	1.60	49.40	2.865	0.662
3	0.0600	188.90	152.3	1.1	1.762	1.843	3.605	1.96	54.40	2.724	0.881
4	0.0810	218.90	182.3	1.5	2.100	1.627	3.728	2.29	57.40	2.677	1.050
5	0.1010	248.00	211.4	1.8	2.427	1.526	3.953	2.59	58.80	2.740	1.213
6	0.1220	270.50	233.9	2.2	2.675	1.469	4.144	2.82	59.60	2.806	1.337
7	0.1420	287.10	250.5	2.6	2.854	1.433	4.287	2.99	60.10	2.860	1.427
8	0.1620	298.80	262.2	2.9	2.976	1.433	4.409	3.08	60.10	2.921	1.488
9	0.1830	314.60	278.0	3.3	3.143	1.433	4.576	3.19	60.10	3.004	1.572

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
10	0.2030	327.90	291.3	3.7	3.281	1.447	4.729	3.27	59.90	3.088	1.641
11	0.2240	337.90	301.3	4.0	3.381	1.483	4.864	3.28	59.40	3.174	1.690
12	0.2440	346.20	309.6	4.4	3.461	1.505	4.966	3.30	59.10	3.235	1.730
13	0.2650	352.90	316.3	4.8	3.522	1.534	5.055	3.30	58.70	3.294	1.761
14	0.2850	360.40	323.8	5.1	3.591	1.577	5.168	3.28	58.10	3.373	1.796
15	0.3060	368.70	332.1	5.5	3.669	1.606	5.274	3.28	57.70	3.440	1.834
16	0.3460	378.70	342.1	6.2	3.750	1.663	5.414	3.25	56.90	3.538	1.875
17	0.3870	388.60	352.0	7.0	3.828	1.714	5.542	3.23	56.20	3.628	1.914
18	0.4280	398.60	362.0	7.7	3.906	1.764	5.670	3.21	55.50	3.717	1.953
19	0.4690	407.80	371.2	8.5	3.973	1.800	5.773	3.21	55.00	3.786	1.986
20	0.5100	415.30	378.7	9.2	4.021	1.836	5.857	3.19	54.50	3.846	2.010
21	0.5510	423.60	387.0	9.9	4.075	1.879	5.954	3.17	53.90	3.917	2.038
22	0.5920	429.40	392.8	10.7	4.102	1.915	6.017	3.14	53.40	3.966	2.051
23	0.6330	438.60	402.0	11.4	4.164	1.958	6.122	3.13	52.80	4.040	2.082
24	0.6730	445.20	408.6	12.1	4.197	1.980	6.177	3.12	52.50	4.079	2.099
25	0.7140	451.10	414.5	12.9	4.222	2.009	6.231	3.10	52.10	4.120	2.111
26	0.7550	456.90	420.3	13.6	4.245	2.038	6.282	3.08	51.70	4.160	2.122
27	0.7960	463.60	427.0	14.4	4.276	2.066	6.342	3.07	51.30	4.204	2.138
28	0.8170	466.00	429.4	14.7	4.281	2.074	6.354	3.06	51.20	4.214	2.140
29	0.8370	468.50	431.9	15.1	4.287	2.088	6.375	3.05	51.00	4.232	2.144

	Total	Effective
C, tsf	0.522	0
ϕ, deg	14.8	31.2
Tan(ϕ)	0.26	0.60





Sample No.		1	2	3
Initial	Water Content,	25.7	23.5	21.2
	Dry Density, pcf	98.3	102.6	104.8
	Saturation,	99.9	101.9	97.2
	Void Ratio	0.6824	0.6120	0.5788
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.59	5.53	5.56
At Test	Water Content,	25.7	23.1	21.8
	Dry Density, pcf	98.3	102.6	104.8
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.6824	0.6120	0.5788
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.59	5.53	5.56
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.85	2.26	2.85
Total Pore Pr., tsf		3.45	3.96	4.46
Ult. Stress, tsf		1.84	2.25	2.74
Total Pore Pr., tsf		3.43	3.94	4.48
$\bar{\sigma}_1$ Failure, tsf		2.72	3.34	4.15
$\bar{\sigma}_3$ Failure, tsf		0.87	1.08	1.30

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown To Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 427055.027 E 367932.856
Ground Elev. 527.60

Plate _____

Client: Mach Mine

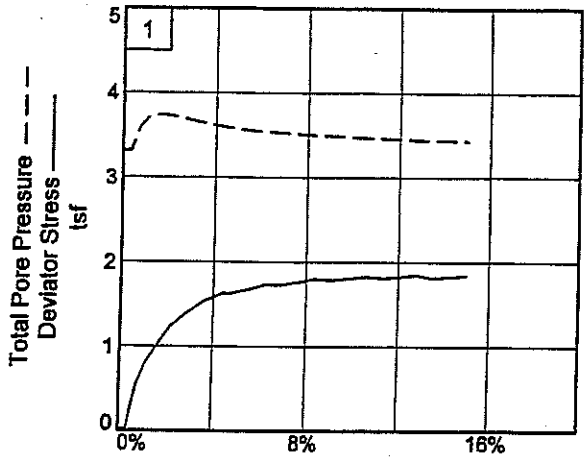
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #5

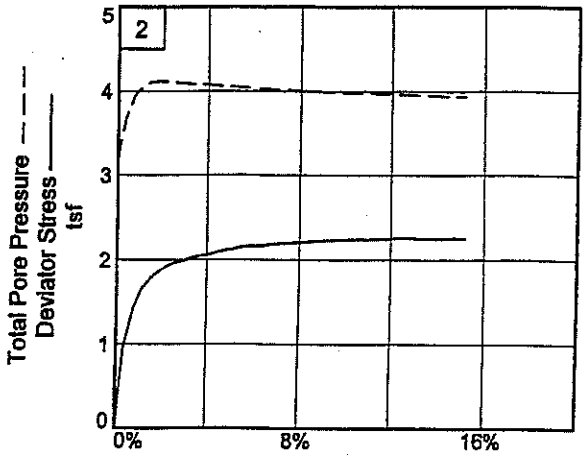
Proj. No.: H-08265 **Date:**

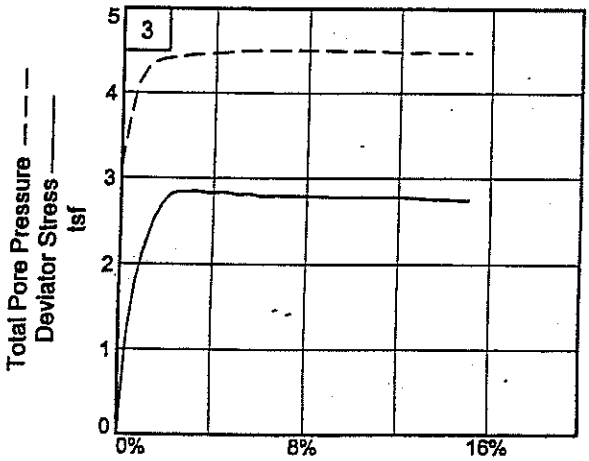
TRIAXIAL SHEAR TEST REPORT

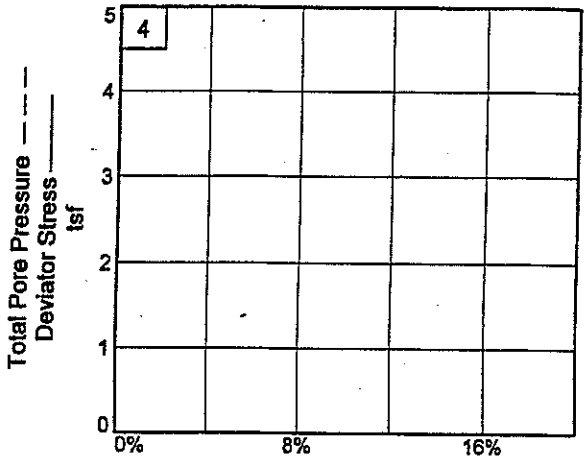
HOLCOMB FOUNDATION ENGINEERING CO.

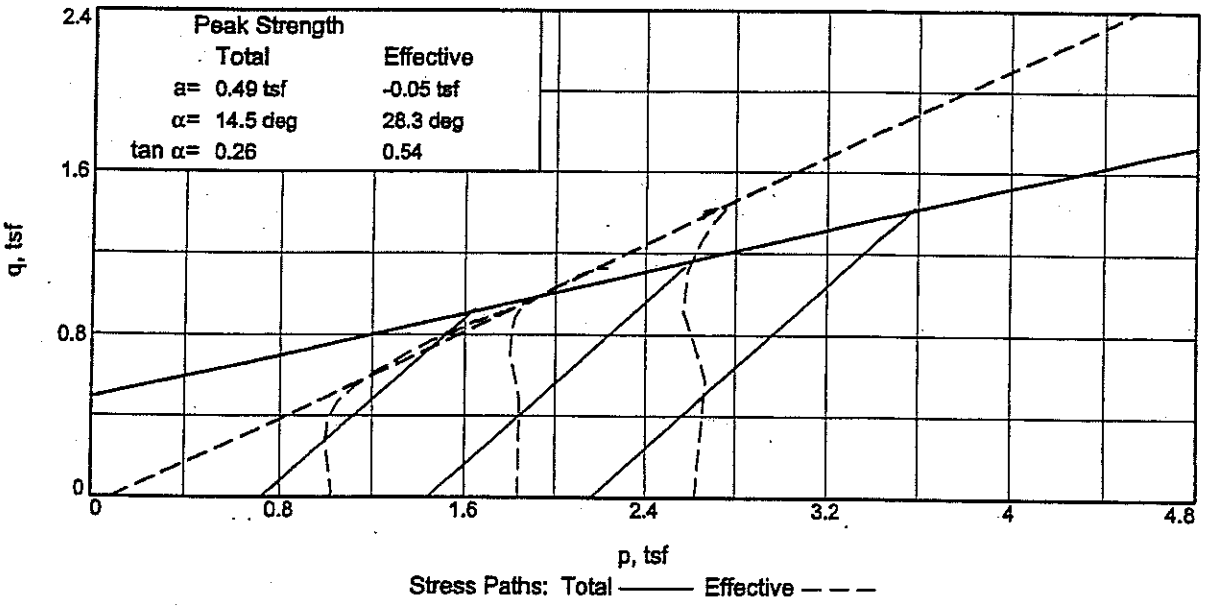
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #5
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:36 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #5
Description: Brown To Gray Silty CLAY
Remarks:
Location: N 427055.027 E 367932.856
Ground Elev. 527.60
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	492.700			1235.100
Moisture content: Dry soil+tare, gms.	410.600			991.300
Moisture content: Tare, gms.	91.400			107.600
Moisture, %	25.7	25.7	25.7	27.6
Moist specimen weight, gms.	1116.4			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.59	5.59	5.59	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	123.6	123.7	123.7	
Dry density, pcf	98.3	98.3	98.3	
Void ratio	0.6824	0.6824	0.6824	
Saturation, %	99.9	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.850 tsf **at reading no.** 25
Ult. Stress = 1.845 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	21.60	0.0	0.0	0.000	1.008	1.008	1.00	46.00	1.008	0.000
1	0.0200	25.00	3.4	0.4	0.034	1.008	1.042	1.03	46.00	1.025	0.017
2	0.0410	68.20	46.6	0.7	0.541	0.727	1.268	1.74	49.90	0.998	0.270
3	0.0610	89.00	67.4	1.1	0.780	0.619	1.399	2.26	51.40	1.009	0.390
4	0.0820	103.20	81.6	1.5	0.940	0.583	1.523	2.61	51.90	1.053	0.470
5	0.1020	117.30	95.7	1.8	1.099	0.583	1.682	2.88	51.90	1.132	0.549
6	0.1230	129.80	108.2	2.2	1.237	0.598	1.835	3.07	51.70	1.216	0.619
7	0.1430	137.30	115.7	2.6	1.318	0.619	1.937	3.13	51.40	1.278	0.659
8	0.1640	145.60	124.0	2.9	1.407	0.641	2.048	3.20	51.10	1.344	0.704
9	0.1840	151.50	129.9	3.3	1.469	0.662	2.131	3.22	50.80	1.397	0.734
10	0.2040	158.10	136.5	3.7	1.538	0.684	2.222	3.25	50.50	1.453	0.769
11	0.2250	162.30	140.7	4.0	1.579	0.706	2.285	3.24	50.20	1.495	0.789
12	0.2450	167.30	145.7	4.4	1.629	0.720	2.349	3.26	50.00	1.534	0.814
13	0.2660	167.30	145.7	4.8	1.623	0.734	2.357	3.21	49.80	1.546	0.811
14	0.2860	170.60	149.0	5.1	1.653	0.749	2.402	3.21	49.60	1.575	0.827
15	0.3070	173.10	151.5	5.5	1.674	0.763	2.437	3.19	49.40	1.600	0.837
16	0.3480	179.80	158.2	6.2	1.735	0.778	2.512	3.23	49.20	1.645	0.867
17	0.3880	180.60	159.0	6.9	1.730	0.792	2.522	3.18	49.00	1.657	0.865
18	0.4290	184.80	163.2	7.7	1.762	0.806	2.568	3.18	48.80	1.687	0.881
19	0.4700	189.70	168.1	8.4	1.800	0.821	2.621	3.19	48.60	1.721	0.900
20	0.5110	189.70	168.1	9.1	1.786	0.828	2.614	3.16	48.50	1.721	0.893
21	0.5520	193.10	171.5	9.9	1.807	0.842	2.650	3.15	48.30	1.746	0.904
22	0.5930	196.40	174.8	10.6	1.827	0.850	2.677	3.15	48.20	1.763	0.913
23	0.6340	196.40	174.8	11.3	1.812	0.857	2.669	3.11	48.10	1.763	0.906
24	0.6750	198.90	177.3	12.1	1.823	0.864	2.687	3.11	48.00	1.775	0.911
25	0.7160	203.10	181.5	12.8	1.850	0.871	2.722	3.12	47.90	1.796	0.925
26	0.7560	201.40	179.8	13.5	1.818	0.878	2.696	3.07	47.80	1.787	0.909
27	0.7970	203.90	182.3	14.3	1.828	0.878	2.706	3.08	47.80	1.792	0.914
28	0.8180	205.60	184.0	14.6	1.837	0.878	2.715	3.09	47.80	1.797	0.918
29	0.8380	207.20	185.6	15.0	1.845	0.886	2.730	3.08	47.70	1.808	0.922

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	232.400			1241.700
Moisture content: Dry soil+tare, gms.	200.100			1014.200
Moisture content: Tare, gms.	62.800			103.000
Moisture, %	23.5	23.1	23.1	25.0
Moist specimen weight, gms.	1132.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.53	5.53	5.53	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	126.8	126.3	126.3	
Dry density, pcf	102.6	102.6	102.6	
Void ratio	0.6120	0.6120	0.6120	
Saturation, %	101.9	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.264 tsf **at reading no.** 27
Ult. Stress = 2.254 tsf **at reading no.** 31

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	33.30	0.0	0.0	0.000	1.836	1.836	1.00	44.50	1.836	0.000
1	0.0190	117.30	84.0	0.3	0.979	1.354	2.332	1.72	51.20	1.843	0.489
2	0.0400	154.80	121.5	0.7	1.410	1.094	2.505	2.29	54.80	1.800	0.705
3	0.0600	175.60	142.3	1.1	1.646	0.986	2.632	2.67	56.30	1.809	0.823
4	0.0810	187.30	154.0	1.5	1.774	0.936	2.710	2.90	57.00	1.823	0.887
5	0.1010	194.70	161.4	1.8	1.853	0.922	2.774	3.01	57.20	1.848	0.926
6	0.1220	201.40	168.1	2.2	1.922	0.929	2.851	3.07	57.10	1.890	0.961
7	0.1420	205.60	172.3	2.6	1.963	0.936	2.899	3.10	57.00	1.917	0.981
8	0.1620	208.10	174.8	2.9	1.984	0.943	2.927	3.10	56.90	1.935	0.992
9	0.1830	212.20	178.9	3.3	2.023	0.958	2.980	3.11	56.70	1.969	1.011
10	0.2030	214.70	181.4	3.7	2.043	0.958	3.001	3.13	56.70	1.979	1.022
11	0.2240	216.40	183.1	4.1	2.054	0.965	3.019	3.13	56.60	1.992	1.027
12	0.2440	219.70	186.4	4.4	2.083	0.972	3.055	3.14	56.50	2.014	1.042
13	0.2650	223.00	189.7	4.8	2.112	0.986	3.098	3.14	56.30	2.042	1.056
14	0.2850	224.70	191.4	5.2	2.123	0.986	3.109	3.15	56.30	2.048	1.061
15	0.3060	228.00	194.7	5.5	2.151	0.994	3.144	3.16	56.20	2.069	1.075
16	0.3260	229.70	196.4	5.9	2.161	1.001	3.162	3.16	56.10	2.081	1.081
17	0.3460	230.50	197.2	6.3	2.162	1.008	3.170	3.14	56.00	2.089	1.081
18	0.3670	233.00	199.7	6.6	2.180	1.008	3.188	3.16	56.00	2.098	1.090
19	0.3870	234.70	201.4	7.0	2.190	1.022	3.212	3.14	55.80	2.117	1.095
20	0.4080	236.40	203.1	7.4	2.200	1.022	3.222	3.15	55.80	2.122	1.100
21	0.4490	238.80	205.5	8.1	2.208	1.037	3.245	3.13	55.60	2.141	1.104

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.4890	242.20	208.9	8.8	2.227	1.044	3.271	3.13	55.50	2.157	1.113
23	0.5300	244.70	211.4	9.6	2.235	1.058	3.293	3.11	55.30	2.176	1.117
24	0.5710	247.20	213.9	10.3	2.243	1.066	3.308	3.10	55.20	2.187	1.121
25	0.6120	248.80	215.5	11.1	2.241	1.066	3.306	3.10	55.20	2.186	1.120
26	0.6530	251.30	218.0	11.8	2.248	1.073	3.321	3.10	55.10	2.197	1.124
27	0.6940	254.70	221.4	12.6	2.264	1.080	3.344	3.10	55.00	2.212	1.132
28	0.7350	255.50	222.2	13.3	2.253	1.087	3.340	3.07	54.90	2.214	1.126
29	0.7760	257.20	223.9	14.0	2.250	1.094	3.345	3.06	54.80	2.220	1.125
30	0.8170	259.80	226.5	14.8	2.257	1.102	3.359	3.05	54.70	2.230	1.128
31	0.8370	260.50	227.2	15.1	2.254	1.102	3.356	3.05	54.70	2.229	1.127

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	241.200			1257.100
Moisture content: Dry soil+tare, gms.	211.700			1046.900
Moisture content: Tare, gms.	72.700			107.600
Moisture, %	21.2	21.8	21.8	22.4
Moist specimen weight, gms.	1141.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.56	5.56	5.56	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	127.0	127.7	127.7	
Dry density, pcf	104.8	104.8	104.8	
Void ratio	0.5788	0.5788	0.5788	
Saturation, %	97.2	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.851 tsf **at reading no.** 9
Ult. Stress = 2.745 tsf **at reading no.** 31

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	2.621	2.621	1.00	43.60	2.621	0.000
1	0.0190	124.80	99.8	0.3	1.163	2.088	3.251	1.56	51.00	2.669	0.581
2	0.0400	183.10	158.1	0.7	1.835	1.649	3.484	2.11	57.10	2.566	0.918
3	0.0600	218.00	193.0	1.1	2.232	1.469	3.701	2.52	59.60	2.585	1.116
4	0.0810	243.00	218.0	1.5	2.512	1.390	3.902	2.81	60.70	2.646	1.256
5	0.1010	260.50	235.5	1.8	2.704	1.354	4.057	3.00	61.20	2.705	1.352
6	0.1220	271.30	246.3	2.2	2.817	1.339	4.156	3.10	61.40	2.748	1.408
7	0.1420	274.60	249.6	2.6	2.844	1.332	4.176	3.14	61.50	2.754	1.422

R10467

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
8	0.1620	275.50	250.5	2.9	2.844	1.310	4.154	3.17	61.80	2.732	1.422
9	0.1830	277.10	252.1	3.3	2.851	1.303	4.154	3.19	61.90	2.729	1.425
10	0.2030	277.10	252.1	3.7	2.840	1.296	4.136	3.19	62.00	2.716	1.420
11	0.2240	277.10	252.1	4.0	2.829	1.289	4.118	3.20	62.10	2.703	1.415
12	0.2440	278.80	253.8	4.4	2.837	1.282	4.119	3.21	62.20	2.700	1.419
13	0.2650	278.80	253.8	4.8	2.826	1.274	4.101	3.22	62.30	2.688	1.413
14	0.2850	278.00	253.0	5.1	2.807	1.260	4.067	3.23	62.50	2.663	1.403
15	0.3060	280.50	255.5	5.5	2.823	1.260	4.083	3.24	62.50	2.672	1.412
16	0.3260	279.60	254.6	5.9	2.803	1.253	4.055	3.24	62.60	2.654	1.401
17	0.3460	279.60	254.6	6.2	2.792	1.253	4.045	3.23	62.60	2.649	1.396
18	0.3670	281.30	256.3	6.6	2.799	1.253	4.052	3.23	62.60	2.652	1.400
19	0.3870	282.10	257.1	7.0	2.797	1.253	4.050	3.23	62.60	2.651	1.399
20	0.4080	283.00	258.0	7.3	2.795	1.253	4.048	3.23	62.60	2.651	1.398
21	0.4490	284.60	259.6	8.1	2.790	1.253	4.043	3.23	62.60	2.648	1.395
22	0.4890	286.30	261.3	8.8	2.787	1.253	4.040	3.22	62.60	2.646	1.393
23	0.5300	287.90	262.9	9.5	2.781	1.260	4.041	3.21	62.50	2.651	1.391
24	0.5710	290.40	265.4	10.3	2.785	1.260	4.045	3.21	62.50	2.652	1.392
25	0.6120	292.10	267.1	11.0	2.779	1.260	4.039	3.21	62.50	2.650	1.390
26	0.6530	294.60	269.6	11.7	2.782	1.274	4.057	3.18	62.30	2.666	1.391
27	0.6940	296.30	271.3	12.5	2.776	1.282	4.058	3.17	62.20	2.670	1.388
28	0.7350	297.10	272.1	13.2	2.761	1.274	4.036	3.17	62.30	2.655	1.381
29	0.7760	298.80	273.8	14.0	2.755	1.282	4.036	3.15	62.20	2.659	1.377
30	0.8170	300.40	275.4	14.7	2.747	1.282	4.029	3.14	62.20	2.655	1.374
31	0.8370	301.30	276.3	15.1	2.745	1.282	4.026	3.14	62.20	2.654	1.372

(58)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/13/12 CHKD BY: DATE:
PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**
PROJECT NO. **B12-495-1413** SHEET 1 OF 17
DESCRIPTION **DTE Gas Line Consolidation Analysis**
File: Mach DTE_C1.xls, hlo, rev.12/11/2012

Determine: The DTE gas pipeline was under mined in the spring of 2011 by Longwall Panel No. 4 of the Mach #1 Mine. Strain gauges were placed on the pipeline at that time and the strains due to mine subsidence determined. Now it is proposed to place slurry impounding embankments of coarse coal refuse over the pipeline. Find out the additional strain that will occur to the pipeline due to foundation consolidation under the refuse embankments.

Soil Boring No. D1 was made was made adjacent to the pipe line on 06/08/2012 and an undisturbed sample was obtained for consolidation testing (see the Soil Borings and Testing appendix of this report).

References:

(1) "Test Report, , Prepared for Holcomb Foundation Engineering Company ..., Incremental Consolidation Test, ASTM D2435", GEOTECHNOLOGY, INC., June 29, 2012, 23 pages.
(2) "Soil Borings and Laboratory Tests, Pond Creek #1 Refuse Disposal Area, Williamson County, Illinois, Holcomb Foundation Engineering Co., July 11, 2012.
(3) "Basic Soil Mechanics (Course SM-10", Chapter 13, "Consolidation", and Chapter 14, "Settlement Analysis", SCS, USDA, January 1966 (Rev. 89/69).

Most Critical Location:

A total of 16 soil borings (Boring D1 and Borings BP1 to BP15) were taken along the gas pipeline during June 2012. The depth to bedrock in these borings ranged from ranged from 9' to 15'. Considering that Longwall Panel No. 3 stopped near the western end of the current Refuse Disposal Areas Nos. 2 and 3, that some of the highest pipe strain due to longwall subsidence should have occurred near the longwall stop location, and that a new impounding coarse refuse embankment will be built over the longwall stop area; evaluate the foundation consolidation under the gas pipeline due to future planned embankment construction. This information will then be used to estimate the additional strain on the pipeline.

Evaluation of Consolidation Test Results:

See accompanying "1-D Consolidation Test: Incremental, ASTM 2435, Project No. J019144.02, Boring D-1, Sample: - Depth 10', Geotechnology, Inc. for lab rebound & compression curve. Analyze test data and construct virgin curve.

The sample was taken from a Shelby tube 10.0' below the ground surface
The initial wet density of the sample was 125 pcf, no groundwater was present in the borehole
P_o = effective overburden pressure on sample = (10' x 125 pcf)/2000 lb/ton = 0.625 tsf
$P_{c(min)}$ = 1.7 tsf > P_o, therefore soil is preconsolidated
$P_{c(max)}$ = 2.7 tsf

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/20/12 CHKD BY: DATE:
PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**
PROJECT NO. **B12-495-1413** SHEET 2 OF 17
DESCRIPTION **DTE Gas Line Consolidation Analysis**
File: Mach DTE_C2.xls, hlo, rev. 12/11/2012

Evaluation of Consolidation Test Results: (continued)

C_c = Compression Index = $(e_1 - e_2)/\log_{10}[(P_{c(max)} + \Delta P)/P_{c(max)})]$
= $(0.627 - 0.343)/\log_{10}[(100/2.7)] = 0.181$ (for P > 2.7 tsf)

C_s = Recompression Index = $(e_o - e_1)/\log_{10}[(P_o + \Delta P)/P_o)]$
= $(0.652 - 0.627)/[\log_{10}(1.9/0.625)] = 0.052$ (for P < 2.7 tsf)

Consolidation Under Gas Pipeline

The most strain and settlement under the refuse embankment will occur after the refuse embankment and impoundment is abandoned and the foundation soil drainage due to compression has fully occurred.

Soil Properties and Densities

At Borehole D1, beside the pipeline on the west side of the site, the total hole depth to bedrock was 15.0'. The foundation soil ranges from a USCS classification of CH to CL. The wet density of the consolidation test sample was 126 pcf. No groundwater was found in Borehole D1. For final settlement conditions, use moist unit weights.

Boring D-4 into consolidated slurry in the Phase 2 slurry cell found that it's average dry density was 65 pcf at an average moisture content of 59%, giving a moist unit weight of 103 pcf.

The coarse coal refuse from Boring D-4 had an average dry unit weight of 107 pcf and an average moisture content of 8%, giving a moist unit weight of 116 pcf. This is refuse which was used to place a cover over the fine coal refuse slurry.

Recent in-place density test of the coarse coal refuse being used to construct the impounding embankments have an moist density of up to 130 pcf.

Use the above moist unit weights in the consolidation analysis.
Assume the post mine subsidence depth to bedrock from the ground surface is 15 feet.

Subsidence Equations:

(from "Principles of Geotechnical Engineering", Das, B.M., 7th Edition, Cengage Learning, Section 11.8)

$S_c = [C_s H/(1 + e_o)][\log(\sigma'_o + \Delta\sigma')/\sigma'_o)]$ (Eq. 11.33) (when $\sigma'_o + \Delta\sigma' \leq \sigma'_c$)

(40)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/23/12 CHKD BY: DATE:
PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**
PROJECT NO. **B12-495-1413** SHEET 3 OF 17
DESCRIPTION **DTE Gas Line Consolidation Analysis**
File: Mach DTE_C3.xls, hlo, rev.12/11/2012

Subsidence Equations: (continued)

$$S_c = [C_s H/(1 + e_o)][\log(\sigma'_c/\sigma'_o)] + [C_c H/(1 + e_o)][\log((\sigma'_o + \Delta\sigma')/\sigma'_o)] \quad \text{(Eq. 11.34) (when } \sigma'_o + \Delta\sigma' > \sigma'_c\text{)}$$

Or, since the virgin e -vs- σ'_v curve is given, find Δe from the curve for the appropriate range of pressures and use :

$$S_c = H[\Delta e/(1 + e_o)] \quad \text{(Eq. 11.29)}$$

S_c = Primary settlement of soil layer
H = soil layer thickness under consideration
e_o =Void ratio of soil sample at pressure σ'_o
σ'_c = Preconsolidation pressure of soil sample
σ'_o = Present consolidation pressure of soil sample
$\Delta\sigma'$ = Change in consolidation pressure on soil sample
log = log to the base 10
C_s = Recompression index = 0.052 (for reconstructed virgin curve)
C_c = Compression Index = 0.181 (for reconstructed virgin curve)
Δe = change in void ratio of soil sample from σ'_o to $(\sigma'_o + \Delta\sigma')$

Consolidation Computations

Since the foundation thickness is relatively thin compared to the width and height of the embankment, and embankment loading influence line charts are based on an infinite depth of compressible material, conservatively compute the consolidation based on the weight of the embankment vertically above the point in question.

Phase 8 Embankment - West Side

Use Boring D1, foundation soil thickness to bedrock = 15'.
See table on Sheet 4 for subsided pipe and ground surface elevations due to longwall Panel #3.
Compute foundation consolidation from bottom of gas pipeline to top of bedrock

Examination of the June 2012 topo reveals that some surface grading has occurred post mine subsidence between Phase 2 and 3 (Pipe line stations 2+40 to Dwina road. Since the best available data indicates that the depth to bedrock from the ground surface is 15' and that the gas pipe line was originally buried in a trench 5' deep. For the purposes of the foundation settlement analysis under the pipe, assume the H = compressible layer depth = 15' - 5' = 10'.

R10471

61

GEOTECHNOLOGY INC
FROM THE GROUND UP

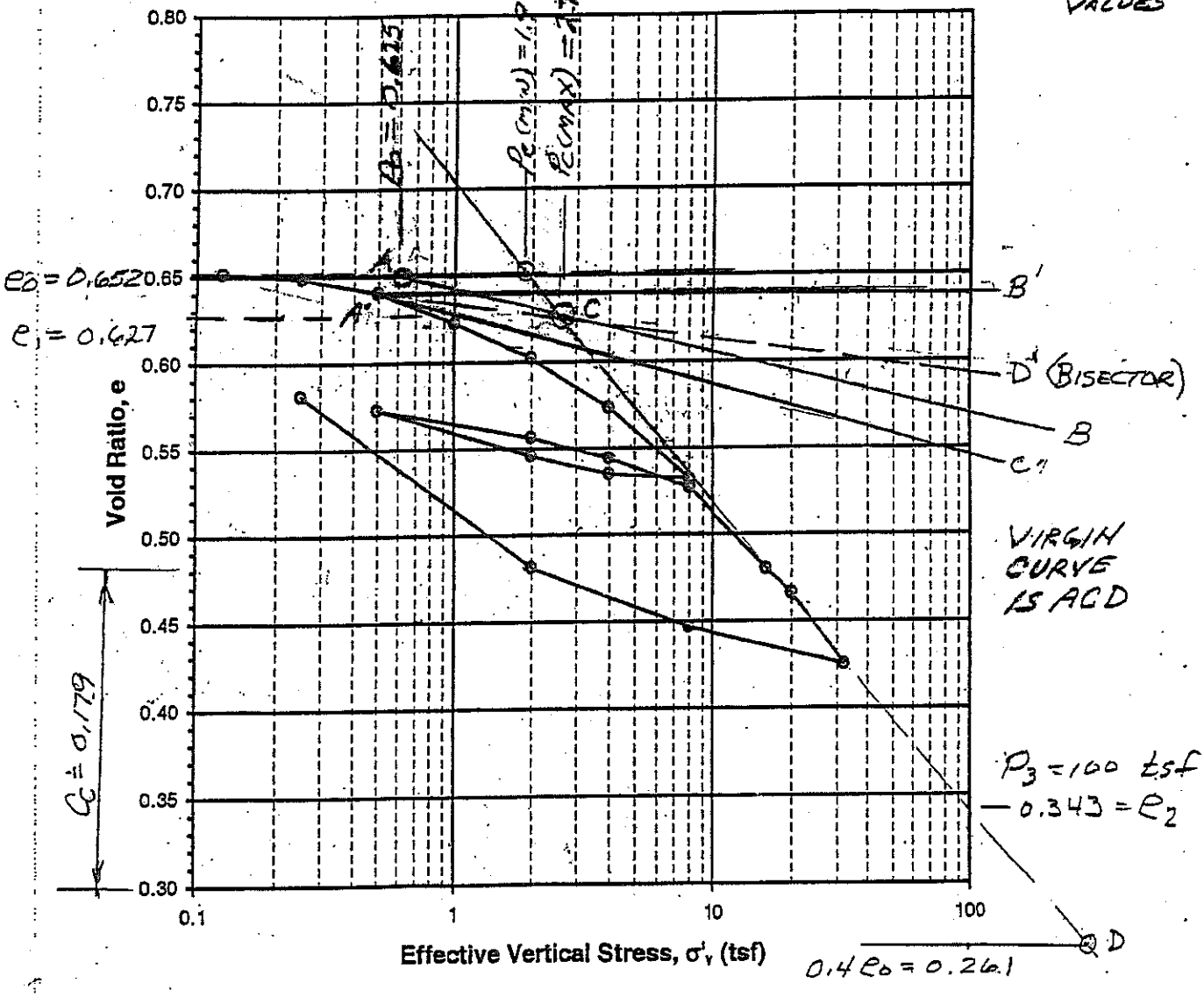
SHEET 4 OF 17

Liquid Limit= _____ Plastic Limit= _____ Plastic Index = _____ USCS: _____

Compression Index, C_c = 0.144 Void Ratio, e_o = 0.652

Recompression Index, C_r = 0.038 Preconsolidation Pressure = 1.9 tsf

SEE BELOW CONSTRUCTION FOR REVISED VALUES



1-D CONSOLIDATION TEST: INCREMENTAL

ASTM D 2435

Project No.: J019144.02

Boring: D-1

Sample: - Depth: 10 ft.

BY: HJO 7/23/12

TRC 8-2-12

62

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	06/20/12	CHKD BY:	DATE:
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan				
PROJECT NO.	B12-295-1413	SHEET	5	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis				
File: Mach DTE_9a.xls, hlo, rev. 12/18/2012					

Embankment Staging Information -

Embankment Stage	Crest Elev.	End of Stage Slurry Elev	Reference Drawing
DTE Impoundment	502	486.8	B12-495-E1
Phase 7 and 2 - 3 Connector	538	525.1	B12-495-M5
Phase 8 & Buttress Plan	588	581.2	B12-495-M6
East of Dwina Stage 1	500	479.8	B12-495-M5
East of Dwina Stage 2	538	529.8	B12-495-M7
East of Dwina Stage 3	588	579.2	B12-495-M8
East of Dwina Stage 4	626	619.2	B12-495-M13

See Section E-E on Drawing Nos. B12-495-M10 and -M13 for maximum embankment over pipeline on western end.

See Section I-I on Drawing Nos. B12-495-M5 and -M11 for maximum embankment over pipeline on eastern end.

See Drawing No. B12-495-M13 for gas pipeline stationing.

North edge of Longwall Panel No. 4 is at N 426,160.

See following sheets 9 through 13 for subsided ground and pipeline elevation determinations.

(63)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/25/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO.: B12-495-1413 SHEET 6 OF 17
DESCRIPTION: DTE Gas Line Consolidation Analysis
File: Mach DTE_C4.xls, hlo, rev. 12/12/2012

Consolidation Computations - Phase 8 Embankment - West Side (Continued)

Gas Pipeline Station	Subsided Ground Elev.	Embankment Fill Height (ft.)	Embankment Loading - Δσ'	tsf
2+40	470.7	0	0	
3+35.7	468.6	33.4	(130 pcf x 33.4 ft)/2000 lb/ton =	2.17
3+56	468.3	33.7	(130 x 33.7)/2000 =	2.19
4+66.1	469.4	68.6	(130 x 68.6/2000 =	4.46
4+86.4	468.8	69.2	(130 x 69.2)/2000 =	4.50
6+04.6	469.1	107.0	(130 x 107)/2000 =	6.96
6+39.2	468.3	119.7	[130(62 + 45.7) + 103 x 12]/2000 =	7.62
6+69.8	467.7	120.3	[130(62 + 36.3] + 103 x 22]/2000 =	7.52
7+40	466.3	121.7	[116 x 7+130(37.7+17)+103x60]/2000 =	7.05
7+95.9	465.2	122.8	(116 x 7+130x20+103x95.8)/2000 =	6.64
8+59.3	464.0	124.0	(116 x 7 + 103 x 117)/2000 =	6.43

Embankment/impoundment loading on foundation will remain 6.43 tsf ± until gas pipeline station 19+24 ± (CCR embankment over Dwina Road begins)

Gas Pipeline Station	H (ft.)	Δσ' tsf	Recom-pression (ft.)	Com-pression (ft.)	Total Consolidation Under Gas Line (ft.)
2+40	10.0	0	0	0	0
3+35.7	10.0	2.17	0.169	0.00	0.17
3+56	10.0	2.19	0.171	0.00	0.17
4+66.1	10.0	4.46	0.20	0.27	0.47
4+86.4	10.0	4.50	0.20	0.25	0.45
6+04.6	10.0	6.96	0.20	0.46	0.66
6+39.2	10.0	7.62	0.20	0.50	0.70
6+69.8	10.0	7.52	0.20	0.49	0.69
7+40	10.0	7.05	0.20	0.46	0.66
7+95.9	10.0	6.64	0.20	0.43	0.63
8+59.3	10.0	6.43	0.20	0.42	0.62

e_o = 0.652
σ_o' = 0.625 tsf
σ_c' = 2.7 tsf
} For recompression

e_o = 0.627
σ_o' = 2.7 tsf
σ_c' = 2.7 tsf
} For compression

The above table gives the estimated foundation consolidation under the gas pipeline at the west side of the Phase 8 planned embankment construction.

(64)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/08/12 CHKD BY: _____ DATE: _____
PROJECT NAME: Williamson - East of Dwina -Expansion Plan
PROJECT NO. B12-495-1413 SHEET 7 OF 17
DESCRIPTION DTE Gas Line Consolidation Analysis
File: Mach DTE_C7.xls, hlo, rev.12/12/2012

Phase 8 Embankment - Southeast Corner

Use Borings BP1 through BP14 and GW-28 for soil thickness to bedrock. These borings were made post mine subsidence. The depth of the gas pipe line was measured post-subsidence from gas pipeline stations 52+17 to 53+57.

See Sheets 11, 12, and 14 to 17 for estimated subsided pipe and ground surface elevations due to longwall Panel #3.

See Sheet 13 for measured depth to bedrock and pipe cover along the pipeline east of Dwina Road.

Compute foundation consolidation from bottom of gas pipeline to top of bedrock

Gas Pipeline Station	Subsided Ground Elev.	Embankment Fill Height (ft.)	Embankment Loading - $\Delta\sigma'$	tsf
5220	472.0	0	-	0
5212	*473.4*	5.6	(130 pcf x 5.6 ft)/2000 lb/ton =	0.37
5192	475.5	3.5	(130 pcf x 3.5 ft)/2000 lb/ton =	0.23
5166	477.9	10.4	(130 pcf x 10.4 ft)/2000 lb/ton =	0.67
5142	*479.0*	16.7	(130 pcf x 16.7 ft)/2000 lb/ton =	1.08
5112	*480.7*	15.0	(130 pcf x 15.0 ft)/2000 lb/ton =	0.98
5072	*483.0*	26.0	(130 pcf x 26.0 ft)/2000 lb/ton =	1.69
5025	485.7	38.9	(130 pcf x 38.9 ft)/2000 lb/ton =	2.53
4985	*488.1*	49.9	(130 pcf x 49.9 ft)/2000 lb/ton =	3.24
4978	*488.5*	49.6	(130 pcf x 49.6 ft)/2000 lb/ton =	3.22
4955	*489.5*	48.5	(130 pcf x 48.5 ft)/2000 lb/ton =	3.15
4883	*491.5*	70.1	(130 pcf x 70.1 ft)/2000 lb/ton =	4.56
4830	*494.0*	86.0	(130 pcf x 86.0 ft)/2000 lb/ton =	5.59
4787	*493.0*	86.5	(130 pcf x 86.5 ft)/2000 lb/ton =	5.63
4740	*491.9*	87.1	(130 pcf x 87.1 ft)/2000 lb/ton =	5.66
4692	*493.3*	87.7	(130 pcf x 87.7 ft)/2000 lb/ton =	5.70
4645	*494.1*	88.3	(130 pcf x 88.3 ft)/2000 lb/ton =	5.74
4599	*497.0*	88.9	(130 pcf x 88.9 ft)/2000 lb/ton =	5.78
4552	*498.7*	89.5	(130 pcf x 89.5 ft)/2000 lb/ton =	5.82
4456	498.6	90.7	(130 pcf x 90.7 ft)/2000 lb/ton =	5.90
4400	*496.6*	91.4	(130 pcf x 91.4 ft)/2000 lb/ton =	5.94

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/16/12 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO. B12-495-1413 SHEET 8 OF 17

DESCRIPTION DTE Gas Line Consolidation Analysis

File: Mach DTE_C8.xls, hlo, rev. 12/12/2012

Phase 8 Embankment - Southeast Corner (Continued)

H = Depth to Bedrock - Gas Line Cover - 8.625" (see Sheet 13 for depth to bedrock values)

Gas Pipeline Station	H (ft.)	Δσ' tsf	Recom-pression (ft.)	Com-pression (ft.)	Total Consolidation Under Gas Line (ft.)
52+20	6.1	0	0	0	0
52+12	6.0	0.37	0.10	0	0.10
51+92	5.6	0.23	0.10	0	0.10
51+66	5.0	0.67	0.10	0	0.10
51+42	4.6	1.08	0.09	0	0.09
51+12	4.0	0.98	0.08	0	0.08
50+72	8.5	1.69	0.17	0	0.17
50+25	9.3	2.53	0.19	0	0.19
49+85	7.6	3.24	0.19	0.07	0.25
49+78	6.0	3.22	0.19	0.05	0.24
49+55	6.0	3.15	0.19	0.04	0.23
48+83	7.4	4.56	0.19	0.19	0.37
48+30	7.8	5.59	0.19	0.27	0.46
47+87	6.9	5.63	0.19	0.24	0.43
47+40	6.0	5.66	0.19	0.21	0.40
46+92	6.0	5.70	0.19	0.22	0.40
46+45	6.0	5.74	0.19	0.22	0.40
45+99	6.0	5.78	0.19	0.22	0.41
45+52	6.0	5.82	0.19	0.22	0.41
44+56	6.0	5.90	0.19	0.23	0.41
44+00	6.0	5.94	0.19	0.23	0.41

As can be seen from the consolidation numbers above, the most critical differential foundation consolidation under the gas pipeline occurs on the western end of the refuse facility (see Sheet 6)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/02/12	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina, Expansion Plan						
PROJECT NO.	B12-495-1413	SHEET	9	OF	17		
DESCRIPTION	DTE Gas Line Consolidation Analysis						
	File: Mach DTE_C6.xls, hlo, rev.12/12/2012						

Predicted Foundation Consolidation Under Gas Pipeline - West End Refuse Embankment Phase 8

Summary of Results

Gas Line Station (ft.)	Original Top of Pipe Elev. msl)	Mine Subsidence (ft.)	Subsided Top of Pipe Elev. (msl)	Foundation Consolidation (ft)	Total Vertical Pipe Movement (ft.)	Final Top of Pipe Elev. (ft.)
200	465.16	0	465.16	0	0.00	465.16
240	*465.02*	0	*465.02*	0	0.00	*465.02*
253	464.98	0	464.98	*0.02*	*0.02*	464.96
300	464.34	0	464.34	*0.11*	*0.11*	*464.23*
335.7	*462.47*	0	*462.47*	0.17	0.17	*462.30*
349	461.78	0	461.78	0.17	0.17	461.61
356	*462.01*	0	*462.00*	0.17	0.17	*461.83*
397	463.33	0	463.33	*0.28*	*0.28*	*463.05*
442	463.88	0	463.88	*0.40*	*0.40*	*463.48*
466.1	*464.12*	0	*464.12*	0.47	0.47	*463.65*
486.4	*464.32*	*0.18*	*464.14*	0.45	*0.63*	*463.51*
502	464.48	0.31	464.17	*0.48*	*0.79*	*463.69*
539	*464.71*	*0.90*	*463.81*	*0.54*	*1.44*	*463.27*
581	464.98	1.57	463.41	*0.62*	*2.19*	*462.79*
604.6	*465.38*	*2.07*	463.32	0.66	*2.73*	*462.66*
609	465.46	2.16	463.30	*0.67*	*2.83*	*462.63*
639.2	*465.21*	*3.15*	*462.10*	*0.70*	*3.85*	*461.40*
658	465.05	3.76	461.29	*0.69*	*4.45*	*460.60*
669.8	*465.03*	*3.86*	*461.16*	0.69	*4.55*	*460.47*
704	464.96	4.16	460.80	*0.68*	*4.84*	*460.12*
740	*464.32*	*4.51*	459.81	0.66	*5.17*	*459.15*
752	464.10	4.62	459.48	*0.65*	*5.27*	*458.83*
795.9	*463.32*	*4.81*	*458.52*	0.63	*5.44*	*457.89*
799	463.27	4.82	458.45	*0.63*	*5.45*	*457.82*
847	461.35	4.84	456.51	*0.62*	*5.46*	*455.89*
859.3	*460.89*	*4.82*	456.07	0.62	*5.44*	*455.45*
895	459.57	4.76	454.81	0.62	*5.38*	454.19

Note: Numbers in italics are interpolated or include interpolated numbers

67

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/16/12	CHKD BY:	DATE:
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan				
PROJECT NO.	B12-495-1413	SHEET	10	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis				
File: Mach DTE_C9.xls, hlo, rev.12/11/2012					

Predicted Foundation Consolidation Under Gas Pipeline -SE Corner Embankment Phase 8

Summary of Results

Gas Line Station (ft.)	Original Top of Pipe Elev. msl)	Mine Subsidence (ft.)	Subsided Top of Pipe Elev. (msl)	Foundation Consolidation (ft)	Total Vertical Pipe Movement (ft.)	Final Top of Pipe Elev. (ft.)
52+20	-	5.28	*468.41*	0.00	5.28	*468.41*
52+12	-	5.28	*469.19*	0.10	5.38	*469.09*
51+92	-	5.28	471.29	0.10	5.38	*471.19*
51+66	-	5.28	473.60	0.10	5.38	*473.50*
51+42	-	5.28	*475.49*	0.09	5.37	*475.40*
51+12	*481.93*	5.28	*476.75*	0.08	5.36	*476.67*
50+72	486.94	5.28	481.66	0.17	5.45	*481.49*
50+25	489.98	5.30	*484.68*	0.19	5.49	*484.49*
49+85	*488.82*	5.30	*483.52*	0.25	5.55	*483.27*
49+78	491.34	5.30	486.04	0.24	5.54	*485.80*
49+55	*491.92*	5.38	*486.54*	0.23	5.61	*486.31*
48+83	493.64	5.50	488.14	0.37	5.87	*487.77*
48+30	*494.03*	5.58	488.55	0.46	6.04	*488.09*
47+87	493.35	5.59	487.76	0.43	6.02	*487.33*
47+40	493.94	5.63	488.31	0.40	6.03	*487.91*
46+92	495.13	5.75	489.38	0.40	6.15	*488.98*
46+45	496.15	5.75	490.40	0.40	6.15	*490.00*
45+99	498.45	5.75	492.70	0.41	6.16	*492.29*
45+52	500.98	5.75	495.23	0.41	6.16	*494.82*
44+56	501.01	5.74	495.27	0.41	6.15	*494.86*
44+00	498.99	5.71	493.28	0.41	6.12	*492.87*

Note: Numbers in italics are interpolated or include interpolated numbers

(68)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	06/11/12	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.	B12-495-1413	SHEET	11	OF	17		
DESCRIPTION	DTE Gas Consolidation Analysis						
File: Mach DTE_9.xls, hlo, rev. 12/12/2012							

Ground and Gas Pipeline Profiles - Post mine Subsidence - West End Phase 2-3 Connector

Gas Line Station (ft.)	Original Ground Elev. (ft.)	Shortest Distance to LW Panel Edge (ft.)	Subsidence (ft.)	Subsided Ground Elev. (ft.)	Original Top of Pipe Elev. (ft)	Subsided Top of Pipe Elev. (ft.)	Remarks
16	-	-488	0	-	465.00	465.00	
60	-	-	-	468.8	-	-	June 2012 spot topo elev.
64	-	-441	0	-	464.87	464.87	
87	-	-418	0	-	462.99	462.99	Sag in gas pipeline
111	-	-395	0	-	463.43	463.43	
142	-	-	-	470	-	-	June 2012 topo contour elev.
156	-	-350	0	-	464.63	464.63	
180	-	-	-	472	-	-	June 2012 topo contour elev.
200	-	-307	0	-	465.16	465.16	
240	-	-	0	-	-	-	West toe of embankment, 2012 topo
253	-	-255	0	-	464.98	464.98	
274	-	-	-	470	-	-	June 2012 topo contour elev.
294	-	-	0	469.2	-	-	June 2012 spot topo elev.
300	-	-209	0	-	464.34	464.34	
349	-	-161	0	-	461.78	461.78	
380	-		0	468	-	-	June 2012 topo contour elev.
397	-	-114	0	-	463.33	463.33	
442	-	-70	0	-	463.88	463.88	
445	-	-	-	468	-	-	June 2012 contour topo elev.
502	-	-11	0.31	-	464.48	464.17	
513	-	0	0.37	-	-	-	LW Panel #3 pullout line
539	-	26	0.75	-	464.54	463.79	Used subsidence for points 71 - 74
550	-	-	-	470	-	-	June 2012 contour topo elev.
581	470	67	1.57	468.4	464.98	463.41	Used subsidence for points 71 - 74
609	-	94	2.16	-	465.46	463.3	Used subsidence for points 27 - 14
658	-	142	3.76	-	465.05	461.29	Used subsidence for points 27 - 14
704	-	187	4.16	-	464.96	460.8	Used subsidence for points 27 - 14
752	-	235	4.62	-	464.10	459.48	Used subsidence for points 13 &14
799	-	281	4.82	-	463.27	458.45	Used subsidence for points 6 - 12
847	-	328	4.84	-	461.35	456.51	Used subsidence for points 6 - 12
895	-	375	4.76	-	459.57	454.81	Used subsidence for points 6 - 12
912	-	392	4.73	-	459.07	454.34	Sag in gas pipeline
941	-	420	4.68	-	460.01	455.33	Used subsidence for point 6
1034	-	-	-	460.6	-	-	June 2012 spot topo elev.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/06/12	CHKD BY:	DATE:
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan				
PROJECT NO.	B12-495-1413	SHEET	12	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis				
File: Mach DTE_9-1.xls, hlo, rev. 12/12/2012					

Ground and Gas Pipeline Profiles - Post mine Subsidence -SE Corner Embankment Phase 8

Gas Line Station (ft.)	Original Ground Elev. (msl	Shortest Distance to LW Panel Edge (ft.)	Subsid-ence (ft.)	Subsided Ground Elev. (msl)	Original Top of Pipe Elev. (msl)	Subsided Top of Pipe Elev. (msl)	Remarks
5357	-	-	-	463.54	-	459.29	Post-subsidence surveyed elev.
5324	-	-	-	465.61	-	461.36	Post-subsidence surveyed elev.
5283	-	-	-	467.38	-	463.47	Post-subsidence surveyed elev.
5269	-	-	-	468.50	-	464.33	Post-subsidence surveyed elev.
5252	-	-	-	*469.75*	-	*465.74*	Ditch elev. 469.0
5243	-	-	-	470.41	-	466.49	Post-subsidence surveyed elev.
5232	-	-	-	*471.43*		*467.41*	Ditch elev. 469.0
5217	-	-	-	472.83	-	468.66	Post-subsidence surveyed elev.
5212	-	-	-	*473.36*	-	*469.19*	Embankment elev. 479.0
5192	-	-	-	475.46	-	471.29	Embankment elev. 479.0
5166	-	-	-	477.85	478.46	473.60	Post-subsidence surveyed elev.
5142	-	-	-	*479.03*	-	*475.49*	Embankment elev. 495.7
5128	485.0	720	5.28	*479.7*	-	-	Original topo spot ground elevation
5119	*485.5*	720	5.28	*480.2*	482.58	477.30	Used subsidence for Points 45-46
5112	*485.9*	720	5.28	*480.7*	*481.93*	*476.65*	Embankment elev. 495.67
5072	*488.3*	720	5.28	*483.0*	486.94	481.66	Used subsidence for Points 45-46
5025	*491.0*	721	5.30	*485.7*	489.98	*484.68*	Used subsidence for Points 45-46
4985	*493.4*	721	5.30	*488.1*	*488.82*	*483.52*	Embankment elev. 538
4978	*493.8*	721	5.30	*488.5*	491.34	486.04	Used subsidence for Points 45-46
4962	494.7	721	5.30	489.4	-	-	Original topo spot ground elevation
4955	*494.9*	722	5.38	*489.5*	*491.92*	*486.54*	Embankment elev. 538
4930	-	724	5.46	-	492.55	487.09	Used subsidence for Points 45-46
4883	*497.0*	725	5.50	*491.5*	493.64	488.14	Original pipe elevation
4850	498	727	5.55	492.5	-	-	Original topo contour ground elev.
4835	-	-	-	-	494.11	-	Original pipe elevation
4830	*497.8*	728	5.58	*492.2*	*494.03*	488.45	Embankment elev. 580
4787	-	729	5.59	-	493.35	487.76	Original pipe elevation
4740	497.5	730	5.63	*491.9*	493.94	488.31	Original pipe elevation
4692	499.0	733	5.75	*493.3*	495.13	489.38	Original pipe elevation
4645	499.8	735	5.75	*494.1*	496.15	490.40	Original pipe elevation
4599	502.7	737	5.75	*497.0*	498.45	492.70	Original pipe elevation
4552	504.4	740	5.75	*498.7*	500.98	495.23	Original pipe elevation
4505	504.5	742	5.75	*498.8*	501.28	495.53	Original topo spot elevation
4456	504.3	744	5.74	*498.6*	501.01	495.27	Original pipe elevation
4409	502.7	747	5.71	*497.0*	499.34	493.63	Original pipe elevation
4400	502.3	747	5.71	*496.6*	498.99	493.28	Embankment bench elev. 588
4361	500.8	749	5.69	*495.1*	497.49	491.80	Original pipe elevation

70

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/13/12 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO. B12-495-1413 SHEET 13 OF 17

DESCRIPTION DTE Gas Line Consolidation Analysis

File: Mach DTE_9-2.xls, hlo, rev.12/12/2012

Ground and Gas Pipeline Profiles - Post Mine Subsidence - SE Corner Embankment Phase 8

Gas line soil cover, depth to bedrock, and subsided ground elevations along gas pipeline stationing

Gas Line Station (ft.)	Borehole or Point No.	Subsided Ground Elev. (msl)	Depth to Bedrock (ft.)	Remarks
5353	B3	-	12	B3 is 29' north of gas line, gas line cover is 51"
5324	J451	465.61	*11.3*	gas line cover is 51", post-subsidence surveyed ground elev.
5313	BP5	-	11	BP5 is 46' south of the gas line
5283	J450	467.38	*11.6*	gas line cover is 47", post-subsidence surveyed ground elev.
5269	J449	468.50	*11.9*	gas line cover is 50", post-subsidence surveyed ground elev.
5265	BP6	-	12	BP 6 is 47' south of the gas line
5252	-	*469.8*	*12*	Sediment Ditch bottom elev. 469.0, outside edge
5243	J448	470.41	*12*	gas line cover is 47", post-subsidence surveyed ground elev.
5232	B2	*471.4*	12	Sediment Ditch bottom elev. 469.0, inside edge, B2 is 23' north of the gas line
5217	BP7/J447	472.83	11	gas line cover is 50", post-subsidence surveyed ground elev.
5212	-	*473.4*	*10.9*	Embankment outside edge of bench elev. 479.0
5192	J446	475.46	*10.5*	Embankment inside edge of bench elev. 479.0, gas line cover is 50"
5166	BP8/J445	477.85	10	gas line cover is 51", BP 8 is 40' south of the gas line
5142	-	*479.0*	*9.6*	Embankment outside edge of bench elev. 495.7
5112	BP9	*480.7*	9	Embankment inside edge of bench elev. 495.7, BP9 is 39' south of gas line
5072	-	*483.0*	*13.5*	Original gas line survey location
5059	BP10	-	15	BP10 is 43' south of the gas line
5025	-	485.7	*14.3*	Original gas line survey location
5010	BP11	-	14	BP11 is 41' south of the gas line
4985	-	*488.1*	*12.6*	Embankment outside edge bench elev. 538
4978	-	*488.5*	*11.0*	Original gas line survey location
4955	BP12	*489.5*	11	Embankment inside edge bench elev. 538, BP12 is 39' south of the gas line
4907	BP13	-	12	BP13 is 42' south of the gas line
4883	-	491.5	*12.4*	Original gas line survey location
4850	-	492.5	*12.9*	Original topo contour ground elev.
4840	BP14	-	13	BP13 is 42' south of the gas line
4830	-	*492.2*	*12.8*	Embankment elev. 580
4787	-	*492.3*	*11.9*	Original gas line survey location
4740	BP15	*491.9*	11	Original gas line survey location
4692	-	*493.3*	11	Original gas line survey location
4645	-	*494.1*	11	Original gas line survey location
4599	-	*497.0*	11	Original gas line survey location
4552	-	*498.7*	11	Original gas line survey location
4456	-	498.6	11	Original gas line survey location
4409	-	*497.0*	11	Boring C-1 at station 42+50 also has bedrock at 11'
4400	-	*496.6*	11	Embankment bench elev. 588

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 8/8/2011 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO.: B12-495-1413 SHEET 14 OF 17

DESCRIPTION: Subsidence Baseline - North-South Line on East Crest and North Slope of Phase 2

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25,				March 2, 2011 Data						
Point #	Northing	Easting	Elevation	Point #	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft
1	426719.9107	360018.6730	491.728	3021101	426719.982	360018.503	487.02	0.07	-0.17	-4.71
2	426695.2703	360019.8605	496.256	3021102	426695.384	360019.704	491.52	0.11	-0.16	-4.73
3	426670.4275	360021.1434	494.665	3021103	426670.505	360021.041	489.96	0.08	-0.10	-4.70
4	426645.2540	360022.4474	493.744	3021104	426645.319	360022.143	489.13	0.07	-0.30	-4.61
5	426592.1332	360024.9538	496.976	3021105	426592.240	360024.739	492.33	0.11	-0.21	-4.65
6	426570.5179	360026.3034	500.712	3021106	426570.644	360026.132	496.03	0.13	-0.17	-4.68
7	426545.4953	360027.5461	503.321	3021107	426545.639	360027.374	498.60	0.14	-0.17	-4.72
8	426520.4934	360028.8517	505.191	3021108	426520.630	360028.674	500.43	0.14	-0.18	-4.76
9	426495.6080	360030.0683	505.450	3021109	426495.760	360029.947	500.65	0.15	-0.12	-4.80
10	426470.5878	360031.3480	505.071	3021110	426470.710	360031.253	500.22	0.12	-0.09	-4.85
11	426445.6565	360032.6524	504.887	3021111	426445.781	360032.575	500.03	0.12	-0.08	-4.86
12	426420.7708	360033.8930	504.987	3021112	426420.897	360033.854	500.19	0.13	-0.04	-4.80
13	426395.6957	360035.2969	503.390	3021113	426395.873	360035.223	498.73	0.18	-0.07	-4.66

March 2, 2011 is the final survey date for this subsidence pinline.

File: PinPoints(1-13).xls
Rev. 12/11/12, hlo

R10481

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	8/8/2011	CHKD BY:		DATE:			72
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan								
PROJECT NO.:	B12-495-1413			SHEET	15	OF	17		
DESCRIPTION:	Baseline - East of Northeast Line on East End of North Slope of Phase 2								

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25, 2011				March 14, 2011 Data						
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	North Distance From South Panel Edge- ft
14	426370.7701	360036.6723	499.318	426370.911	360036.528	494.75	0.14	-0.14	-4.57	221
15	426361.5685	360013.3246	502.989	426361.784	360013.113	498.45	0.22	-0.21	-4.54	212
16	426352.2762	359990.2042	504.222	426352.545	359989.949	499.78	0.27	-0.26	-4.44	202
17	426333.7608	359943.7031	504.670	426334.220	359943.359	500.57	0.46	-0.34	-4.10	184
18	426324.4877	359920.4504	505.191	426325.057	359920.040	501.20	0.57	-0.41	-3.99	174
19	426315.1771	359897.3310	505.647	426315.849	359896.868	501.74	0.67	-0.46	-3.91	165
20	426305.9136	359873.9982	505.995	426306.666	359873.449	502.09	0.75	-0.55	-3.90	156
21	426296.7287	359850.7578	506.104	426297.493	359850.286	502.27	0.76	-0.47	-3.83	147
22	426287.4709	359827.5596	506.695	426288.314	359827.146	503.00	0.84	-0.41	-3.70	137
23	426278.2247	359804.3451	506.973	426279.123	359804.008	503.50	0.90	-0.34	-3.48	128
24	426268.8649	359781.1768	507.302	426269.899	359780.932	504.12	1.03	-0.24	-3.18	119
25	426259.5715	359757.9131	507.259	426260.685	359757.663	504.48	1.11	-0.25	-2.78	110
26	426250.3285	359734.7090	507.055	426251.481	359734.428	504.68	1.15	-0.28	-2.37	100
27	426241.2263	359711.4219	507.236	426242.399	359711.163	505.23	1.17	-0.26	-2.01	91
28	426231.9559	359688.2576	507.200	426233.115	359688.031	505.55	1.16	-0.23	-1.65	82
29	426222.6980	359665.0069	506.935	426223.800	359664.726	505.62	1.10	-0.28	-1.32	73

Notes : March 14, 2011 is the final survey date for this subsidence pinline
The south edge of Panel No. 3 runs east-west on N 426,150.

File: PinPoints(14-29)R.xls
rev. 12/12/2012, hlo

R10482

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	6/18/2012	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.:	B12-495-1413			SHEET	16	OF	17
DESCRIPTION:	Baseline "H" - Easterly - Westerly Line on South Crest of Phase 3						

73

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25, 2011				April 5, 2011 Data						North Distance From South Panel Edge - ft
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	
41	426845.7081	358349.6385	502.643	426845.208	358349.684	497.53	-0.50	0.05	-5.11	696
42	426850.5251	358373.9329	502.258	426850.038	358373.731	497.06	-0.49	-0.20	-5.19	701
43	426855.8123	358398.1280	503.157	426855.298	358397.722	497.89	-0.51	-0.41	-5.27	706
44	426860.8552	358423.5055	503.137	426860.332	358423.018	497.90	-0.52	-0.49	-5.23	711
45	426866.1608	358447.2328	502.900	426865.664	358446.789	497.68	-0.50	-0.44	-5.22	716
46	426870.8456	358472.4792	503.025	426870.335	358472.133	497.72	-0.51	-0.35	-5.30	721
47	426875.1704	358497.2750	503.464	426874.635	358497.112	497.97	-0.54	-0.16	-5.50	725
48	426879.8172	358521.4775	503.638	426879.307	358521.162	498.01	-0.51	-0.32	-5.63	730
49	426882.8554	358546.0150	503.542	426882.316	358545.639	497.80	-0.54	-0.38	-5.75	733
50	426886.7078	358570.6605	503.066	426886.150	358570.189	497.31	-0.56	-0.47	-5.75	737
51	426891.8012	358594.9990	502.607	426891.224	358594.567	496.86	-0.58	-0.43	-5.75	742
52	426896.1595	358619.7378	502.623	426895.618	358619.215	496.90	-0.54	-0.52	-5.72	746
53	426900.5154	358644.1971	502.522	426899.986	358643.651	496.85	-0.53	-0.55	-5.68	751
54	426906.6990	358670.1668	502.643	426906.127	358669.635	497.02	-0.57	-0.53	-5.62	757
55	426912.1325	358693.5654	503.041	426911.545	358693.006	497.44	-0.59	-0.56	-5.60	762
56	426916.9026	358717.7688	503.382	426916.292	358717.181	497.75	-0.61	-0.59	-5.63	767
57	426921.7875	358742.4041	502.960	426921.092	358741.901	497.30	-0.70	-0.50	-5.66	772

Note : April 5 is the final survey date for this subsidence pinline

The south edge of Panel No. 3 runs E-W on N 426150

File: PinPoints(41-57)R.xls

rev. 12/12/2012, hlo

R10483

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

74

BY: HLO DATE: 6/14/2012 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO.: B05-495-1413 SHEET 17 OF 17

DESCRIPTION: Baseline "G", North-South Line on East Crest of Phase 3 Longwall Panel No. 3

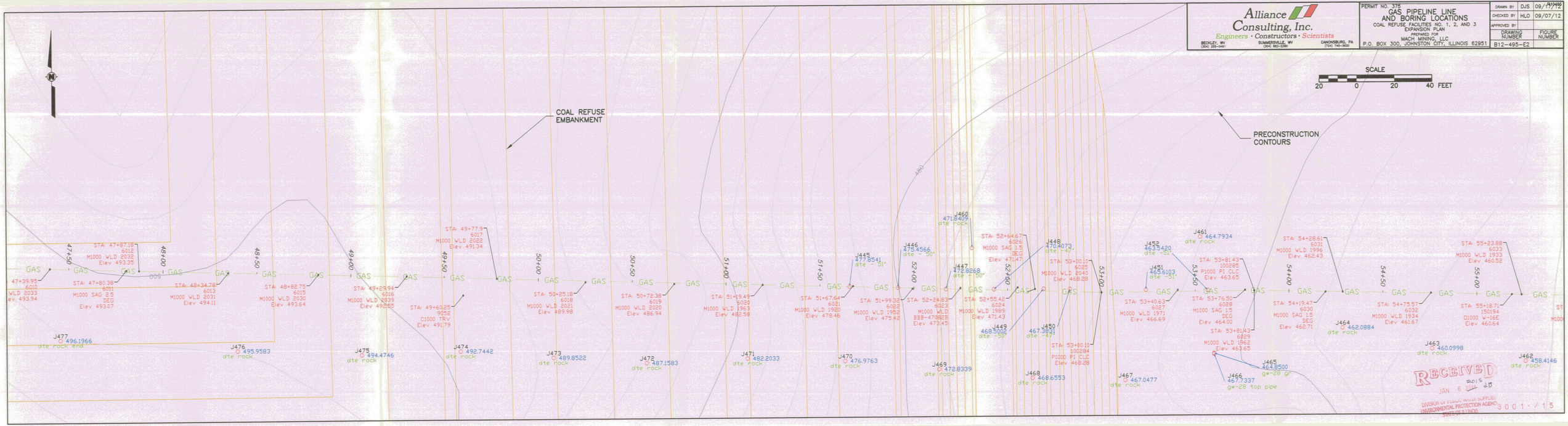
Data for 74 Pin Monitoring at Pond Creek Mine

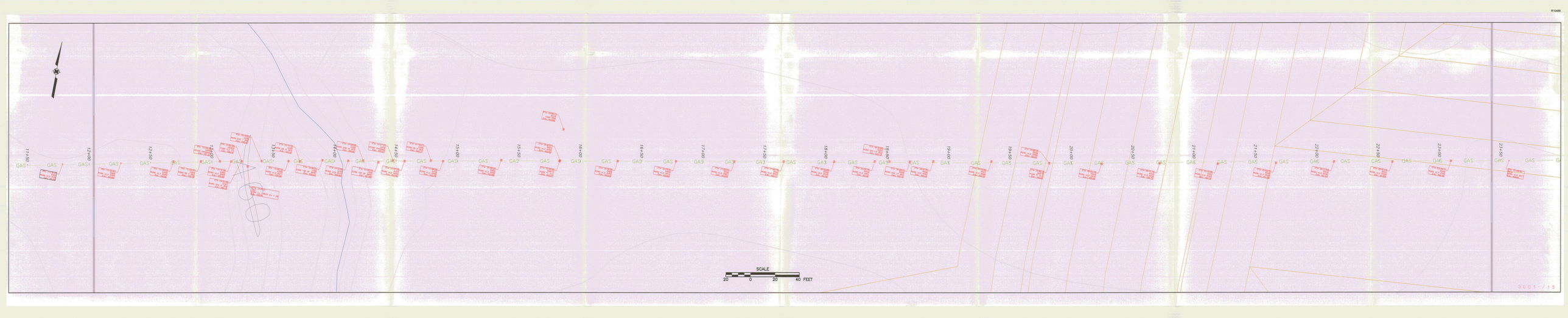
Baseline Data Average: Shot On January 21 & 25, 2011				March 2, 2011 Data						South Distance From North Panel Edge - ft
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	
58	427199.6407	360028.9146	500.411	427199.607	360028.720	495.29	-0.03	-0.19	-5.12	400
59	427224.5358	360026.1533	500.980	427224.461	360025.974	495.74	-0.08	-0.18	-5.24	375
60	427249.5863	360023.7018	502.050	427249.480	360023.645	496.77	-0.11	-0.06	-5.28	350
61	427274.7897	360025.0566	503.185	427274.642	360025.016	497.85	-0.15	-0.04	-5.33	325
62	427299.3534	360024.9848	503.014	427299.137	360024.927	497.62	-0.22	-0.06	-5.39	301
63	427324.5774	360024.8801	503.320	427324.321	360024.786	497.99	-0.26	-0.09	-5.33	275
64	427349.6602	360024.2754	503.670	427349.352	360024.195	498.39	-0.31	-0.08	-5.28	250
65	427374.6456	360025.7748	504.209	427374.197	360025.791	498.97	-0.45	0.02	-5.24	225
66	427400.4026	360024.4149	504.250	427399.693	360024.431	499.13	-0.71	0.02	-5.12	200
67	427424.3185	360023.1859	504.307	427423.281	360023.166	499.52	-1.04	-0.02	-4.78	176
68	427449.8823	360022.4175	504.086	427448.541	360022.384	499.76	-1.34	-0.03	-4.33	150
69	427474.4033	360021.6317	503.570	427472.707	360021.618	499.98	-1.70	-0.01	-3.59	126
70	427499.8466	360019.9085	503.036	427498.111	360019.842	500.33	-1.74	-0.07	-2.71	100
71	427524.8346	360017.6149	503.016	427523.356	360017.551	501.22	-1.48	-0.06	-1.79	75
72	427550.7951	360014.3475	502.936	427549.757	360014.321	501.78	-1.04	-0.03	-1.15	49
73	427574.7175	360010.3658	503.324	427574.039	360010.355	502.60	-0.68	-0.01	-0.73	25
74	427599.6555	360005.8279	502.913	427599.288	360005.815	502.54	-0.37	-0.01	-0.37	0

Notes: March 2, 2011 is the final survey date for this subsidence pinline.
The north edge of Panel No. 3 runs E-W on N427,600.

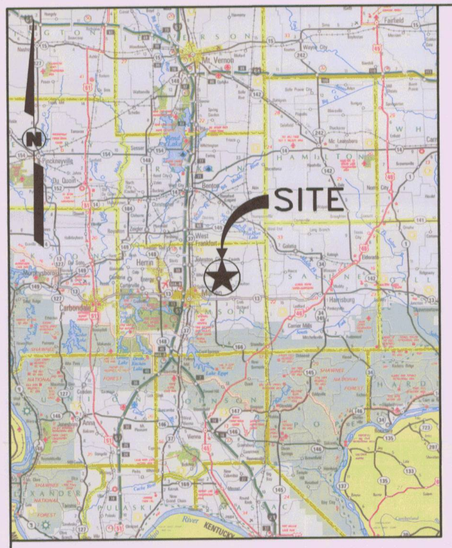
File: PlnPoints(58-74)R.xls
rev. 12/12/2012, hlo

R10484


Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0441
SUMMERSVILLE, WV (304) 872-2396
CANONSBURG, PA (724) 745-3600
PERMIT NO. 375
GAS PIPELINE LINE AND BORING LOCATIONS
COAL REFUSE FACILITIES NO. 1, 2, AND 3 EXPANSION PLAN
PREPARED FOR MACH MINING, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951
DRAWN BY DJS 09/17/12
CHECKED BY HLO 09/07/12
APPROVED BY
DRAWING NUMBER B12-495-E2
FIGURE NUMBER
R10486
SCALE
20 0 20 40 FEET
COAL REFUSE EMBANKMENT
PRECONSTRUCTION CONTOURS
47+50
48+00
48+50
49+00
49+50
50+00
50+50
51+00
51+50
52+00
52+50
53+00
53+50
54+00
54+50
55+00
GAS
STA: 47+39.95 6010 WLD 2033 Elev 493.94
STA: 47+87.18 6012 M1000 WLD 2032 Elev 493.35
STA: 47+80.38 6011 M1000 SAG 2.5 DEG Elev 493.07
STA: 48+34.78 6013 M1000 WLD 2031 Elev 494.11
STA: 48+82.75 6015 M1000 WLD 2030 Elev 493.64
STA: 49+29.94 6016 M1000 WLD 2029 Elev 492.85
STA: 49+60.25 9052 C1000 TRV Elev 491.79
STA: 49+77.9 6017 M1000 WLD 2022 Elev 491.34
STA: 50+25.18 6018 M1000 WLD 2021 Elev 489.98
STA: 50+72.38 6019 M1000 WLD 2020 Elev 486.94
STA: 51+19.49 6020 M1000 WLD 1963 Elev 482.58
STA: 51+67.64 6021 M1000 WLD 1980 Elev 478.46
STA: 51+99.88 6022 M1000 WLD 1952 Elev 475.42
STA: 52+24.83 6023 M1000 WLD BBB-470328 Elev 473.45
STA: 52+64.67 6026 M1000 SAG 1.5 DEG Elev 471.47
STA: 52+55.42 6024 M1000 WLD 1989 Elev 471.43
STA: 53+00.10 6025 M1000 WLD 2040 Elev 468.28
STA: 53+00.10 100284 P1000 P1 CLC Elev 468.28
STA: 53+40.63 6027 M1000 WLD 1971 Elev 466.69
STA: 53+81.43 100285 P1000 P1 CLC Elev 463.65
STA: 53+76.50 6028 M1000 SAG 1.5 DEG Elev 464.00
STA: 53+81.43 6029 M1000 WLD 1962 Elev 463.65
STA: 54+19.47 6030 M1000 SAG 1.5 DEG Elev 462.71
STA: 54+28.61 6031 M1000 WLD 1996 Elev 462.43
STA: 54+75.57 6032 M1000 WLD 1934 Elev 461.67
STA: 55+18.71 150194 G1000 W-16E Elev 460.64
STA: 55+83.88 6033 M1000 WLD 1933 Elev 460.52
J445 477.8541 dte - 51°
J446 475.4566 dte - 50°
J447 472.8268 dte - 50°
J448 470.4073 dte - 47°
J449 468.5002 dte - 50°
J450 467.3891 dte - 51°
J451 465.6103 dte - 51°
J452 463.5420 dte - 51°
J460 471.8409 dte rock
J461 464.7934 dte rock
J462 458.4146 dte rock
J463 460.0998 dte rock
J464 462.0884 dte rock
J465 464.8500 gw-28 gr
J466 467.7337 gw-28 top pipe
J467 467.0477 dte rock
J468 468.6553 dte rock
J469 472.8339 dte rock
J470 476.9763 dte rock
J471 482.2033 dte rock
J472 487.1583 dte rock
J473 489.8522 dte rock
J474 492.7442 dte rock
J475 494.4746 dte rock
J476 495.9583 dte rock
J477 496.1966 dte rock end
RECEIVED
JAN 6 2015
DIVISION OF PUBLIC WATER SUPPLIES
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS
8001415


11+50
12+00
12+50
13+00
13+50
14+00
14+50
15+00
15+50
16+00
16+50
17+00
17+50
18+00
18+50
19+00
19+50
20+00
20+50
21+00
21+50
22+00
22+50
23+00
23+50
GAS
SCALE
20 0 20 40 FEET

R10487



LOCATION MAP

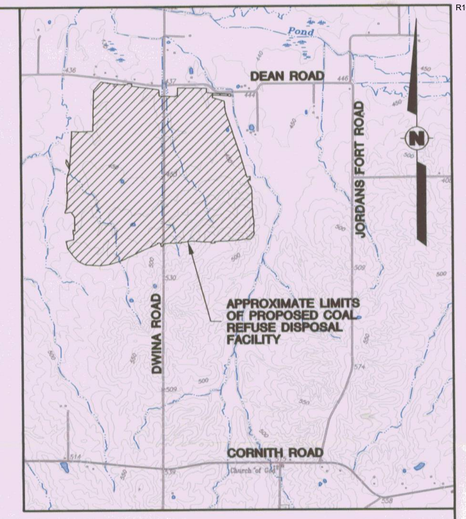
REFERENCE:

OFFICIAL ILLINOIS HIGHWAY MAP 2005 – 2006
ISSUED BY ILLINOIS DEPARTMENT OF TRANSPORTATION
ROOM 121, HARRY R. HANLEY BUILDING, 2300
SOUTH DIRKSEN PARKWAY, SPRINGFIELD, IL 62764.

SCALE
12 0 12 MILES

INDEX OF DRAWINGS

FIGURE NO.	DRAWING NO.	TITLE
1	B12-271-T1	TITLE SHEET
2	B12-271-M1	EXISTING CONDITIONS MAP
3	B12-271-M2	SURFACE DRAINAGE MAP
4	B12-271-M5	PHASE 9 PLAN
5	B12-271-M7	PHASE 10 PLAN
6	B12-271-M8	PHASE 11 PLAN
7	B12-271-M13	PHASE 12 PLAN
8	B12-271-E2	POND NO. 1 - PLAN AND SECTIONS
9	B12-271-M16	ABANDONMENT PLAN
10	B12-271-M14	SECTION A-A
11	B12-271-M15	SECTION B-B
12	B12-271-M11	SLOPE STABILITY SECTIONS (C-C THROUGH E-E)
13	B12-271-M4	MISCELLANEOUS DETAILS
14	B12-271-M9	DECANT INSTALLATION AND UNIFORM SECTION MAT DETAILS
15	B12-271-E3	GAS PIPELINE FILTER DIAPHRAGM DESIGN
16	B12-271-B1	USBR TYPE V1 IMPACT BASIN DETAILS



VICINITY MAP

REFERENCE:

7.5 MIN. USGS TOPOGRAPHIC MAP OF
PITTSBURG ILLINOIS QUADRANGLE.

SCALE
2000 0 2000 FEET

PERMIT NO. 417 AND 375
POND CREEK NO. 1 MINE
FACILITY NO. 2
EXPANSION PLAN

Prepared For

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417
TITLE SHEET
POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	ZAM	06/13/13	PROJECT NO. B12-271-1413	FIGURE NO. 1
CHECKED BY	CEY	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12-271-T1

R10488

E 358000 E 359000 E 360000 E 361000 E 362000 E 363000

N 431000 N 430000 N 429000 N 428000 N 427000

B-4 B-3 GW-11 GW-12 GW-13

8293 8295 8297 8298 8299 8874 (APPROXIMATE LOCATION) 8294

CREST ELEVATION 538

EXISTING PHASE 5/5A FINES DISPOSAL IMPOUNDMENT

EXISTING PHASE 5 INTERNAL DRAIN COLLECTION PIPE

EXISTING DITCH "L"

GW-10

EXISTING PHASE 5A FINE COAL REFUSE LEVEL – EL. 499.8 (APPROXIMATE)

EXISTING PHASE 5 INTERNAL DRAIN

EXISTING SEDIMENT DITCH

EXISTING DITCH "I"

BH - 4

BH - 5

D-2

EXISTING PHASE 7 FINE COAL REFUSE LEVEL – EL. 525.0

B-5

SEDIMENTATION DITCH DISCHARGE

EXISTING PHASE 4/6/7 FINES DISPOSAL IMPOUNDMENT

EXISTING PHASE 4/6 INTERNAL DRAIN

B-2

DWINA ROAD

EXISTING INTERNAL DRAIN OUTLET PIPE (TYP.)

BH - 6

GW-14

GW-7A

EXISTING PHASE 3 CAP EL. 500

EXISTING PHASE 3 INTERNAL DRAIN

EXISTING DITCH "P"

REFUSE CONVEYOR FROM PREPARATION PLANT

EXISTING DITCH "O"

CREST ELEVATION 538

B-7

EXSITING GAS PIPELINE FILTER DIAPHRAGM

EXISTING 8-INCH GAS PIPELINE

COMBINATION DITCH CD-2

C-1

BP-4/GW-28 B-2 B-3 BP-15 BP-2 BP-1 BP-14 BP-3 BP-13 BP-5 BP-6 BP-9 BP-7 BP-10 BP-8 BP-11 BP-12

EXISTING PHASE 2A FINES DISPOSAL IMPOUNDMENT

EXISTING PHASE 2A FINE COAL REFUSE LEVEL – EL. 517.4

COMBINATION DITCH CD-1

B-1

GW-8 (RELOCATED)

C-2

CREST ELEVATION 538

EXISTING PHASE 2A INTERNAL DRAIN

GW-5

EXISTING PERMIT NO. 375 EXCESS SPOIL STOCKPILE AREA

SCALE

200 0 200 400 FEET

LEGEND

- EXISTING 8" GAS PIPELINE
- EXISTING INTERNAL DRAIN
- EXISTING PERMIT BOUNDARY
- LONGWALL MINING TO BE COMPLETED PRIOR TO CONSTRUCTION
- B-5 — EXPLORATION HOLE COMPLETED PRIOR TO MAY 2009
- BH - 4 — EXPLORATION HOLE COMPLETED DURING MAY 2009
- GW-7A — EXPLORATION HOLE/GROUND WATER WELL COMPLETED PRIOR TO MAY 2009
- GW-13 — EXPLORATION HOLE/GROUND WATER WELL COMPLETED DURING MAY 2009
- B-2 — EXPLORATION HOLE/GROUND WATER WELL COMPLETED DURING JULY 2012
- 8298 — EXISTING BOREHOLE LOCATION
- P-8 — EXISTING PIEZOMETER

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

Claudio E. Yon P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES October 25, 2015

Jody R. Sulesky

OFFICIAL SEAL — Notary Public, State of West Virginia — JODY R SULESKY — PO Box 925 Beaver, WV 25813 — My Commission expires October 25, 2015

CLAUDIO E. YON 062-050632 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 — SUMMERSVILLE, WV (304) 883-2360 — CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-0341-02
I.D.N.R. PERMIT NOS. 375 AND 417

EXISTING CONDITIONS MAP

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/27/12	PROJECT NO. B12-271-1413	FIGURE NO. 2
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12-271-M1

R10489

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

POND NO. 1

FLUME NO. 4

A

30 FOOT BENCH AND GUTTER

40 FOOT BENCH AND GUTTER

DITCH "L" FLUME NO. 1

PHASE 8 CREST ELEVATION 588

20 FOOT BENCH AND GUTTER

30 FOOT BENCH AND GUTTER

36" DIA. DR-26 HDPE DECANT PIPE AND FILTER DIAPHRAGM PER APPROVED PLAN

PHASE 8 FINE COAL REFUSE DISPOSAL IMPOUNDMENT

B

30 FOOT BENCH AND GUTTER

PHASE 8 MAXIMUM FINE COAL REFUSE LEVEL - EL. 582.0

DITCH "O" FLUME NO. 2

EXISTING COMBINATION DITCH CD-1

PHASE 12 FINE COAL REFUSE LEVEL-EL. 619.3

PHASE 12 CREST EL. 626

PHASE 12 FINE COAL REFUSE DISPOSAL IMPOUNDMENT

FLUME NO. 5

30 FOOT BENCH AND GUTTER

28 INCH DIA DR-17 HDPE DECANT PIPE 18" MIN. BELOW SURFACE. DAYLIGHT AT SEDIMENT DITCH

FILTER DIAPHRAGM AND OUTLET DRAIN

FLUME NO. 6

5 FOOT BERM

30' STARTER BENCH AT TOE OF EMBANKMENT

A

CULVERT C-1 (3) 42" CMP'S

40' ACCESS ROAD AND GUTTER

FLUME NO. 3

30 FOOT BENCH AND GUTTER

GATE INSTALLED END OF DWINA ROAD NORTH BOUND

PROPOSED SEDIMENT DITCH

30 FOOT BENCH AND GUTTER

CLAUDIO ELIA FOR
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

Claudio E. Elia P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC Jody R. Sulesky THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct 29 2022

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 929
Beaver, WV 25813
My commission expires October 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

3001.15

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

NOTES:

1. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.
2. FOR POND NO. 1 PLAN AND SECTIONS SEE FIGURE NO. 8.
3. FOR SECTIONS A-A, AND B-B SEE FIGURE NOS. 10 AND 11.
4. SLOPE BENCHES AT 0.5% TO DRAIN AS SHOWN.
5. FOR DECANT PIPE AND FILTER DIAPHRAGM INSTALLATION DETAILS SEE FIGURE NO. 14.
6. PHASE 8 IS SHOWN FOR REFERENCE. PHASE 8 SHALL BE CONSTRUCTED CONCURRENTLY WITH THE PROPOSED PLAN, AND IN ACCORDANCE WITH THE APPROVED PLAN.

LEGEND

- EXISTING 8" GAS PIPELINE
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- 100' STREAM BUFFER ZONE

SCALE
200 0 200 400 FEET

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

SURFACE DRAINAGE MAP

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	MSR	02/28/12	PROJECT NO. B12-271-1413	FIGURE NO. 3
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12-271-M2	

R10490

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

EXISTING SEDIMENT DITCH

DWINA ROAD

POND NO. 1

CONSTRUCT TEMPORARY FLUME

EXISTING ROAD UNDER EMBANKMENT LIMITS TO BE REMOVED PRIOR TO CONSTRUCTION

PHASE 5A MAXIMUM FINE COAL REFUSE LEVEL EL. 513.5

EXISTING FLUME

PHASE 5A CREST ELEVATION 538

PHASE 9 CREST ELEVATION – 500

EAST OF DWINA INCISED STARTER CELL

PHASE 7 MAXIMUM FINE COAL REFUSE LEVEL EL. 522.0

PHASE 7 CREST ELEVATION 538

APPROXIMATE LIMITS OF PHASE 9 CONSTRUCTION

PHASE 9 MAXIMUM FINE COAL REFUSE LEVEL EL. 492.0

CONSTRUCT TEMPORARY DITCH

ABANDON EXISTING PIEZOMETERS IN PLACE

EXISTING ROAD UNDER EMBANKMENT LIMITS TO BE REMOVED PRIOR TO CONSTRUCTION

PHASE 2A MAXIMUM FINE COAL REFUSE LEVEL EL. 525.0

REFUSE CONVEYOR FROM PREPARATION PLANT

EXISTING FLUME

PHASE 9 CREST ELEVATION – 500

PHASE 7 CREST ELEVATION 538

CONSTRUCT SUMP TO COLLECT STORM RUNOFF TO BE PUMPED TO THE SEDIMENT DITCH

EXISTING 8–INCH GAS PIPELINE

CONSTRUCT TEMPORARY DITCH. SEE FIGURE NO. 17 FOR SIZE AND CONSTRUCTION DETAILS

EXISTING FLUME

PHASE 2A CREST ELEVATION 538

GATE INSTALLED END OF DWINA ROAD NORTH BOUND

DWINA ROAD

PERMIT NO. 417 EXCESS SPOIL STOCKPILE AREA

N 431000 N 430000 N 429000 N 428000 N 427000 N 426000 N 425000

E 358000 E 359000 E 360000 E 361000 E 362000 E 363000

P-9 P-10 P-11 P-21 P-22 P-12 P-13 P-14 P-17 P-15 P-16 P-20 P-19 P-18

C C D D

OFFICIAL SEAL
Notary Public, State of Illinois
JODY R SULESKY
PO Box 923
Benton, IL 62812
My commission expires October 25, 2015

062-050632
LICENSED PROFESSIONAL ENGINEER
CLAUDIO ELI YON
STATE OF ILLINOIS

SCALE
200 0 200 400 FEET

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES 10-25-2015

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

30 OCT 15

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

NOTES:

1. REFER TO FIGURE NO. 12 FOR STABILITY CROSS SECTIONS C–C AND D–D.
2. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.

LEGEND

- EXISTING 8" GAS PIPELINE
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- TEMPORARY DITCH
- EXISTING INTERNAL DRAIN
- P-13 EXISTING PIEZOMETER
- 100' STREAM BUFFER ZONE

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 SUMMERSVILLE, WV (304) 883-2360 CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

PHASE 9 PLAN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	MSR	02/28/12	PROJECT NO. B12–271–1413	FIGURE NO. 4
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12–271–M5	

R10491

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

DWINA ROAD

CONSTRUCT TEMPORARY FLUME

POND NO. 1

30 FOOT BENCH AND GUTTER

EXISTING PHASE 5A MAXIMUM FINE COAL REFUSE LEVEL EL. 513.5

PHASE 5A CREST ELEVATION 538

EXISTING FLUME NO.1

PHASE 7 CREST ELEVATION 538

PHASE 7 MAXIMUM FINE COAL REFUSE LEVEL EL. 525.0

PHASE 10 CREST ELEVATION 538

CONSTRUCT TEMPORARY FLUME

APPROXIMATE LIMITS OF PHASE 10 CONSTRUCTION

CONSTRUCT TEMPORARY DITCH

PHASE 9 MAXIMUM FINE COAL REFUSE LEVEL EL. 492.0

PHASE 10 MAXIMUM FINE COAL REFUSE LEVEL EL. 529.8

REFUSE CONVEYOR FROM PREPARATION PLANT

EXISTING FLUME NO. 2

PHASE 7 CREST ELEVATION 538

EXISTING 8-INCH GAS PIPELINE

CONSTRUCT SUMP TO COLLECT STORM RUNOFF TO BE PUMPED TO THE SEDIMENT DITCH

CONSTRUCT TEMPORARY DITCH. SEE FIGURE NO. 13 FOR SIZE AND CONSTRUCTION DETAILS

PHASE 2A MAXIMUM FINE COAL REFUSE LEVEL EL. 522.0

PHASE 2A CREST ELEVATION 538

EXISTING FLUME

GATE INSTALLED END OF DWINA ROAD NORTH BOUND

DWINA ROAD

PERMIT NO. 417 EXCESS SPOIL STOCKPILE AREA

E 358000 E 359000 E 360000 E 361000 E 362000 E 363000

N 431000 N 430000 N 429000 N 428000 N 427000 N 426000 N 425000

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050532

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC Jody R. Sulesky

THIS 24 DAY OF NOVEMBER MY COMMISSION EXPIRES October 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

NOTES:

1. REFER TO FIGURE NO. 12 FOR STABILITY CROSS SECTIONS C-C AND D-D.
2. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.

SCALE 200 0 200 400 FEET

LEGEND

- EXISTING 8" GAS PIPELINE
- EXISTING INTERNAL DRAIN
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- TEMPORARY DITCH
- P-20 EXISTING PIEZOMETER
- 100' STREAM BUFFER ZONE

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 SUMMERSVILLE, WV (304) 883-2360 CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

PHASE 10 PLAN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	MSR	02/28/12	PROJECT NO. B12-271-1413	FIGURE NO. 5
CHECKED BY	RPC	12/19/12		DRAWING NO. B12-271-M7
APPROVED BY	CEY	12/19/12		

CLAUDIO ELI YON 062-050532 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

OFFICIAL SEAL Notary Public, State of West Virginia JODY R SULESKY PO Box 923 Dover, WV 25813 My commission expires October 29, 2022

R10492

E 358000 E 359000 E 360000 E 361000 E 362000 E 363000

N 431000 N 430000 N 429000 N 428000 N 427000

CONSTRUCT BUTTRESS PRIOR TO PHASE 8 EMBANKMENT CONSTRUCTION PER APPROVED PLAN

DWINA ROAD

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

CONSTRUCT FLUME NO. 4

OUTLET NO. 10 DAYLIGHT AT 8.2%

POND NO. 1

OUTLET NO. 9 DAYLIGHT AT 8.2%

30 FOOT BENCH AND GUTTER

CONSTRUCT FLUME NO. 5

OUTLET NO. 8 DAYLIGHT AT 8.2%

EXISTING FLUME NO. 1

PHASE 7 CREST ELEVATION 538

PHASE 8 CREST ELEVATION 588

PHASE 11 CREST EL. 588

36" DIA. DR-26 HDPE DECANT PIPE AND FILTER DIAPHRAGM PER APPROVED PLAN

PROPOSED INTERNAL DRAIN

OUTLET NO. 7 DAYLIGHT AT 8.2%

PHASE 8 MAXIMUM FINE COAL REFUSE LEVEL EL. 582.0

EXCAVATE FINES DISPLACEMENT ZONE TO EL. 583.0 AFTER PHASE 11 EMBANKMENT CONSTRUCTION IS COMPLETE (SEE NOTE NO. 9)

CONSTRUCT FLUME NO. 6

PHASE 10 MAXIMUM FINE COAL REFUSE LEVEL EL. 529.8

PHASE 11 MAXIMUM FINE COAL REFUSE LEVEL EL. 581.1

OUTLET NO. 6 DAYLIGHT AT 8.2%

PHASE 11 EMBANKMENT LIMITS TO MATCH BENCH OF SEDIMENT DITCH

OUTLET NO. 5 DAYLIGHT AT 8.2%

REFUSE CONVEYOR FROM PREPARATION PLANT

EXISTING FLUME NO. 2

OUTLET NO. 2 DAYLIGHT AT 5.5%

OUTLET NO. 3 DAYLIGHT AT 5.5%

OUTLET NO. 4 DAYLIGHT AT 5.5%

INSTALL FILTER DIAPHRAGM AND OUTLET DRAIN – STATION 49+99 PRIOR TO EMBANKMENT CONSTRUCTION (SEE NOTE NO. 7)

FLUME NO. 3

CULVERT C-1 (3) 42" CMPS

OUTLET NO. 1 DAYLIGHT AT 5.5%

40' FOOT ACCESS ROAD AND GUTTER

GATE INSTALLED END OF DWINA ROAD NORTH BOUND

30 FOOT BENCH AND GUTTER

CONSTRUCT BUTTRESS PRIOR TO PHASE 8 EMBANKMENT CONSTRUCTION PRE APPROVED PLAN

CONSTRUCT PHASE 8 EMBANKMENT CONCURRENTLY WITH PHASE 11 CONSTRUCTION PER APPROVED PLAN AND AS OUTLINED IN THIS APPLICATION

PERMIT NO. 417 EXCESS SPOIL STOCKPILE AREA

NOTES:

1. REFER TO FIGURE NO. 12 FOR STABILITY CROSS SECTIONS C–C AND D–D AND PIEZOMETER TIP ELEVATIONS.
2. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.
3. REFER TO FIGURE NO. 13 FOR INTERNAL DRAIN SIZES AND DETAILS.
4. INTERNAL DRAIN ELEVATIONS MAY VARY SLIGHTLY TO ALLOW OUTLET DRAIN LINES TO DAYLIGHT AT BENCH GUTTER STRUCTURE.
5. ALL INTERNAL DRAIN COLLECTION LINES TO BE PLACED ON 0.5% SLOPE TO DRAIN AS SHOWN.
6. REFER TO FIGURE NO. 13 FOR PIEZOMETER INSTALLATION DETAILS.
7. FOR FILTER DIAPHRAGM AND OUTLET DRAIN DETAILS, REFER TO FIGURE NO. 15.
8. PHASE 8 SHALL BE CONSTRUCTED CONCURRENTLY WITH PHASE 11, AND IN ACCORDANCE WITH THE APPROVED PLAN.
9. A TRANSFER ZONE SHALL BE EXCAVATED AT THE END OF PHASE 11 CONSTRUCTION TO ALLOW FOR A PLANNED DISPLACEMENT OF FINE COAL REFUSE DUE TO ABANDONMENT CAPPING OF PHASE 8.
10. REFER TO APPLICATION FOR CONSTRUCTION TIMING.

LEGEND

- EXISTING 8" GAS PIPELINE
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- PROPOSED INTERNAL DRAIN
- EXISTING INTERNAL DRAIN
- 100' STREAM BUFFER ZONE
- P-28 EXISTING PIEZOMETER
- P-47 PROPOSED PIEZOMETER

SCALE 200 0 200 400 FEET

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yoo P.E. NO. 062-060632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES OCT 29 2022

CLAUDIO ELI YOO 062-060632 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

OFFICIAL SEAL Notary Public, State of West Virginia JODY R SULESKY PO Box 927 Bradley, WV 25813 My commission expires October 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

3001-715

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

PHASE 11 PLAN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/28/12	PROJECT NO. B12-271-1413	FIGURE NO. 6
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12-271-M8	

R10493

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

DWINA ROAD

30 FOOT BENCH AND GUTTER

EXTEND FLUME NO. 4

POND NO. 1

EXTEND FLUME NO. 5

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 13)

EXISTING FLUME NO. 1

ABANDON PHASE 8 DECANT PIPE BY REMOVING OR GROUTING IN PLACE

PHASE 12 CREST EL. 626

PHASE 8 CREST ELEVATION 588

PHASE 8 ABANDONMENT CAP (SEE NOTE 5)

28 INCH DIA. DR-17 HDPE DECANT PIPE

PHASE 12 MAXIMUM FINE COAL REFUSE LEVEL EL. 619.3

FILTER DIAPHRAGM AND OUTLET DRAIN

EXTEND FLUME NO. 6

EXTEND DECANT PIPE OUTLET DOWN SLOPE AT 18" (MIN) BELOW SURFACE. DAYLIGHT ON BENCH OR AT SEDIMENT DITCH

REFUSE CONVEYOR FROM PREPARATION PLANT

EXISTING FLUME NO. 2

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 13)

EXTEND FLUME NO. 3

CULVERT C-1 (3) 42" CMPS

GATE INSTALLED END OF DWINA ROAD NORTH BOUND

APPROXIMATE LIMITS OF PHASE 12 CONSTRUCTION

30 FOOT BENCH AND GUTTER

PERMIT NO. 417 EXCESS SPOIL STOCKPILE AREA

NOTES:

1. REFER TO FIGURE NO. 12 FOR STABILITY CROSS SECTIONS C-C, D-D, AND E-E AND PIEZOMETER TIP ELEVATIONS.
2. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.
3. REFER TO FIGURE NO. 13 FOR PIEZOMETER INSTALLATION DETAILS.
4. REFER TO FIGURE NO. 14 FOR DECANT PIPE AND FILTER DIAPHRAGM INSTALLATION DETAIL.
5. PHASE 8 ABANDONMENT CAP SHALL BE CONSTRUCTED PRIOR TO PHASE 12 CONSTRUCTION. REFER TO APPLICATION AND FIGURE NO. 9 FOR DETAILS.

LEGEND

- EXISTING 8" GAS PIPELINE
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- EXISTING INTERNAL DRAIN
- P-28 EXISTING PIEZOMETER
- P-50 PROPOSED PIEZOMETER
- 100' STREAM BUFFER ZONE

SCALE 200 0 200 400 FEET

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 21 DAY OF NOV 2012 MY COMMISSION EXPIRES Oct 19, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

3001-715

CLAUDIO ELI YON 062-050632 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

OFFICIAL SEAL Notary Public, State of West Virginia JODY R SULESKY PO Box 5881 Beaver, WV 25813 My commission expires October 19, 2022

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

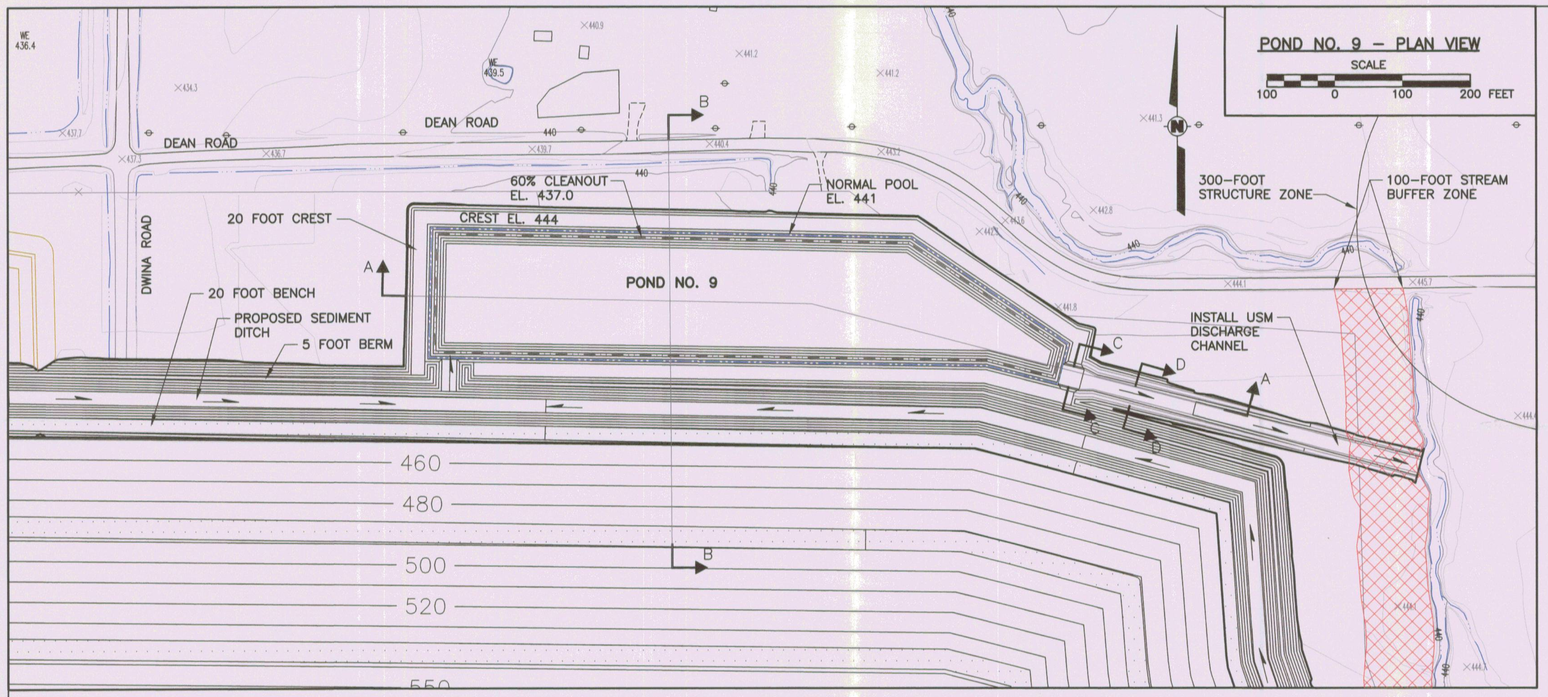
MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

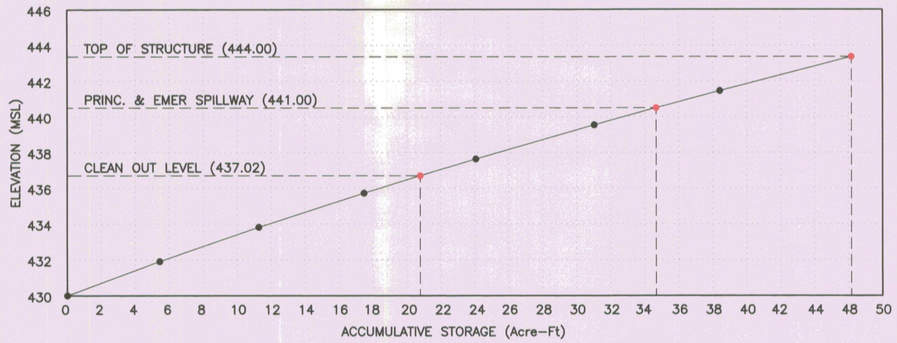
PHASE 12 PLAN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/28/12	PROJECT NO. B12-271-1413	FIGURE NO. 7
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12-271-M13	

R10494





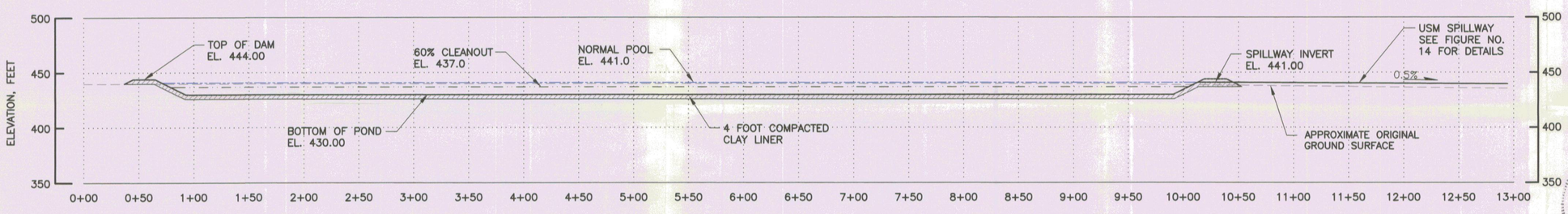
STAGE–STORAGE AREA CURVE

SEDIMENTATION POND NO. 9

SEDIMENT STORAGE REQUIRED	60% CLEANOUT VOLUME	STORAGE PROVIDED (TO NORMAL POOL)
24.60 ACRE–FEET	20.79 ACRE–FEET (EL. 437.0)	34.67 ACRE–FEET

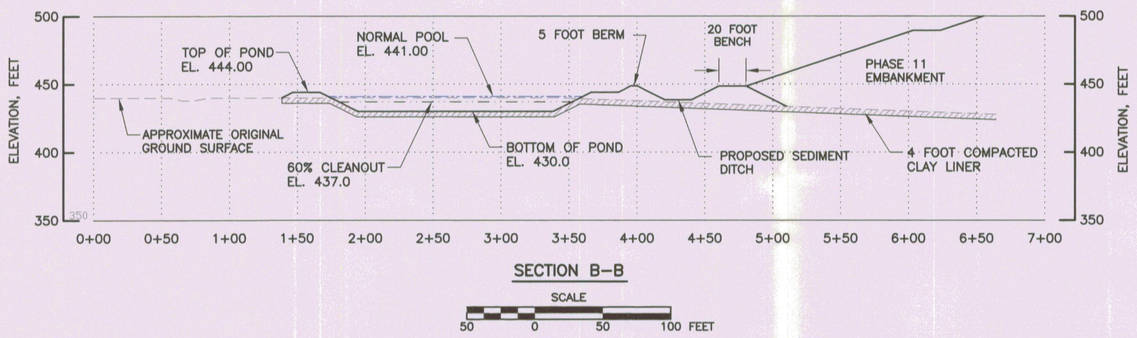
NOTES:

1. CONSTRUCTION OF POND NO. 9 WILL NOT EXCEED MSHA OR OWR REGULATIONS GOVERNING STRUCTURE CLASSIFICATION.
2. POND NO. 9 WILL BE INCISED AND WILL NOT EXCEED A HEIGHT OF FIVE FEET ABOVE THE UPSTREAM TOE OF THE STRUCTURE MEASURED FROM ORIGINAL GROUND.
3. REFER TO FIGURE NO. 2 FOR SURFACE DRAINAGE PLAN.
4. REFER TO FIGURE NOS. 13 AND 14 FOR DRAINAGE STRUCTURE DETAILS.



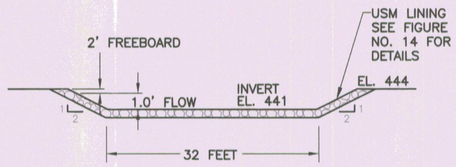
SECTION A–A

SCALE 50 0 50 100 FEET



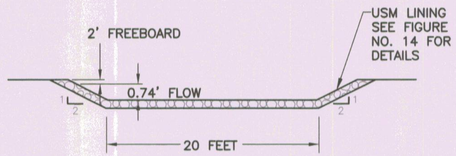
SECTION B–B

SCALE 50 0 50 100 FEET



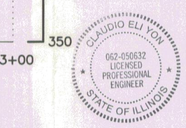
SPILLWAY CONTROL SECTION C–C

N.T.S.



SPILLWAY SLOPE SECTION D–D

N.T.S.

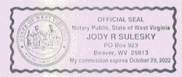


"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF Nov 2014 MY COMMISSION EXPIRES Oct 29, 2022

Jody R. Sulesky



*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

3001/15

REV.	DATE	DESCRIPTION	P.M.
1	07/21/14	REVISED SPILLWAY SIZE	

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

POND NO. 9 – PLAN AND SECTIONS

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/27/12	PROJECT NO. B12-271-1413	FIGURE NO. 8
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12-271-E2

Drawing: \\arc-data\ACAD\Drawings\2012\12-271\E2.dwg - Layout Tab: Model
Date: 12/19/2012 2:52pm - Plotted by: rmarshall
Xrefs: COMBINED-TOPO.dwg - PHASE11.dwg - POND-DITCH.dwg

R10495

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

POND NO. 9

FLUME NO. 4

FLUME NO. 5

FLUME NO. 1

FLUME NO. 7

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 13)

CONSTRUCT FLUME NO. 8

CONSTRUCT FLUME NO. 9

FLUME NO. 6

FLUME NO. 2

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 13)

EXISTING 8-INCH GAS PIPELINE

FLUME NO. 3

CULVERT C-1
(3) 42" CMPS
GATE INSTALLED
END OF DWINA ROAD NORTH BOUND

N 431000
N 430000
N 429000
N 428000
N 427000
N 426000
N 425000
E 358000
E 359000
E 360000
E 361000
E 362000
E 363000

SCALE
200 0 200 400 FEET

LEGEND:

PERMIT NO. 375 BOUNDARY

PERMIT NO. 417 BOUNDARY

NOTES:

1. PUMPS WILL BE MAINTAINED ONSITE THROUGH ABANDONMENT CONSTRUCTION TO EVACUATE THE DESIGN STORM UNTIL THE IMPOUNDING CAPABILITY HAS BEEN ELIMINATED.
2. REFUSE FACILITY SHALL BE ABANDONED AND SEEDED IN ACCORDANCE WITH THE ILLINOIS RECLAMATION PERMIT.
3. REFER TO FIGURE NO. 13 FOR DRAINAGE STRUCTURE DETAILS.
4. THE PHASE 8 ABANDONMENT CAP SHALL BE CONSTRUCTED PRIOR TO PHASE 12 EMBANKMENT CONSTRUCTION.
5. THE PHASE 12 ABANDONMENT CAP CONSTRUCTION MAY BEGIN IMMEDIATELY AFTER PHASE 12 EMBANKMENT CONSTRUCTION IS COMPLETE OR AFTER THE MAXIMUM PHASE 12 FINES LEVEL HAS BEEN REACHED AND THE FINE COAL REFUSE HAS CONSOLIDATED.
6. IF PHASE 12 ABANDONMENT BEGINS IMMEDIATELY AFTER EMBANKMENT CONSTRUCTION THE PHASE 12 DECANT WILL NOT BE REQUIRED TO BE INSTALLED.
7. REFER TO DRAWING NO. B12-271-E13 FOR LOCATION OF SEDIMENT DITCH PROFILE AND SECTION C-C THROUGH E-E.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 90
Thrasher, WV 25813
My Commission Expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050632

Jody R. Sulesky

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491
SUMMERSVILLE, WV (304) 883-2360
CANONSBURG, PA (724) 745-3630

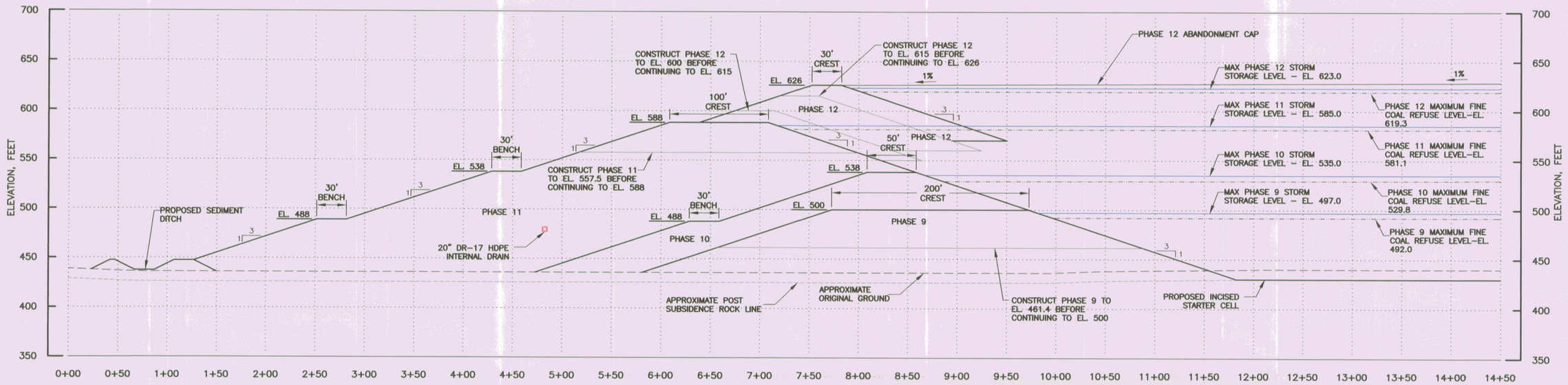
MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

ABANDONMENT PLAN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

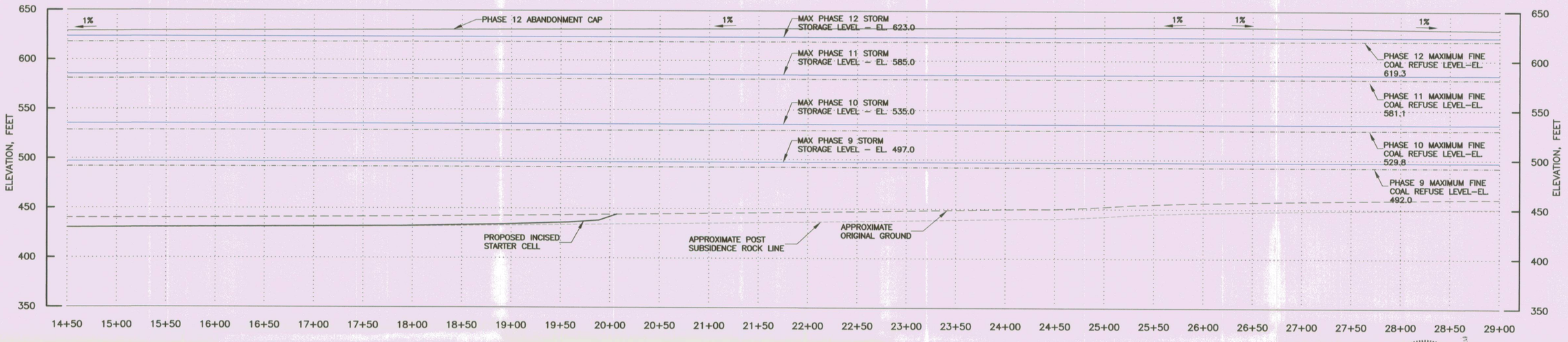
CAD BY	RAL	02/29/12	PROJECT NO. B12-271-1413	FIGURE NO. 9
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12-271-M16

R10496



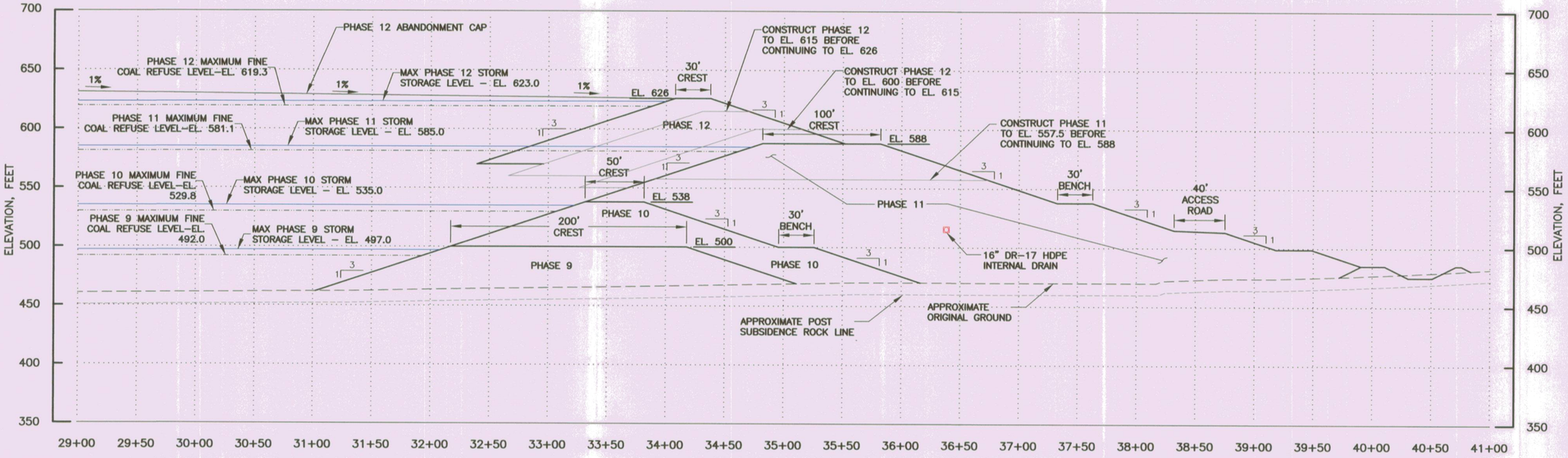
SECTION A–A

SCALE
50 0 50 100 FEET



SECTION A–A (CONTINUED)

SCALE
50 0 50 100 FEET



SECTION A–A (CONTINUED)

SCALE
50 0 50 100 FEET

NOTE:
FOR PLAN LOCATION OF SECTION A–A SEE FIGURE NO. 3.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon — P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct 29 2022

Jody R. Sulesky

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

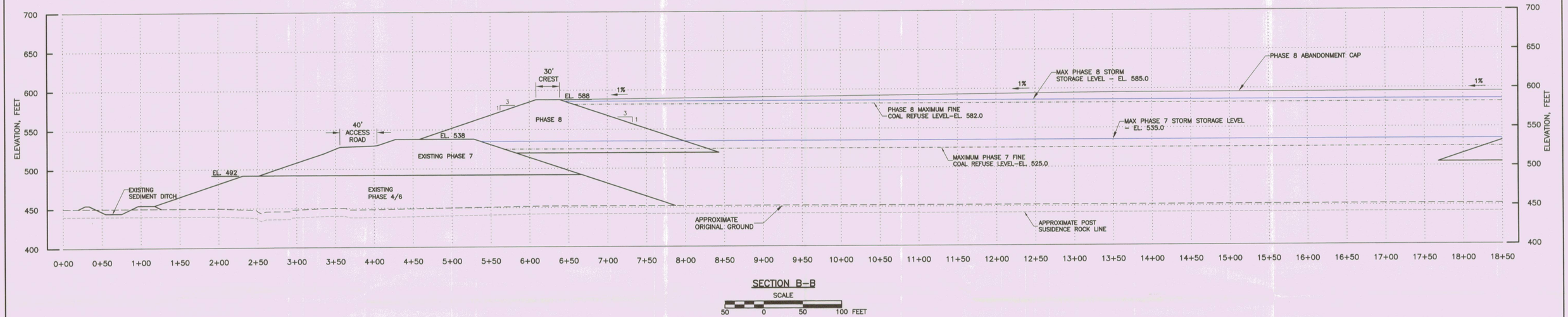
SECTION A–A

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/28/12	PROJECT NO. B12–271–1413	FIGURE NO. 10
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12–271–M14	

Design: \projects\AGS\DWG\B12271\M14.dwg - Layout Tab: Model
Date: Dec 01, 2014-2:17pm - Plotted by: mreadnour
Xrefs:

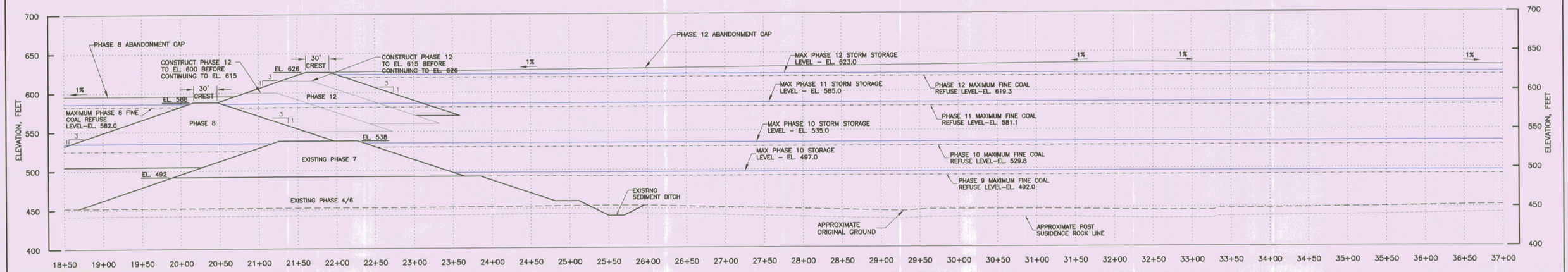
R10497



SECTION B–B

SCALE

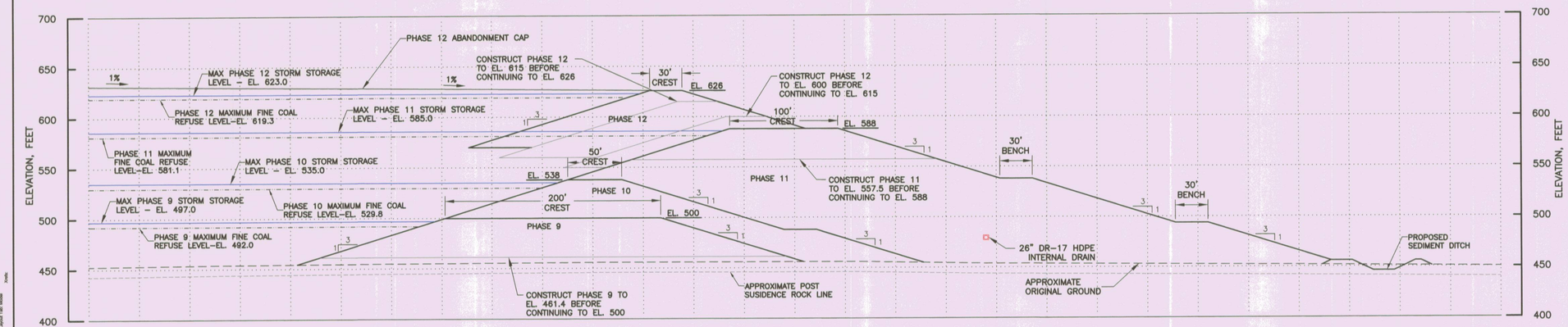
50 0 50 100 FEET



SECTION B–B (CONTINUED)

SCALE

50 0 50 100 FEET



SECTION B–B (CONTINUED)

SCALE

50 0 50 100 FEET

NOTE:
FOR PLAN LOCATION OF SECTION B–B SEE FIGURE NO. 3.

CLAUDIO ELI YON
862-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon — P.E. NO. 062-050632

OFFICIAL SEAL
Notary Public State of West Virginia
JODY R SULESKY
PO Box 973
Beaver, WV 25813
My commission expires October 24, 2022

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOVEMBER MY COMMISSION EXPIRES Oct 24 2022

Jody R. Sulesky

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

3001-715

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2380 · CANONSBURG, PA (724) 745-3630

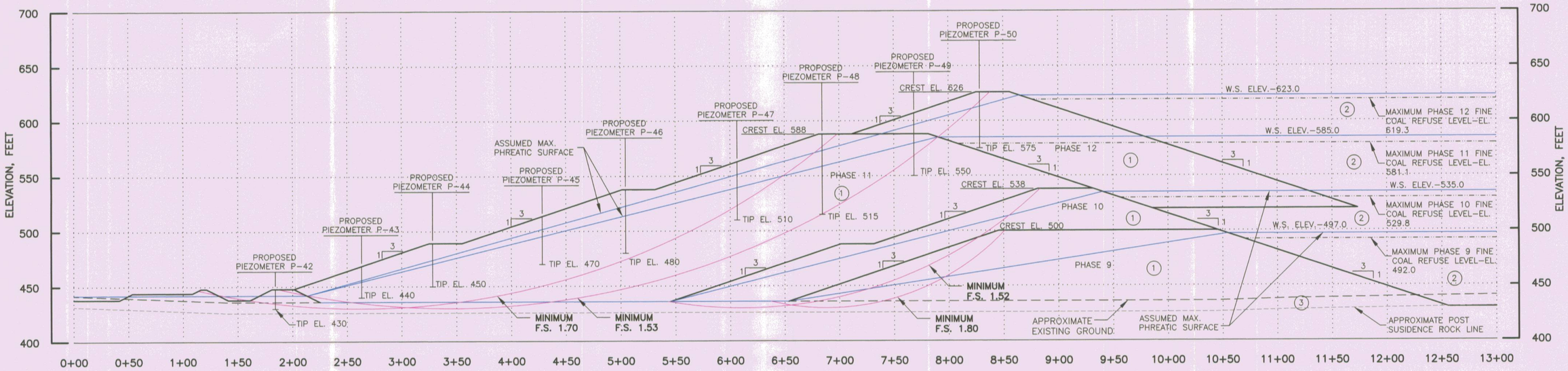
MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

SECTION B–B

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/29/12	PROJECT NO. B12–271–1413	FIGURE NO. 11
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12–271–M15

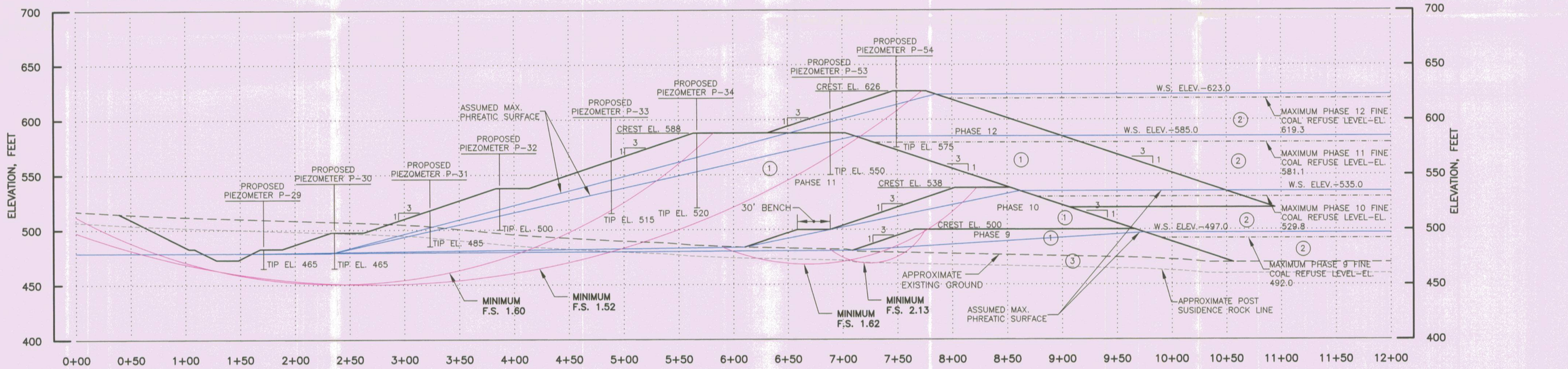
Drawing: S:\acad\PCN2\B\M\M15-12271-1413M15.dwg - Layout: Tab: Model
Date: Dec. 01, 2014 2:23pm - Plotted by: rcrawford



SECTION C-C

SCALE

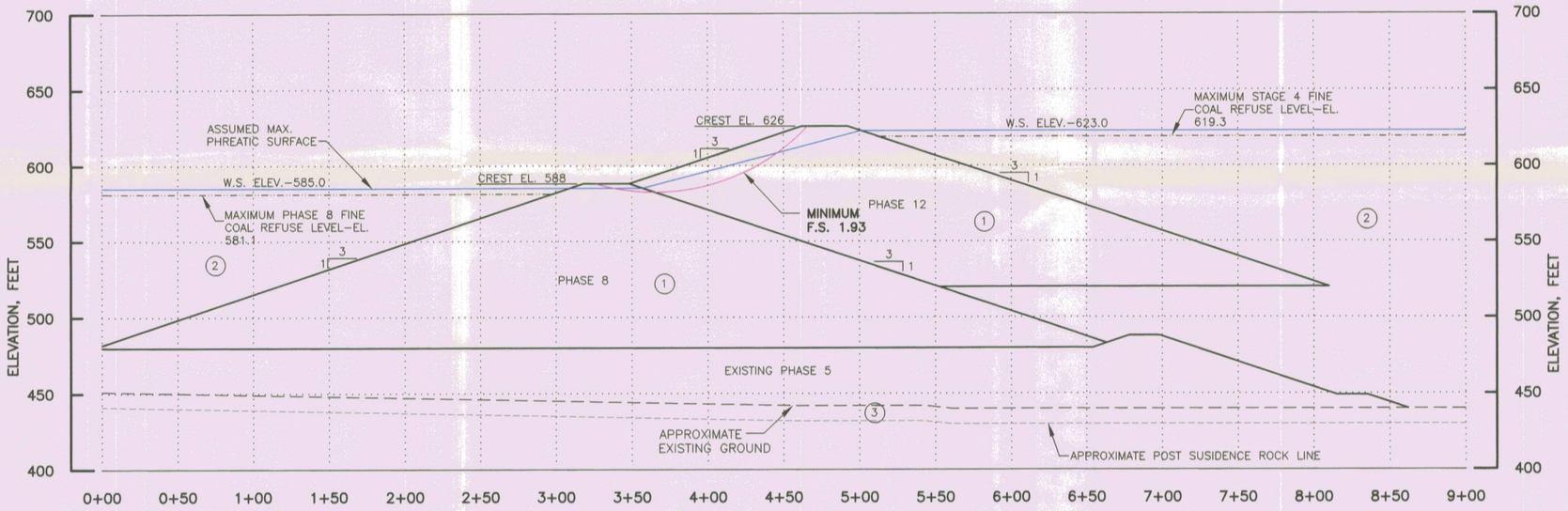
50 0 50 100 FEET



SECTION D-D

SCALE

50 0 50 100 FEET



SECTION E-E

SCALE

50 0 50 100 FEET

PIEZOMETER NO.	MAXIMUM ANTICIPATED WATER LEVEL ELEVATION, FT.	DESIGN TIP ELEVATION
P - 29	478.7	465
P - 30	479.6	465
P - 31	501.4	485
P - 32	518.9	500
P - 33	545.6	515
P - 34	565.9	520
P - 35	442.0	430
P - 36	455.9	440
P - 37	474.0	450
P - 38	501.8	470
P - 39	523.0	480
P - 40	551.3	510
P - 41	573.0	515
P - 42	442.0	430
P - 43	455.9	440
P - 44	474.0	450
P - 45	501.8	470
P - 46	523.0	480
P - 47	551.3	510
P - 48	573.0	515
P - 49	596.3	550
P - 50	613.0	575
P - 51	596.3	550
P - 52	613.0	575
P - 53	597.8	550
P - 54	613.6	575

NOTES:

1. THE PIEZOMETER WATER LEVELS LISTED ABOVE ARE BASED ON THE SLOPE STABILITY ANALYSES AND ESTIMATED TOP FLOW LINES. EXCEEDANCE OF THESE VALUES DOES NOT NECESSARILY MEAN THAT THE SLOPE STABILITY FACTOR OF SAFETY HAS BEEN REDUCED TO LESS THAN 1.5. IT DOES MEAN HOWEVER, THAT THE PHREATIC LEVEL IS HIGHER THAN ANTICIPATED. THEREFORE, IF ANY OF THE PIEZOMETRIC WATER LEVELS EXCEED THESE VALUES, THE SLOPE STABILITY SHOULD BE REANALYZED.
2. FOR PLAN LOCATION OF PIEZOMETERS SEE FIGURE NOS. 6 AND 7.
3. PIEZOMETER WARNING LEVELS ARE FOR THE FINAL PHASE 12 CONDITIONS

3001/15

MATERIAL PROPERTIES USED IN STABILITY ANALYSES

SOIL TYPE NO.	MATERIAL	TOTAL UNIT WEIGHT, (PCF)	SHEAR STRENGTH PARAMETERS	
			FRICTION ANGLE, (DEGREES)	COHESION, (PSF)
(1)	COARSE COAL REFUSE	130	33.7	0
(2)	FINE COAL REFUSE	80	28	0
(3)	EXISTING SOIL	125	26.8	0

NOTES:

1. MATERIAL PROPERTIES USED IN THE STABILITY ANALYSES ARE BASED ON LABORATORY TEST DATA AND OUR EXPERIENCE WITH SIMILAR MATERIAL.
2. REFER TO THE CALCULATION BRIEF (APPENDIX B) FOR UPSTREAM SLOPE STABILITY ANALYSES.
3. FOR THE STATIC STABILITY ANALYSIS, EFFECTIVE STRESS PROPERTIES WERE USED FOR THE COAL REFUSE AND EXISTING SOIL.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, Jody R. Sulesky

THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct 29 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

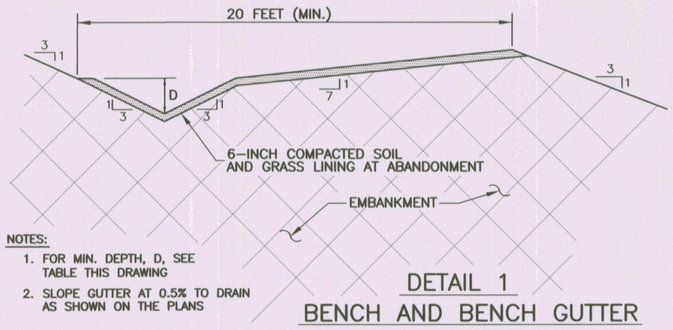
BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 746-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

SLOPE STABILITY SECTIONS (C-C THROUGH E-E)

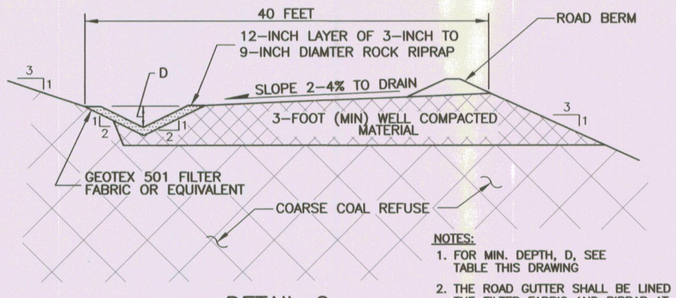
POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/28/12	PROJECT NO. B12-271-1413	FIGURE NO. 12
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12	DRAWING NO. B12-271-M11	



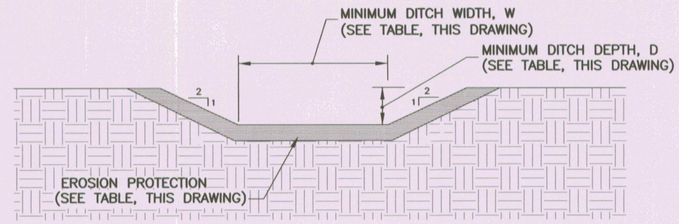
NOTES:
1. FOR MIN. DEPTH, D, SEE TABLE THIS DRAWING
2. SLOPE GUTTER AT 0.5% TO DRAIN AS SHOWN ON THE PLANS

DETAIL 1
BENCH AND BENCH GUTTER
N.T.S.

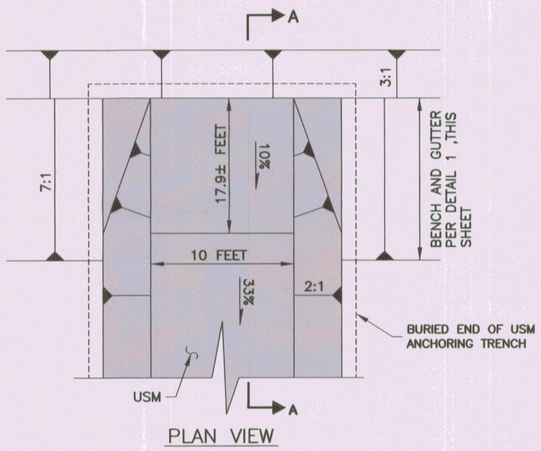


NOTES:
1. FOR MIN. DEPTH, D, SEE TABLE THIS DRAWING
2. THE ROAD GUTTER SHALL BE LINED WITH THE FILTER FABRIC AND RIPRAP AT ABANDONMENT. DURING ACTIVE OPERATIONS, THE ROAD SURFACE AND GUTTER SHALL BE MAINTAINED IN THE EMBANKMENT MATERIAL AND REPAIRED AS NECESSARY.

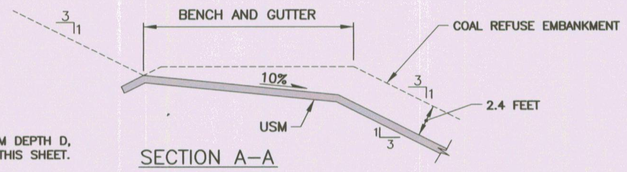
DETAIL 2
ROAD AND GUTTER
N.T.S.



DETAIL 3
DRAINAGE DITCH
N.T.S.



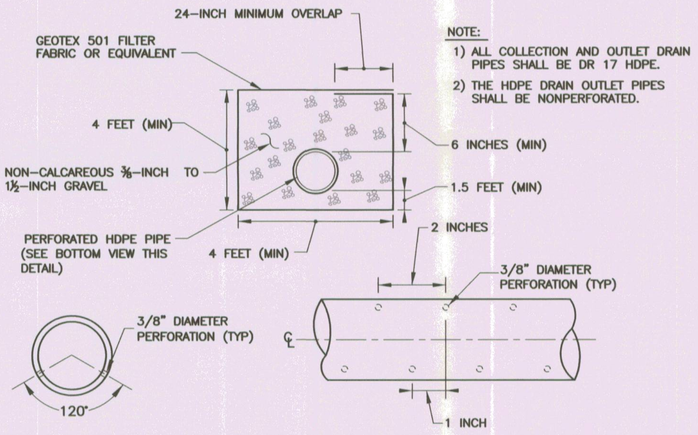
PLAN VIEW



NOTE:
FOR MINIMUM DEPTH D, SEE TABLE THIS SHEET.

SECTION A–A

DETAIL 4
BENCH GUTTER TO USM FLUME DITCH ENTRANCE
N.T.S.



NOTE:
1) ALL COLLECTION AND OUTLET DRAIN PIPES SHALL BE DR 17 HDPE.
2) THE HDPE DRAIN OUTLET PIPES SHALL BE NONPERFORATED.

END VIEW

BOTTOM VIEW

DETAIL 5
GRAVEL/PIPE UNDERDRAIN DETAIL
N.T.S.

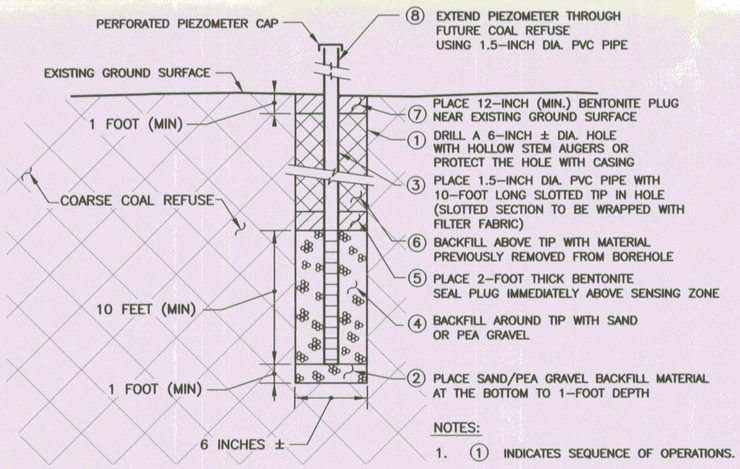
UNDERDRAIN COLLECTION PIPE DESIGN

OUTLET	SLOPE (%)	DIA. (INCHES)	Q_{REQ} (CFS)	Q_{FULL} (CFS)
1	0.5	16	3.19	3.30
2	0.5	16	3.19	3.30
3	0.5	16	3.19	3.30
4	0.5	16	3.19	3.30
5	0.5	20	3.55	5.98
6	0.5	20	3.55	5.98
7	0.5	26	9.92	12.03
8	0.5	26	9.92	12.03
9	0.5	22	6.55	7.71
10	0.5	22	6.55	7.71

UNDERDRAIN OUTLET DRAIN PIPE DESIGN

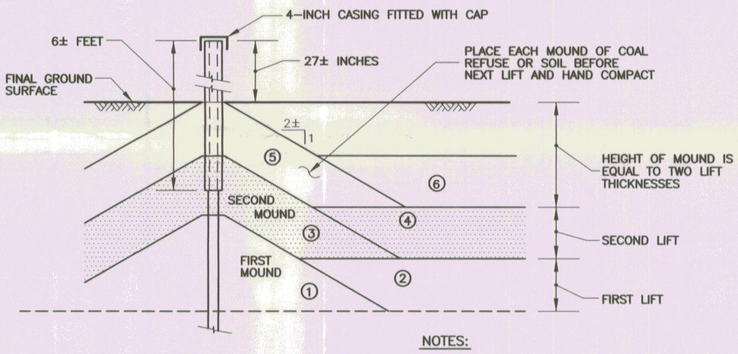
OUTLET	SLOPE (%)	DIA. (INCHES)	Q_{REQ} (CFS)	Q_{FULL} (CFS)
1	5.5	16	6.39	10.93
2	5.5	16	6.39	10.93
3	5.5	16	6.39	10.93
4	5.5	16	6.39	10.93
5	8.2	20	7.10	24.20
6	8.2	20	7.10	24.20
7	8.2	26	19.85	48.73
8	8.2	26	19.85	48.73
9	8.2	22	13.10	31.21
10	8.2	22	13.10	31.21

NOTE:
FOR LOCATION OF PIPE UNDERDRAINS, SEE FIGURE NO. 6. COLLECTION LINES SHALL BE PERFORATED PER DETAIL NO. 5 THIS SHEET. OUTLET LINES SHALL BE NON–PERFORATED.



NOTES:
1. ① INDICATES SEQUENCE OF OPERATIONS.
2. IF PNEUMATIC PIEZOMETERS ARE INSTALLED, USE SAME DETAIL EXCEPT REPLACE SLOTTED PVC WITH PNEUMATIC SENSOR EPOXIED INTO STANDARD WELL POINT.

DETAIL 6
PIEZOMETER INSTALLATION
N.T.S.



NOTES:
① INDICATES SEQUENCE OF OPERATIONS.

DETAIL 7
PIEZOMETER EXTENSION PROCEDURE
N.T.S.

ROCK RIPRAP GRADATION LIMITS

DITCH	D_{100}* (INCHES)	D_{50}* (INCHES)	D_{15}* (INCHES)	MINIMUM LAYER THICKNESS,(IN)
ROAD GUTTER	13.5 TO 16	9 TO 10.5	4 TO 5	16
GROUTED ROCK RIPRAP FLUMES**	13.5 TO 16	9 TO 10.5	4 TO 5	16

* PERCENT OF THE ROCK PARTICLES (BY WEIGHT) THAT ARE SMALLER THAN THE SPECIFIED PARTICLE DIAMETER (D).

** GROUT PENETRATION SHALL BE A MINIMUM OF 12 INCHES.

SURFACE DRAINAGE FACILITIES DESIGN PARAMETERS

ITEM	DETAIL NO.	MINIMUM CHANNEL DEPTH, D (FT.)	BOTTOM WIDTH, W (FT.)	TYPE OF CHANNEL	PEAK DESIGN FLOW, (CFS)	MANNINGS "N"	DESIGN SLOPE, (%)	FLOW DEPTH, (FT.)	VELOCITY, (FPS)	PERMANENT EROSION PROTECTION
FLUME NOS. 1–9	5*	2.4	10	TRAPEZOIDAL	269.44	0.015	33.0	0.63	38.23	USM*
FLUME NOS. 1–9	3	2.4	10	TRAPEZOIDAL	269.44	0.035	33.0	0.63	38.23	GROUTED ROCK RIPRAP
TEMPORARY FLUME	3	3.3	15	TRAPEZOIDAL	269.44	0.066	33.0	1.19	13.08	ROCK RIPRAP
PERIMETER DITCH	5*	3.2	10	TRAPEZOIDAL	130.76	0.045	1.0	2.10	4.40	SOIL AND GRASS LINING
SEDIMENT DITCH	3	8.36	20	TRAPEZOIDAL	81.64	0.033	0.25	6.40	2.43	SOIL AND GRASS LINING
TEMPORARY CONVEYANCE DITCH	5	2.1	8	TRAPEZOIDAL	121.00	0.015	6.7	0.71	18.21	GROUTED ROCK RIPRAP
ACCESS ROAD GUTTER	2	2.0	0	TRIANGULAR	8.82	0.035	10.0	0.80	6.78	ROCK RIPRAP
BENCH GUTTER	1	2.4	0	TRIANGULAR	40.8	0.033	0.5	2.08	3.15	SOIL AND GRASS LINING

NOTES:
* REFER TO FIGURE NO. 14 FOR DETAIL INSTALLATION AND SIZE OF UNIFORM SECTION MAT (USM).

CLAUDIO ELI YUN
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 563
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yun R.P.E. NO. 062-050632

Jody R. Sulesky

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES 10/29/2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255–0491
SUMMERSVILLE, WV (304) 883–2360
CANONSBURG, PA (724) 745–3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417
MISCELLANEOUS DETAILS
POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

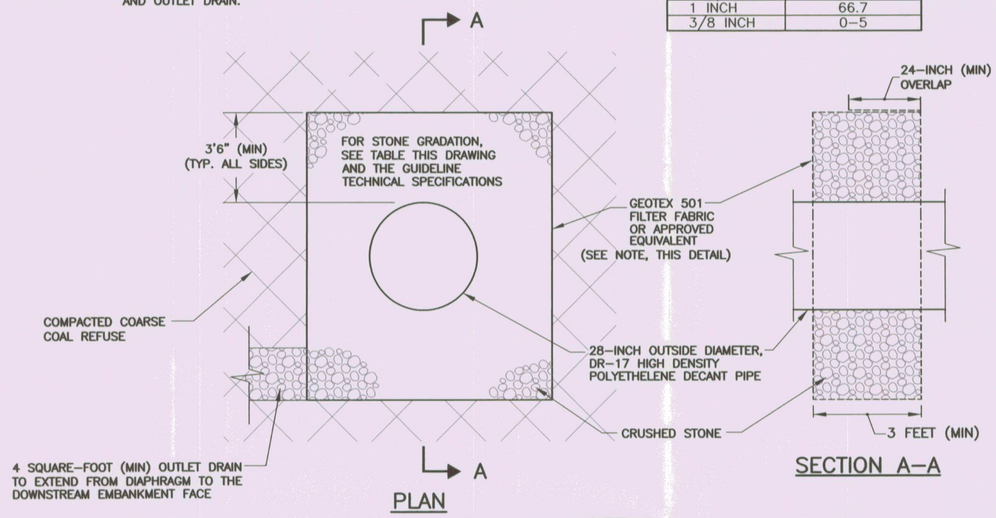
CAD BY	RAL	02/28/12	PROJECT NO. B12–271–1413	FIGURE NO. 13
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12–271–M4

Drawing: \\en-sharePCADDRAWINGS\2271\2271M4.dwg - Layout Tab: Model
Date: Dec 21, 2014 2:12pm - Plotted by: smeadows
Xrefs:

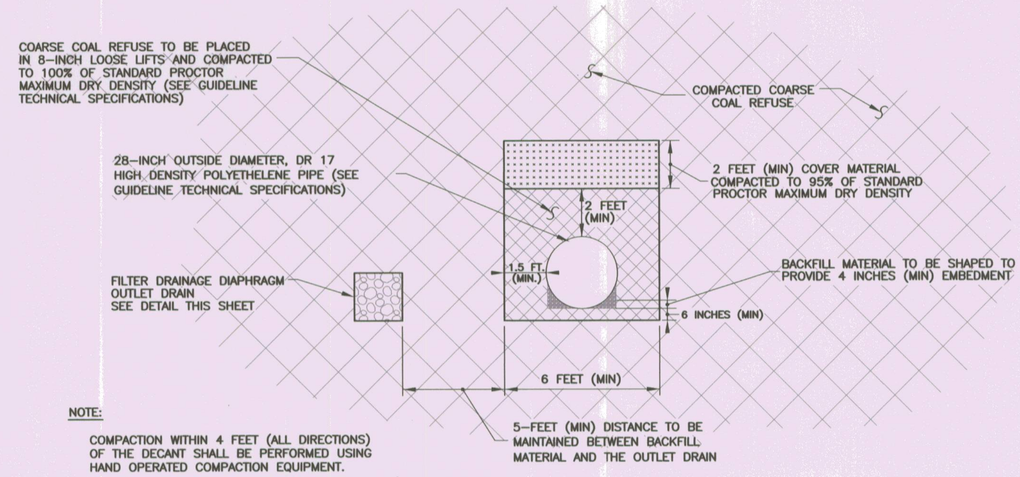
NOTE:

THE FILTER DRAINAGE DIAPHRAGM SHALL BE WRAPPED ENTIRELY WITH FILTER FABRIC INCLUDING FABRIC BETWEEN THE DIAPHRAGM AND OUTLET DRAIN.

TABLE OF STONE GRADATION	
STONE SIZE	PERCENT FINER
1–1/2 INCH	100
1 INCH	66.7
3/8 INCH	0–5



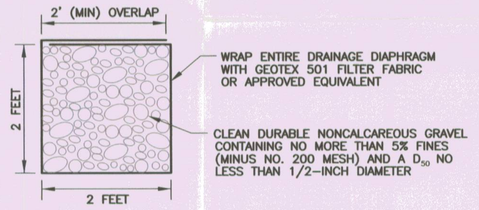
DETAIL 1
DECANT FILTER–DRAINAGE DIAPHRAGM
N.T.S.



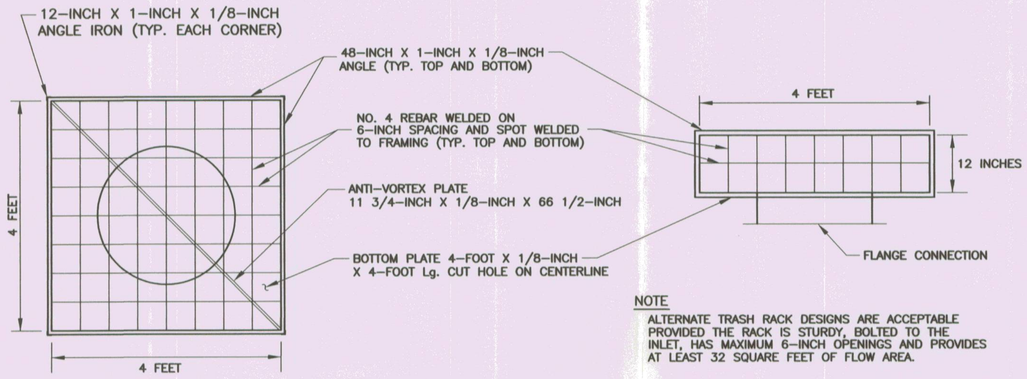
NOTE:

COMPACTION WITHIN 4 FEET (ALL DIRECTIONS) OF THE DECANT SHALL BE PERFORMED USING HAND OPERATED COMPACTION EQUIPMENT.

DETAIL 2
DECANT PIPE INSTALLATION
N.T.S.



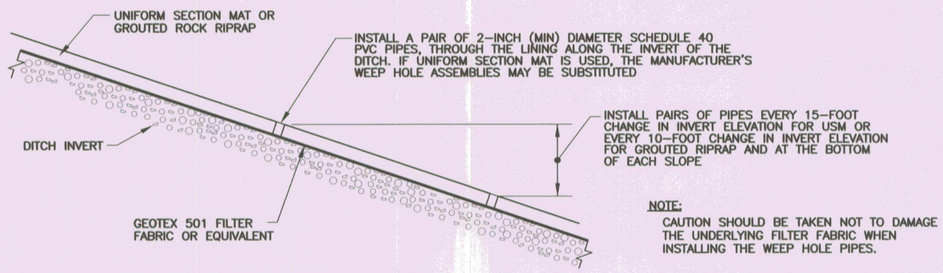
DETAIL 4
DECANT FILTER DRAINAGE DIAPHRAGM OUTLET DRAIN
N.T.S.



NOTE

ALTERNATE TRASH RACK DESIGNS ARE ACCEPTABLE PROVIDED THE RACK IS STURDY, BOLTED TO THE INLET, HAS MAXIMUM 6–INCH OPENINGS AND PROVIDES AT LEAST 32 SQUARE FEET OF FLOW AREA.

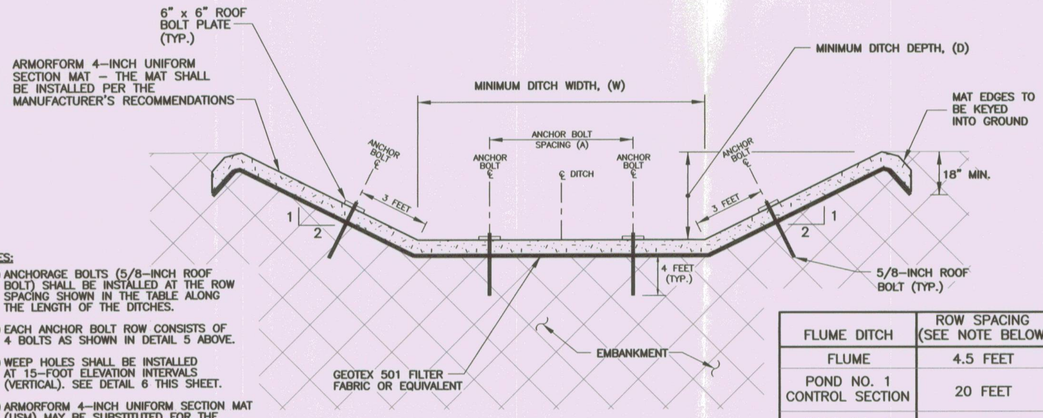
DETAIL 3
TRASH RACK
N.T.S.



NOTE:

CAUTION SHOULD BE TAKEN NOT TO DAMAGE THE UNDERLYING FILTER FABRIC WHEN INSTALLING THE WEEP HOLE PIPES.

DETAIL 6
WEEP HOLE PIPE INSTALLATION
N.T.S.

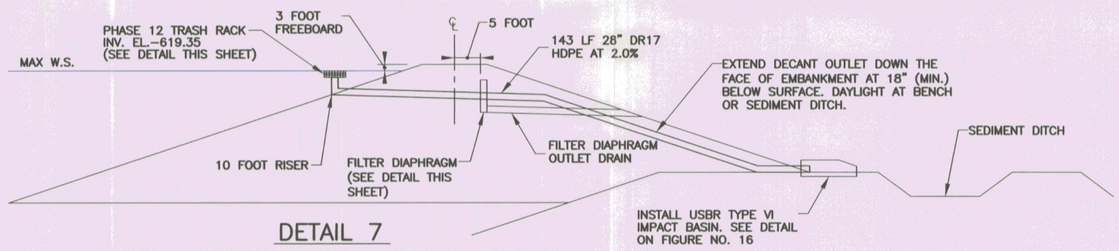


NOTES:

1) ANCHORAGE BOLTS (5/8–INCH ROOF BOLT) SHALL BE INSTALLED AT THE ROW SPACING SHOWN IN THE TABLE ALONG THE LENGTH OF THE DITCHES.
2) EACH ANCHOR BOLT ROW CONSISTS OF 4 BOLTS AS SHOWN IN DETAIL 5 ABOVE.
3) WEEP HOLES SHALL BE INSTALLED AT 15–FOOT ELEVATION INTERVALS (VERTICAL). SEE DETAIL 6 THIS SHEET.
4) ARMORFORM 4–INCH UNIFORM SECTION MAT (USM) MAY BE SUBSTITUTED FOR THE GROUTED ROCK RIPRAP. THE MAT SHALL BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS AND PER DETAIL 5.
5) ALL UNIFORM SECTION MAT PANEL OVERLAPS TO BE IN DIRECTION OF FLOW.

FLUME DITCH	ROW SPACING (SEE NOTE BELOW)	MINIMUM DITCH WIDTH, (W)	MINIMUM DITCH DEPTH, (D)	ANCHOR BOLT SPACING, (A)
FLUME	4.5 FEET	10 FEET	2.4 FEET	5 FEET
POND NO. 1 CONTROL SECTION	20 FEET	30 FEET	4 FEET	15 FEET
POND NO. 1 SLOPE SECTION	20 FEET	20 FEET	2.65 FEET	10 FEET

DETAIL 5
4–INCH UNIFORM SECTION MAT (USM) INSTALLATION DETAIL
N.T.S.



DETAIL 7
TYPICAL DECANT INSTALLATION SECTION
N.T.S.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, Jody R. Sulesky

THIS 14 DAY OF Nov 2012 MY COMMISSION EXPIRES 10/29/2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255–0491
SUMMERSVILLE, WV (304) 883–2360
CANONSBURG, PA (724) 745–3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

DECANT AND UNIFORM SECTION MAT DETAILS

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	MSR	02/27/12	PROJECT NO. B12–271–1413	FIGURE NO. 14
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12–271–M9

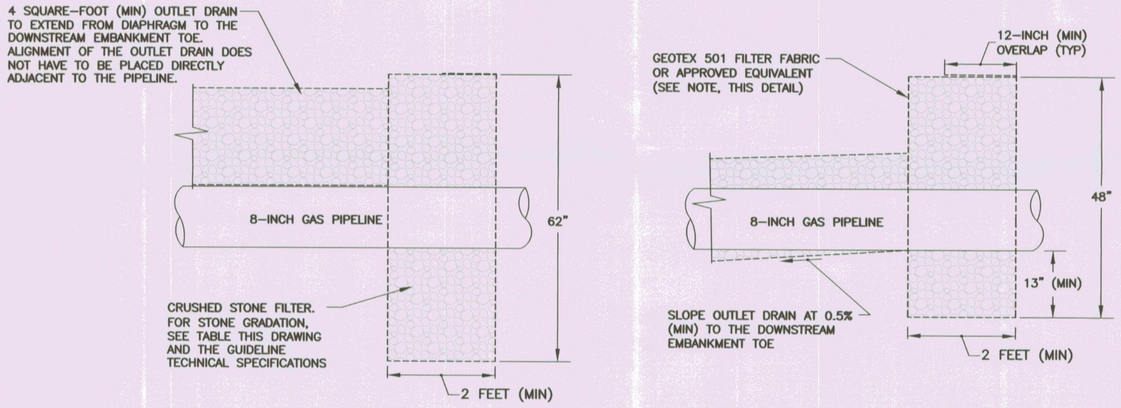
Drawing: tags-esa/CAD/Maps/B12271/12271M9.dwg – Layout Tab: Model
Date: Dec 21, 2012 4:19pm – Plotted By: smeadows

R10501

TABLE OF STONE GRADATION	
STONE SIZE	PERCENT FINER
1–1/2 INCH	100
1 INCH	66.7
3/8 INCH	0–5

NOTE:

THE FILTER DRAINAGE DIAPHRAGM SHALL BE WRAPPED ENTIRELY WITH FILTER FABRIC INCLUDING FABRIC BETWEEN THE DIAPHRAGM AND OUTLET DRAIN. OVERLAP EDGES OF GEOTEXTILE 12" (MIN) IN ALL AREAS.



DETAIL 3
GAS PIPELINE FILTER–DRAINAGE DIAPHRAGM

N.T.S.

NOTE:

FOR PLAN LOCATION OF FILTER DIAPHRAGM, SEE FIGURE NO. 6.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, Jody R. Sulesky

THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

SCALE
1 0 1 2 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255–0491 · SUMMERSVILLE, WV (304) 883–2360 · CANONSBURG, PA (724) 745–3630

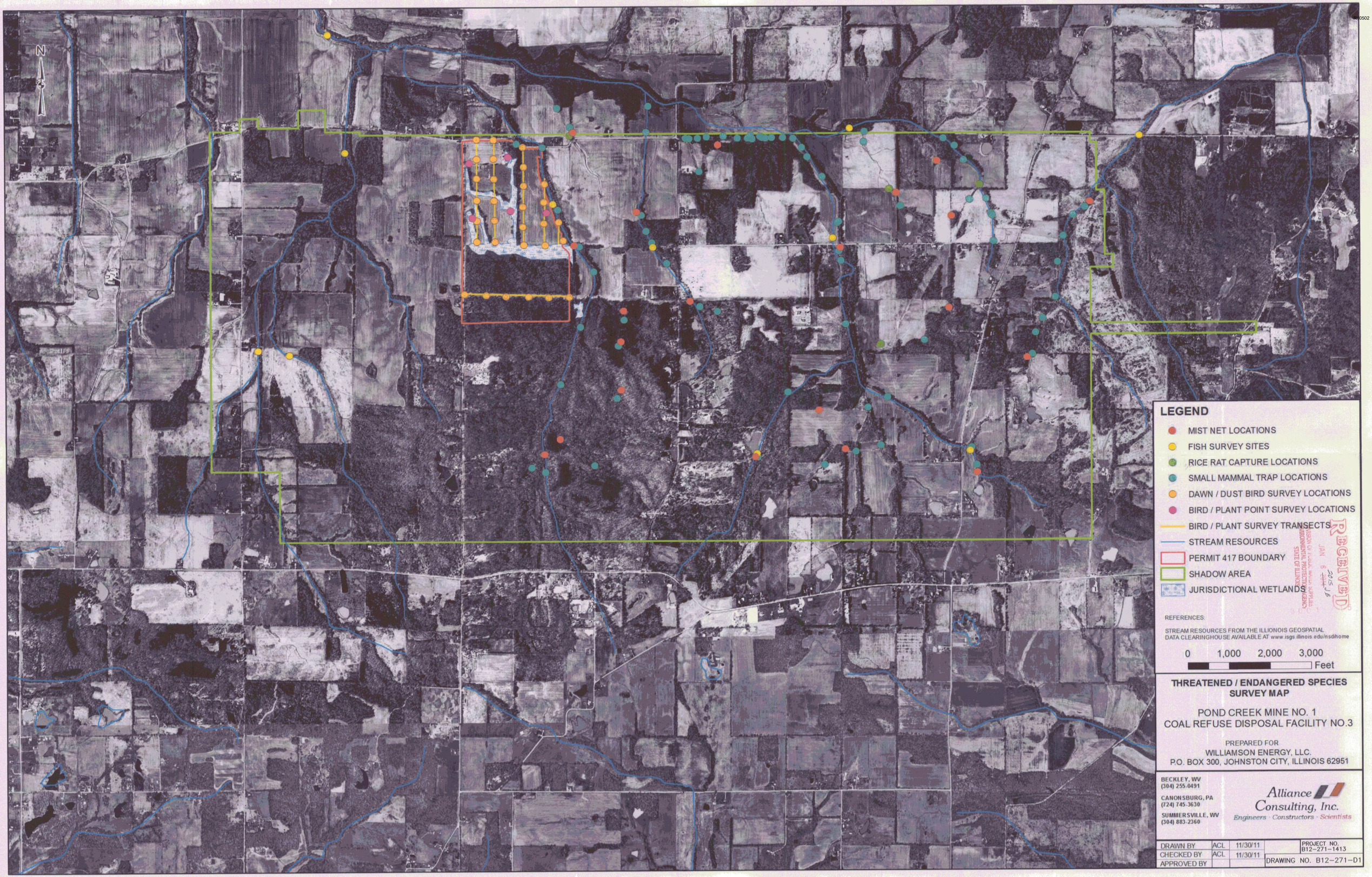
MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

GAS PIPELINE FILTER DIAPHRAGM DESIGN

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DJS	12/18/12	PROJECT NO. B12–271–1413	FIGURE NO. 15
CHECKED BY	RPC	12/19/12		
APPROVED BY	CEY	12/19/12		DRAWING NO. B12–271–E3

Drawing: Jenna\ACAD\Williamson\2012\271E3.dwg - Layout Tab: Model
Date: Dec 31, 2014 2:39pm - Plotted by: mmeeks



THREATENED / ENDANGERED SPECIES SURVEY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO.3

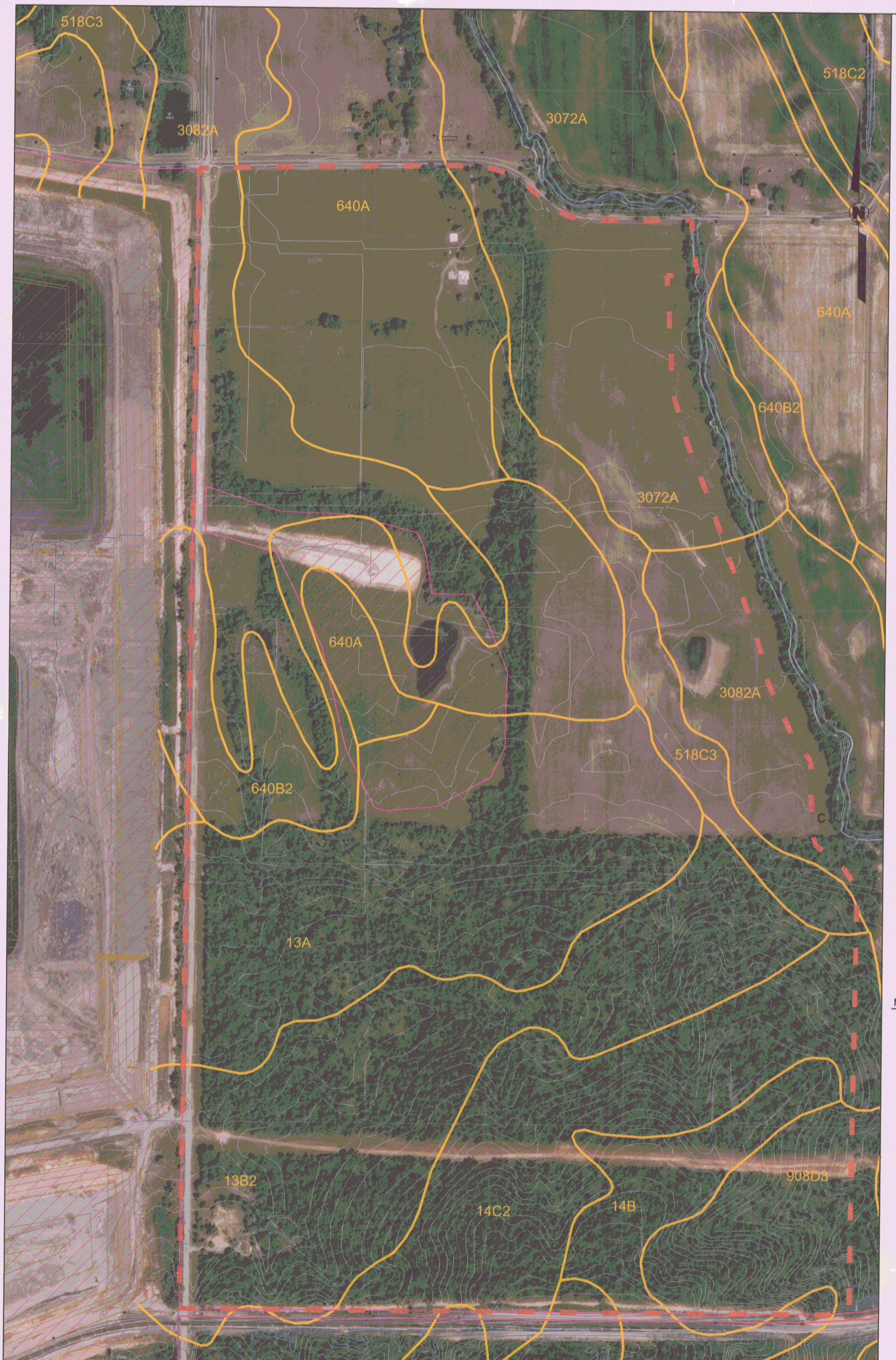
PREPARED FOR
WILLIAMSON ENERGY, LLC.
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV
(304) 255-0491
CANONSBURG, PA
(724) 745-3630
SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	11/30/11		PROJECT NO. B12-271-1413
CHECKED BY	ACL	11/30/11		
APPROVED BY				DRAWING NO. B12-271-D1

R10503



LEGEND

- SOIL CLASSIFICATION LINE
- PERMIT NO. 417 BOUNDARY
- PERMIT NO. 375 BOUNDARY

STRUCTURES

1	RESIDENCE (OCCUPIED)
1VAC	RESIDENCE (UNOCCUPIED)
2	MOBILE HOME (OCCUPIED)
2VAC	MOBILE HOME (UNOCCUPIED)
3	SHED
4	GARAGE
5	BARN
6	GRAIN BIN OR SILO

SOIL INFORMATION

Soil ID	Soil Series	Slope (%)	Capability	Acres
13A	Bluford	0–2	PF[1]	39.08
13B2	Bluford	2–5	PF	37.49
14B	Ava	2–5	PF	8.60
14C2	Ava	5–10	HC	24.44
301B	Grantsburg	2–5	PF	0.57
340D3	Zanesville	10–18	LC	0.05
518C3	Rend	5–10	LC	9.35
640A	Bluford (bench)	0–2	PF	27.85
640B2	Bluford (bench)	2–5	PF	24.09
908D3	Hickory–Kell	10–18	LC	10.24
3072A	Sharon	0–2	PF[2]	18.40
3382A	Belknap	0–2	PF[2]	29.62
	TOTAL ACREAGE			229.78

NOTE:

PF[1] – Prime farmland if drained.

PF[2] – Prime farmland if drained & protected from flooding or not frequently flooded.

PF = Prime Farmland

HC = High Capability

LC = Limited Capability

NOTES:

1) FOR DETAILED INFORMATION ON SOIL SUITABILITIES, LIMITATIONS FOR USE, LAND CLASSIFICATIONS AND VEGETATIVE PRODUCTIVITY, REFER TO THE SOIL RESOURCE REPORT CONTAINED IN PART II, ATTACHMENT II.13.A OF THE PERMIT APPLICATION.

2) FOR TOPSOIL THICKNESS MEASUREMENT REPORT AND THICKNESS, ATTACHMENT II–13–D OF PERMIT APPLICATION.

SCALE

200 0 200 400 FEET

3001715

REV.	DATE	DESCRIPTION	
2	12/12/14	REVISE SOILS CAPABILITY DESCRIPTION	SMS
1	11/14/14	ADDED NOTES 1 AND 2	CEY

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255–0491 | SUMMERSVILLE, WV (304) 883–2360 | CANONSBURG, PA (724) 745–3630

IDNR–M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 5 – SOILS MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

Prepared For

WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	MSR	02/28/12	PROJECT NO. B12–271–1413	
CHECKED BY	SMS	06/21/13		
APPROVED BY	CEY	06/28/13	DRAWING NO. B12–271–E5	

R10504

Dwina Rd

Dean Rd

Dean Rd

Jordan's Fort Rd

Jordans Fort R

T8S R3E 1

T8S R4E 6

T8S R4E 5

T8S R3E 12

T8S R4E 7

T8S R4E 8

T8S R3E 13

T8S R4E 18

A080301-302
A080301-402
A080301-403
A080301-401
A080301-404
A080301-412
A080301-406
A080301-409
A080301-407
A080301-408
400.007 Surf 10 Ac (Alex Paula) New River Royalty, LLC

A080406-301
A080406-302
A080406-403
A080406-303
A080406-311
A080406-310
A080406-305
A080406-402
A080406-309
A080406-308
A080406-306
A080406-404

A080405-301
A080405-401
A080405-302
8405300-002
A080405-303
A080405-305
A080405-304
A080405-307
A080405-403
A080405-306

A080407-101
A080407-103
A080407-105
A080407-2XX
A080407-104
A080407-102
A080407-201
A080407-202
A080407-106
A080407-107
A080407-108
A080407-301
A080407-302
A080407-303
A080407-203
A080407-205
A080407-206
A080407-415
A080407-417
A080407-401
A080407-410
A080407-4??
A080407-419
A080407-405
A080407-402
A080407-406
A080407-407
A080407-408
A080407-304
A080407-305

A080408-101
A080408-102
A080408-206
A080408-103
A080408-104
A080408-108
A080408-107
A080408-110
A080408-106
A080408-201
A080408-101
A080408-303
A080408-304
A080408-410
A080408-413
A080408-414
A080408-307
A080408-308
A080408-415
A080408-309
A080408-412
A080408-305

A080312-203
A080312-201
A080312-202
A080312-103
A080312-204
A080312-105
A080312-302
A080312-401
A080312-303
A080312-305
A080312-402
A080312-403
A080312-404

A080313-201
A080313-202
A080313-203
A080313-103
A080313-204
A080313-206
A080313-207
A080313-208
A080313-210
A080313-212
A080313-105
A080313-211
A080313-209
A080313-426
A080313-402
A080313-312
A080313-428
A080313-427
A080313-429
A080313-417

A080418-207
A080418-210
A080418-206
A080418-203
A080418-201
A080418-101
A080418-102
A080418-213
A080418-214
A080418-215
A080418-301
A080418-302
A080418-317

A080417-102
A080417-101
A080417-201
A080417-106
A080417-109

0' 400' 800' 1200'
SCALE 1" = 400'

LEGEND

1 RESIDENCE (OCCUPIED)
1VAC RESIDENCE(UNOCCUPIED)
2 MOBILE HOME(OCCUPIED)
2VAC MOBILE HOME(UNOCCUPIED)
3 SHED
4 GARAGE
5 BARN
6 GRAIN BIN OR SILO

PROPOSED PERMIT #417 BOUNDARY
ADJACENT PERMIT #375 BOUNDARY
RANGE/SECTION LINES
SECTION CENTERS
EXISTING ROADWAY
1/2 MILE RADIUS

REV.	DATE	DESCRIPTION	P.M.
1	11/07/14	UPDATED DWINA ROAD LAYOUT	

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

IDNR-M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 2 – IDENTIFICATION OF INTERESTS

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA
Prepared For
WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	SMS	06/12/12	PROJECT NO. B12-271-1413
CHECKED BY	JLP	06/21/13	
APPROVED BY	CEY	06/28/13	DRAWING NO. B12-271-E7

R10505



LEGEND

PERMIT NO. 417 BOUNDARY

PERMIT NO. 375 BOUNDARY

STRUCTURES

1 RESIDENCE (OCCUPIED)

1VAC RESIDENCE (UNOCCUPIED)

2 MOBILE HOME (OCCUPIED)

2VAC MOBILE HOME (UNOCCUPIED)

3 SHED

4 GARAGE

5 BARN

6 GRAIN BIN OR SILO

PRE-MINE LAND USE

CROPLAND

FORESTRY

RESIDENTIAL

WILDLIFE HABITAT

INDUSTRIAL/COMMERCIAL

WATER

ROADS

NOTES:

1. NO KNOWN ARCHELOGICAL SITE LISTED OR ELIGIBLE TO BE LISTED ON NATIONAL REGISTER OF HISTORIC PLACES.
2. NO CEMETERIES LOCATED WITHIN 1/2 MILE OF PERMIT BOUNDARY.

0′ 400′ 800′ 1200′

3001/15

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

IDNR-M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 3 S.F. – ENVIRONMENTAL RESOURCES MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

Prepared For

WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	SMS	06/14/12	PROJECT NO. B12-271-1413
CHECKED BY	SMS	06/21/13	
APPROVED BY	CEY	06/28/13	DRAWING NO. B12-271-E6

R10506

PC-2

STRIKE N 40°W

DIP 7° NE

N

PC-1

PC-3

PC-4
(PROPOSED SITE)

Pond

Dean Road

Thorn Road

Jordan's Fort Road

Dwina Road

Corinth Road

Church of God

GW-12

GW-13

GW-14

GW-28

GW-8R

C-1

C-2

UNDEFINED SEGMENT OF DRAINAGE PATTERN A

DRAINAGE PATTERN A

END OF DRAINAGE PATTERN 5+00

EXISTING CULVERT

EXISTING NON-JURISDICTIONAL FARM DITCH

UNDEFINED SEGMENT OF DRAINAGE PATTERN B

DRAINAGE PATTERN B

END OF DRAINAGE PATTERN 4+76

T8S R3E 1

T8S R4E 5

T8S R4E 6

T8S R4E 7

T8S R4E 8

T8S R3E 12

T8S R3E 13

T8S R4E 18

LEGEND

- PROPOSED PERMIT #417 BOUNDARY
- ADJACENT PERMIT #375 BOUNDARY
- RANGE/SECTION LINES
- SECTION CENTERS
- EXISTING ROADWAY
- 1/2 MILE RADIUS
- GAS PIPELINE
- MINOR WATERWAY
- RAILROAD
- SUBWATERSHED BOUNDARY
- STRUCTURES FROM USGS MAPPING
- PC-4 SURFACE WATER MONITORING
- GW-12 GROUND WATER MONITORING
- CORINTH WATER SYSTEM
- WETLAND "A"
- WETLAND "B"
- UNDEFINED DRAINAGE PATTERN
- DELINEATED DRAINAGE PATTERN

0+00 1+00 2+00

NOTE:
BOTH DRAINAGE PATTERNS A AND B ARE EPHEMERAL SWALES.

SCALE
400 0 400 800 FEET

REV.	DATE	DESCRIPTION	P.M.
1	10/08/14	REVISED PER I.D.N.R. COMMENTS SEPT 23, 2014	CEY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

IDNR–M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 4 – HYDROGEOLOGIC MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA
Prepared For
WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	SMS	05/31/13	PROJECT NO. B12-271-1413
CHECKED BY			DRAWING NO. B12-271-M23
APPROVED BY			

R10507

T8S/R3E/S1

T8S/R4E/S6

T8S/R3E/S13

T8S/R4E/S18

WM116A HISTORIC FARMSTEAD

11WM335 HISTORIC FARMSTEAD

11WM118 HISTORIC CEMETERY ALSIP

DEAN ROAD

DWINA ROAD

GATE TO BE INSTALLED END OF DWINA ROAD SOUTH BOUND

SHAFT SITE

30 FOOT BENCH AND GUTTER

FLUME NO. 1

FLUME NO. 2

FLUME NO. 3

FLUME NO. 4

FLUME NO. 5

FLUME NO. 6

PROPOSED REFUSE BELT ALIGNMENT

36 INCH DIA DR-26 HDPE DECANT PIPE

PHASE 8 MAXIMUM FINE COAL REFUSE LEVEL EL. 580.9

REFUSE CONVEYOR FROM PREPARATION PLANT

CULVERT C-1 (3) 42" CMPS (SEE DRAWING B12-271-B2)

POND NO. 9

NPDES 009

EAST OF DWINA STAGE 4 CREST EL. 625

28 INCH DIA DR-17 HDPE DECANT PIPE DAYLIGHT AT 2% INV. ELEV. 619.25

EAST OF DWINA STAGE 4 MAXIMUM FINE COAL REFUSE LEVEL EL. 619.2

DECANT DITCH

FILTER DIAPHRAGM AND DRAIN

CREST EL. 625

BURIED GAS LINE (OWNED BY PARENT COMPANY OF WILLIAMSON ENERGY LLC)

GATE INSTALLED

ACCESS ROAD NO. 1

POTENTIAL SUBSOIL STORAGE AREA

GATE TO BE INSTALLED

A080312-101
A080312-102
A080312-103
A080312-104
A080312-105
A080312-201
A080312-202
A080312-203
A080312-204
A080312-301
A080312-302
A080312-303
A080312-304
A080312-305
A080312-401
A080312-402
A080312-403
A080312-404
A080313-108
A080313-103
A080313-201
A080313-202
A080313-203
A080313-204
A080301-302
A080301-404
A080301-412
A080301-409
A080301-406
A080301-407
A080301-408
A080406-306
A080406-309
A080406-308
A080406-305
A080406-402
A080407-101
A080407-103
A080407-104
A080407-105
A080407-2XX
A080407-201
A080407-203
A080407-205
A080407-206
A080407-106
A080407-107
A080407-108
A080407-301
A080407-302
A080407-303
A080407-304
A080407-305
A080407-415
A080407-417
A080407-419
A080407-402
A080407-406
A080407-407
A080407-408
A080418-101
A080418-102
A080418-201

P-28 P-29 P-30 P-31 P-32 P-33 P-34 P-35 P-53 P-54 P-36 P-37 P-38 P-39 P-40 P-41 P-42 P-51 P-52 P-43 P-44 P-45 P-46 P-47 P-48 P-49 P-50

LEGEND

- EXISTING 8" METHANE PIPELINE
- ADJACENT PERMIT (PERMIT NO. 375 BOUNDARY)
- PERMIT NO. 417 BOUNDARY
- EXISTING INTERNAL DRAIN
- EXISTING PIEZOMETER
- PROPOSED PIEZOMETER
- 100' STREAM BUFFER ZONE
- PROPERTY LINE
- A080415-300 PROPERTY ID
- DRAINAGE AREA
- TOWNSHIP-RANGE BOUNDARIES
- T8S R4E 7 TOWNSHIP/RANGE/SECTION
- T8S/R4E/S18 ADJACENT TOWNSHIP/RANGE/SECTION

STRUCTURES

1	■	RESIDENCE (OCCUPIED)
1VAC	□	RESIDENCE (UNOCCUPIED)
2	▬	MOBILE HOME (OCCUPIED)
2VAC	▭	MOBILE HOME (UNOCCUPIED)
3	□	SHED
4	□	GARAGE
5	□	BARN
6	○	GRAIN BIN OR SILO

NOTES:

1. REFER TO FIGURE NO. 16 FOR STABILITY CROSS SECTIONS H-H, I-I, AND J-J AND PIEZOMETER TIP ELEVATIONS.
2. REFER TO FIGURE NOS. 17 AND 18 FOR DRAINAGE STRUCTURE DETAILS.
3. REFER TO FIGURE NO. 17 FOR PIEZOMETER INSTALLATION DETAILS
4. REFER TO FIGURE NO. 18 FOR DECANT PIPE AND FILTER DIAPHRAGM INSTALLATION DETAIL

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.
4	11/25/14	REVISED PHASE 8 LAYOUT	CEY
3	09/11/14	EXTENDED STREAM BUFFER ZONE AND RELOCATED OUTLET 009	CEY
2	07/10/14	REVISED PER COMMENTS DATED 07/08/2014	CEY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 863-2380 · CANONSBURG, PA (724) 743-3620

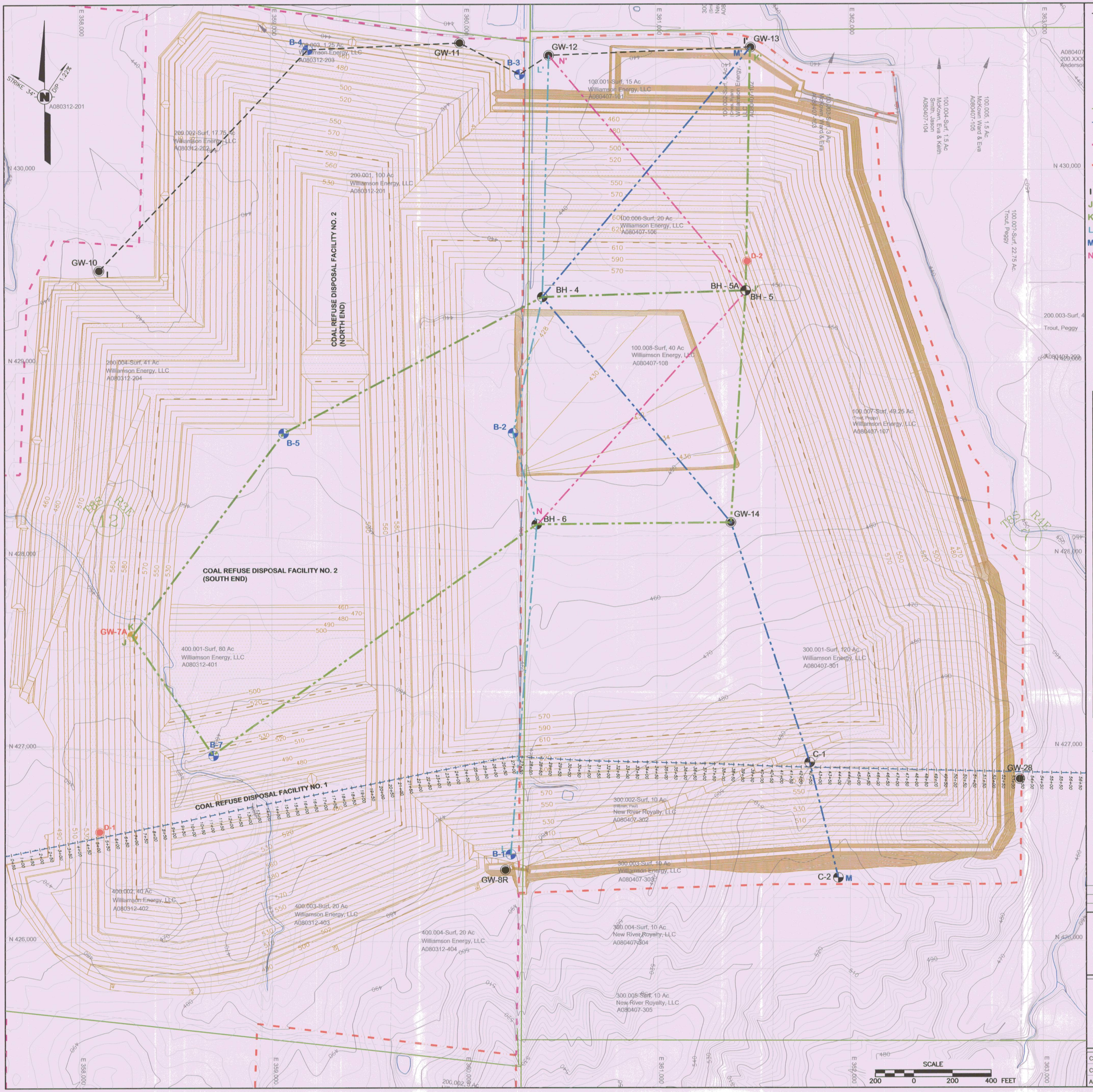
IDNR-M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 6 S.F. - OPERATIONAL PLAN MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA
Prepared For
WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/28/12	PROJECT NO. B12-271-1413
CHECKED BY	SMS	–	DRAWING NO. B12-271-M24
APPROVED BY	CEY	–	

R10608



LEGEND

B-5	EXPLORATION HOLE COMPLETED PRIOR TO MAY 2009
BH - 4	EXPLORATION HOLE COMPLETED DURING MAY 2009
GW-7A	EXPLORATION HOLE/GROUND WATER WELL COMPLETED PRIOR TO MAY 2009
GW-13	EXPLORATION HOLE/GROUND WATER WELL COMPLETED DURING MAY 2009
D-1	EXPLORATION HOLE/GROUND WATER WELL COMPLETED DURING JUNE/JULY 2012
	TOWNSHIP/RANGE
	EXISTING 8" METHANE PIPELINE
	PERMIT NO. 375 BOUNDARY
	PERMIT NO. 417 BOUNDARY
	PROPERTY LINE
I — — — I'	GEOLOGIC CROSS SECTION I–I' LOCATION
J — — — J'	GEOLOGIC CROSS SECTION J–J' LOCATION
K — — — K'	GEOLOGIC CROSS SECTION K–K' LOCATION
L — — — L'	GEOLOGIC CROSS SECTION L–L' LOCATION
M — — — M'	GEOLOGIC CROSS SECTION M–M' LOCATION
N — — — N'	GEOLOGIC CROSS SECTION N–N' LOCATION

NOTES:

1) FOR GEOLOGIC CROSS SECTION I–I', SEE DRAWING NO. B12–271–M17.
2) FOR GEOLOGIC CROSS SECTION J–J', SEE DRAWING NO. B12–271–M18.
3) FOR GEOLOGIC CROSS SECTION K–K', SEE DRAWING NO. B12–271–M19.
4) FOR GEOLOGIC CROSS SECTION L–L', SEE DRAWING NO. B12–271–M20.
5) FOR GEOLOGIC CROSS SECTION M–M', SEE DRAWING NO. B12–271–M21.
6) FOR GEOLOGIC CROSS SECTION N–N', SEE DRAWING NO. B12–271–M22.

SURVEYED BOREHOLE LOCATIONS

BORING NUMBER	NORTHING	EASTING	TOP OF PIPE	GROUND ELEVATION
BH - 4	429343	360407	--	436.27
BH - 5	429376	361463	--	444.28
BH - 5A	429376	361463	--	444.28
BH - 6	428164	360375	--	452.07
GW-7A	427587	358275	--	452.0
GW-8R	426371	360211	482.5	--
GW-10	429483	358105	437.88	435.17
GW-11	430660	359981	440.50	437.77
GW-12	430596	360443	438.13	435.25
GW-13	430637	361492	444.57	441.57
GW-14	428172	361383	458.52	455.56
GW-28	426840	362879	467.73	--
B - 1	426451	360239	--	481.8
B - 2	428637	360254	--	446.3
B - 3	430497	360292	--	435.4
B - 4	430626	359192	--	442.2
B - 5	428636	359062	--	447.9
B - 7	426964	358695	--	459.4
C - 1	426926	361790	--	490.5
C - 2	426329	361937	--	519.8
D - 1	426569	358104	--	468.7
D - 2	429528	361471	--	447.00

* BOREHOLE INFORMATION FOR D–2 IS APPROXIMATE.

REFERENCES:

1) TOPOGRAPHIC MAPPING PROVIDED BY WILLIAMSON ENERGY, LLC.
2) INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2 WAS ACQUIRED FROM ALLIANCE CONSULTING INC.'S (ALLIANCE) DRAWING NO. B09–018–M2.
3) LOCATIONS FOR BORING NOS. B–1, B–2, B–3, B–4, B–5, B–7 AND GW–7A WERE OBTAINED FROM ALLIANCE'S DRAWING NO. B05–330–M25.
4) COORDINATE AND ELEVATION DATA FOR BORINGS BH–4, BH–5, BH–6 AND GW–10 THROUGH GW–14 WERE OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS.

REV.	DATE	DESCRIPTION	P.M.

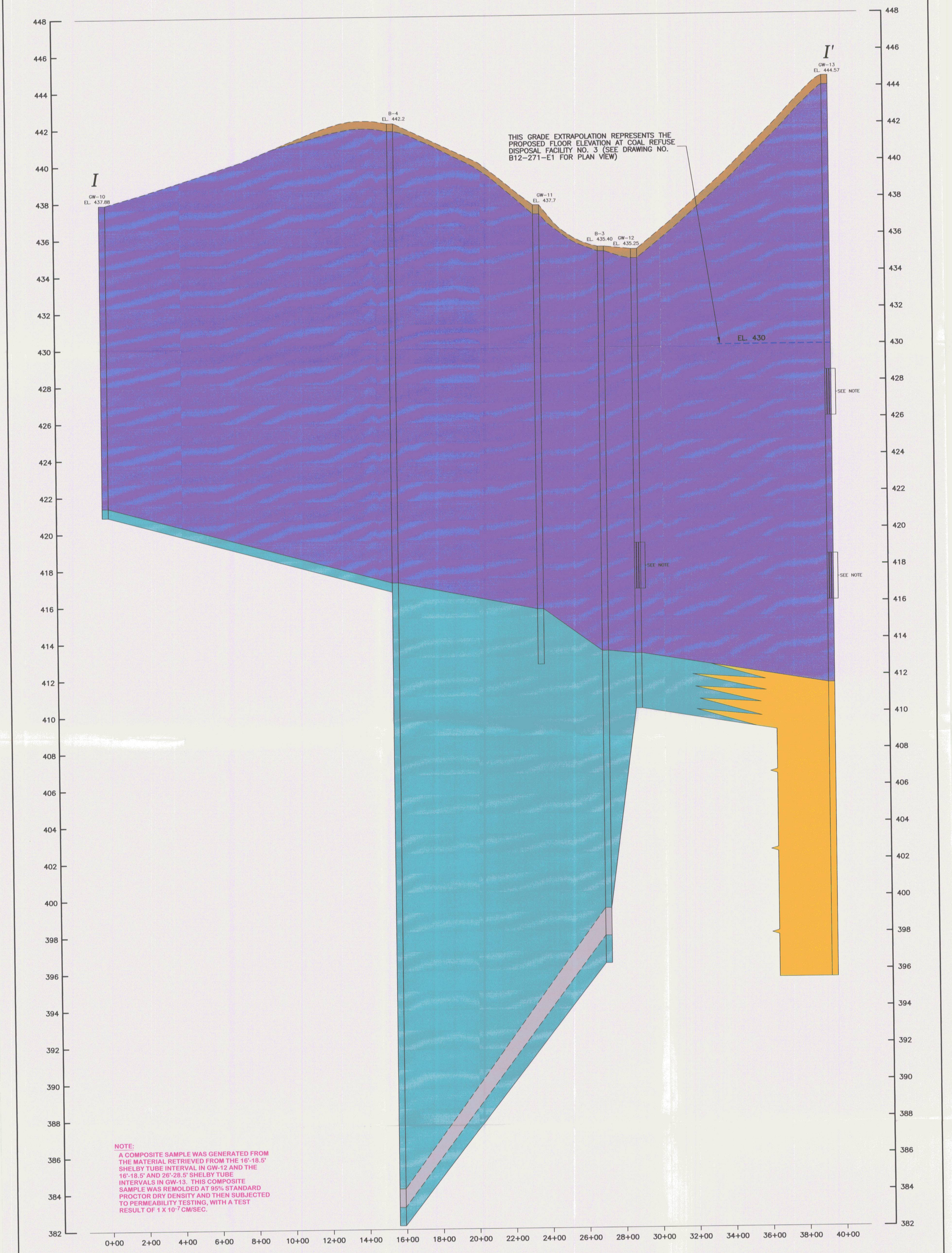
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255–0491
SUMMERSVILLE, WV (304) 883–2361
CANONSBURG, PA (724) 745–3630

GEOLOGIC CROSS SECTIONS LOCATION MAP

COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC

CAD BY	DSM	05/21/13	PROJECT NO. B12–271–1413	
CHECKED BY	JLP	06/21/13	DRAWING NO. B12–271–E1	
APPROVED BY	CEY	06/28/13		

R10509



NOTE:
A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-12 AND THE 16'-18.5' AND 26'-28.5' SHELBY TUBE INTERVALS IN GW-13. THIS COMPOSITE SAMPLE WAS REMOLDED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

GEOLOGIC CROSS SECTION I–I'

VERTICAL SCALE
2 0 2 4 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- CLAY/CLAYEY SILT–TILL
- SHALE
- SANDSTONE
- COAL
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10^{-7} CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING THE NORTH END OF COAL REFUSE DISPOSAL FACILITY NO. 2
- CUT GRADE EXTRAPOLATED INTO THIS SECTION FOR REPRESENTATION OF THE PROPOSED FLOOR ELEVATION AT THE NORTH END OF THE EAST COAL REFUSE DISPOSAL FACILITY

REFERENCES:

1) BOREHOLE B–3 AND B–4 DATA WERE OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S (HOLCOMB) APRIL 2007 DRILLING LOGS.
2) INFORMATION FOR GW–10 THROUGH GW–13 WAS ACQUIRED FROM HOLCOMB'S MAY 2009 DRILLING LOGS.
3) FLOOR GRADE INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NO. 2 WAS OBTAINED FROM ALLIANCE CONSULTING, INC.'S DRAWING NO. B09–018–M2.

CLAUDIO ELI YON
062-050532
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050532

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct 29, 2022

Jody R. Sulesky

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

3001-/15

REV.	DATE	DESCRIPTION	P.M.
1	10/08/14	REVISED PER I.D.N.R. COMMENTS SEPT 23, 2014	CEY

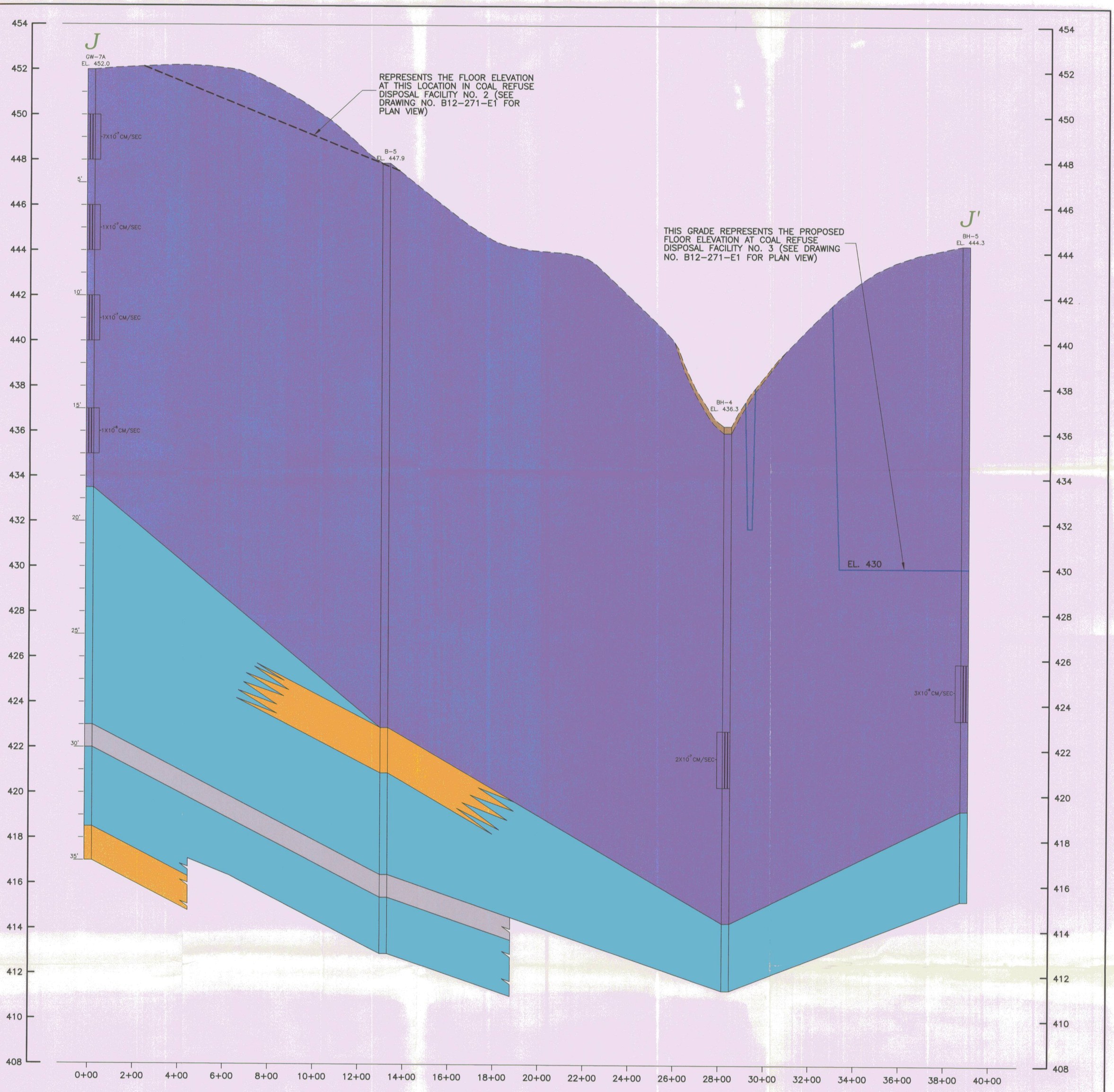
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 SUMMERSVILLE, WV (304) 883-2361 CANONSBURG, PA (724) 745-3630

GEOLOGIC CROSS SECTION I–I'
COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY	NW	06/21/13	
APPROVED BY	CEY	06/28/13	DRAWING NO. B12-271-M17

...ing: last-saved:C:\ADRAWINGS\B12271\B12271M17R.dwg - Layout Tab: Model
...e: Dec 16, 2014 - 1:57pm - Plotted by: smadonia
Xrefs:

R10510



GEOLOGIC CROSS SECTION J–J'

VERTICAL SCALE
2 0 2 4 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- CLAY/CLAYEY SILT-TILL
- SHALE
- SANDSTONE
- COAL
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10⁻⁷ CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING COAL REFUSE DISPOSAL FACILITY NO. 2
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING THE NORTH END OF THE EAST COAL REFUSE DISPOSAL AREA

REFERENCES:

1) BOREHOLE B-5 INFORMATION WAS OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S (HOLCOMB) APRIL 2007 DRILLING LOG.
2) BOREHOLE BH-4 AND BH-5 DATA WERE ACQUIRED FROM HOLCOMB'S MAY 2009 DRILLING LOGS.
3) DATA FOR GW-7A WAS OBTAINED FROM ALLIANCE CONSULTING, INC.'S (ALLIANCE) DRAWING NO. B05-330-M21, PREPARED ON BEHALF OF WILLIAMSON ENERGY, LLC.
4) EXCAVATION/FLOOR GRADE INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NO. 2 WAS ACQUIRED FROM ALLIANCE'S DRAWING NO. B09-018-M2.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

3001/15

REV.	DATE	DESCRIPTION	P.M.
1	10/08/14	REVISED PER I.D.N.R. COMMENTS SEPT 23, 2014	CEY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491
SUMMERSVILLE, WV (304) 883-2361
CANONSBURG, PA (724) 745-3630

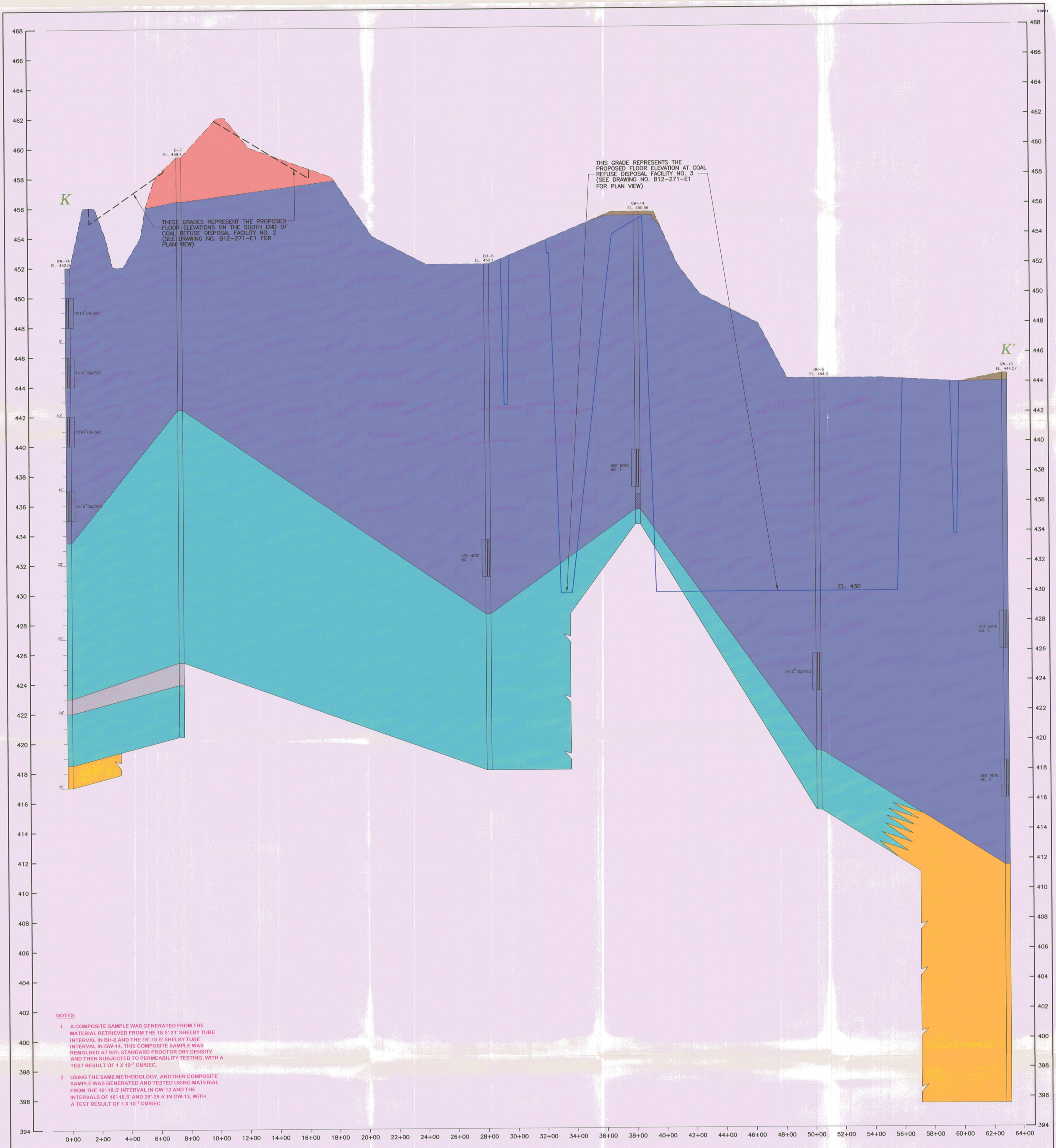
GEOLOGIC CROSS SECTION J–J'

COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY	NW	06/21/13	
APPROVED BY	CEY	06/28/13	DRAWING NO. B12-271-M18

Drawing: \\acad-acad\CADDRAWINGS\12271\12271M18R.dwg - Layout Tab: Model
Date: Dec 18, 2014-1:26pm - Plotted by: smeadows
Xrefs:

R10591



NOTES:

1. A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 18.5'-21' SHELBY TUBE INTERVAL IN BH-6 AND THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-14. THIS COMPOSITE SAMPLE WAS REMOLDED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.
2. USING THE SAME METHODOLOGY, ANOTHER COMPOSITE SAMPLE WAS GENERATED AND TESTED USING MATERIAL FROM THE 16'-18.5' INTERVAL IN GW-12 AND THE INTERVALS OF 16'-18.5' AND 26'-28.5' IN GW-13, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

GEOLOGIC CROSS SECTION K-K'

VERTICAL SCALE
2 0 2 4 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- TILL — SILT
- TILL — CLAY/CLAYEY SILT
- SILTY CLAY WITH COAL
- SHALE
- SANDSTONE
- COAL
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10^{-7} CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- CUT/FILL GRADES ASSOCIATED WITH DEVELOPING COAL REFUSE DISPOSAL FACILITY NO. 2
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING THE SOUTH END OF THE EAST COAL REFUSE DISPOSAL AREA
- CUT GRADE EXTRAPOLATED INTO THIS SECTION FOR REPRESENTATION OF THE FLOOR ELEVATION AT THE EAST COAL REFUSE DISPOSAL AREA

REFERENCES:

1) DATA FOR GW-7A AND B-7 WERE OBTAINED FROM ALLIANCE CONSULTING, INC.'S DRAWING NO. B05-330-M21, PREPARED ON BEHALF OF WILLIAMSON ENERGY, LLC.
2) INFORMATION FOR BH-5, BH-6, GW-13 AND GW-14 WERE ACQUIRED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS
3) EXCAVATION/FLOOR GRADE INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NO. 2 WAS OBTAINED FROM ALLIANCE CONSULTING INC.'S DRAWING NO. B09-018-M2.

CLAUDIO ELI YON
062-050032
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

R.P.E. NO. 062-050032

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES 10/29/2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED. NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

REV.	DATE	DESCRIPTION	P.M.
1	10/08/14	REVISED PER I.D.N.R. COMMENTS SEPT 23, 2014	CEY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2361 · CANONSBURG, PA (724) 745-3630

GEOLOGIC CROSS SECTION K-K'
COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY			DRAWING NO. B12-271-M19
APPROVED BY			

Drawing: I:\acad\COGO\MW\GB-12271-1327\M19R.dwg - Layout:Tab2 Model
Date: Dec 16, 2014 - 1:26pm - Plotted by: smedcalf

R10512

L

B-1
EL. 481.8

FILL TO EL. 588

FILL TO EL. 588

BH-6
EL. 452.1

B-2
EL. 446.3

BH-4
EL. 436.3

L'

GW-12
EL. 435.25

SEE NOTE NO. 1

SEE NOTE NO. 2

2X10^{-7} CM/SEC

THIS GRADE EXTRAPOLATION REPRESENTS THE PROPOSED FLOOR ELEVATION AT COAL REFUSE DISPOSAL FACILITY NO. 3 (SEE DRAWING NO. B12-271-E1 FOR PLAN VIEW)

484 482 480 578 476 474 472 470 468 466 464 462 460 458 456 454 452 450 448 446 444 442 440 438 436 434 432 430 428 426 424 422 420 418 416 414 412 410 408 406 404

0+00 2+00 4+00 6+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00 42+00

NOTES:

1. A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 18.5'-21' SHELBY TUBE INTERVAL IN BH-6 AND THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-14. THIS COMPOSITE SAMPLE WAS REMOLDED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.
2. USING THE SAME METHODOLOGY, ANOTHER COMPOSITE SAMPLE WAS GENERATED AND TESTED USING MATERIAL FROM THE 16'-18.5' INTERVAL IN GW-12 AND THE INTERVALS OF 16'-18.5' AND 26'-28.5' IN GW-13, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

GEOLOGIC CROSS SECTION L-L'

VERTICAL SCALE
2 0 2 4 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- CLAY/CLAYEY SILT-TILL
- SHALE
- SANDSTONE
- COAL
- LIMESTONE
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10^{-7} CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- CUT GRADE EXTRAPOLATED INTO THIS SECTION FOR REPRESENTATION OF THE FLOOR ELEVATIONS AT THE EAST COAL REFUSE DISPOSAL AREA

REFERENCES:

1) BOREHOLE B-1 AND B-2 DATA WERE OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S (HOLCOMB) APRIL 2007 DRILLING LOGS.
2) INFORMATION FOR BH-4, BH-6 AND GW-12 WERE OBTAINED FROM HOLCOMB'S MAY 2009 DRILLING LOGS.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

3001/15

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2361 · CANONSBURG, PA (724) 745-3630

GEOLOGIC CROSS SECTION L-L'

COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-M20

Drawing: \\ahr-esse\CAD\RAWINS\B12271\M20.dwg - Layout Tab: Model Xrefs:
Date: Dec 18, 2014-1:45pm - Plotted by: smassiova

R10513

M

C-2
EL. 519.8

FILL TO EL. 588

C-1
EL. 490.5

GW-14
EL. 455.56

SEE NOTE NO. 1

BH-4
EL. 436.3

2X10^{-7} CM/SEC

FILL TO EL. 588

M'

GW-13
EL. 444.57

SEE NOTE NO. 2

SEE NOTE NO. 2

525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405 400 395

0+00 2+00 4+00 6+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00 42+00 44+00 46+00 48+00 50+00 52+00

NOTES:

1. A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-14 AND THE 18.5'-21' SHELBY TUBE INTERVAL IN BH-6. THIS COMPOSITE SAMPLE WAS REMOLDED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

2. USING THE SAME METHODOLOGY, ANOTHER COMPOSITE SAMPLE WAS GENERATED AND TESTED USING MATERIAL FROM THE 16'-18.5' INTERVAL IN GW-12 AND THE INTERVALS OF 16'-18.5' AND 26'-28.5' IN GW-13, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

GEOLOGIC CROSS SECTION M-M'

VERTICAL SCALE
5 0 5 10 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- CLAY/CLAYEY SILT-TILL
- SILTY CLAY WITH COAL
- SHALE
- SANDSTONE
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10^{-7}CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING THE EAST COAL REFUSE DISPOSAL AREA

REFERENCE:

INFORMATION FOR BH-4, GW-13 AND GW-14 WAS OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

Claudio E. Yon

R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC,

Jody R. Sulesky

THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29, 2020

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2020

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

3001 15

REV.	DATE	DESCRIPTION	P.M.

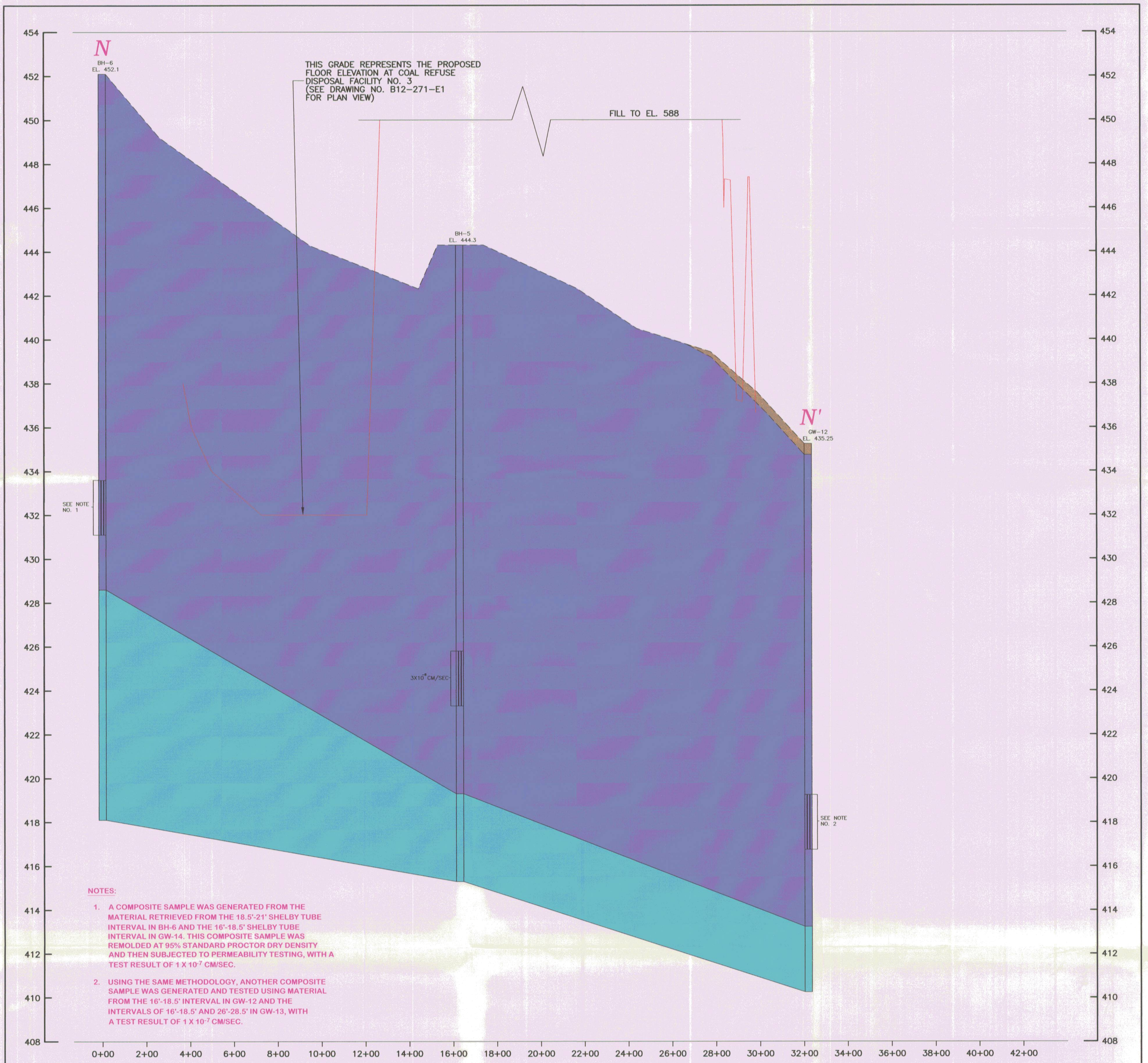
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2361 · CANONSBURG, PA (724) 745-3630

GEOLOGIC CROSS SECTION M-M'
COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-M21

Drawing: \\ac-esx\CAD\DRAWINGS\12271\12271M21.dwg - Layout Tab: Model
Date: Dec 18, 2014-1:46pm - Plotted by: smeadows
Xrefs:

R10514



NOTES:

1. A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 18.5'-21' SHELBY TUBE INTERVAL IN BH-6 AND THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-14. THIS COMPOSITE SAMPLE WAS REMOLDED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.
2. USING THE SAME METHODOLOGY, ANOTHER COMPOSITE SAMPLE WAS GENERATED AND TESTED USING MATERIAL FROM THE 16'-18.5' INTERVAL IN GW-12 AND THE INTERVALS OF 16'-18.5' AND 26'-28.5' IN GW-13, WITH A TEST RESULT OF 1 X 10^{-7} CM/SEC.

GEOLOGIC CROSS SECTION N–N'

VERTICAL SCALE
2 0 2 4 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

LEGEND:

- SURFICIAL MATERIAL
- CLAY/CLAYEY SILT–TILL
- SHALE
- SHELBY TUBE PUSH INTERVAL (WITH PERMEABILITY TESTING)
- 1X10⁻⁷ CM/SEC — PERMEABILITY TEST RESULT AND INTERVAL OF MATERIAL TESTED
- EXCAVATION/CUT ASSOCIATED WITH DEVELOPING THE EAST COAL REFUSE DISPOSAL FACILITY

REFERENCE:

INFORMATION FOR BH–5, BH–6 AND GW–12 WAS OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS.

CLAUDIO ELI YON
062-050632
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

OFFICIAL SEAL
Notary Public, State of West Virginia
JODY R SULESKY
PO Box 923
Beaver, WV 25813
My commission expires October 29, 2022

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

Claudio E. Yon R.P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, Jody R. Sulesky

THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct. 29, 2022

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES". PROPERTY LINES, ADJACENT PERMIT AREAS, UTILITIES, MINE WORKINGS AND RELATED FEATURES ARE FOR ILLUSTRATIONAL PURPOSES ONLY AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC. THE BASE MAP AND INFORMATION CONTAINED THEREON WERE PROVIDED BY THE OWNER AND HAVE NOT BEEN SURVEYED OR VERIFIED BY ALLIANCE CONSULTING, INC.

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2361 · CANONSBURG, PA (724) 745-3630

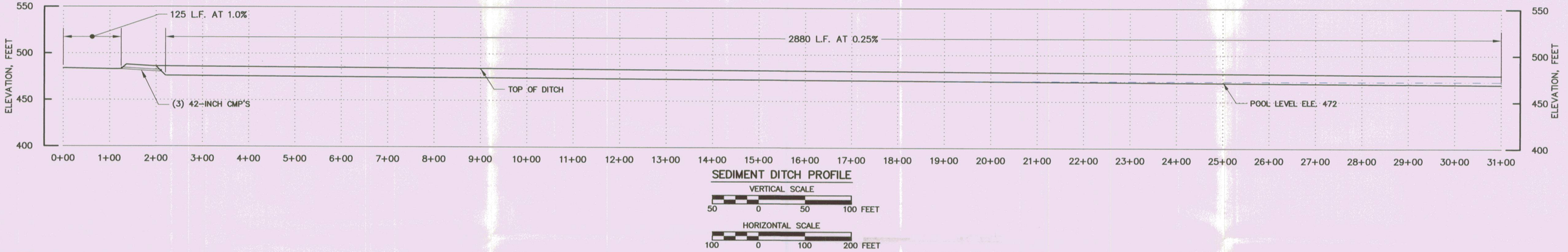
GEOLOGIC CROSS SECTION N–N'

COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DSM	05/21/13	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-M22

Drawing: \\allnas4\CAD\RAWINGS\12271\12271M22.dwg - Layout Tab: Model Xrefs:
Date: Dec 18, 2014 - 1:56pm - Plotted by: smeadows

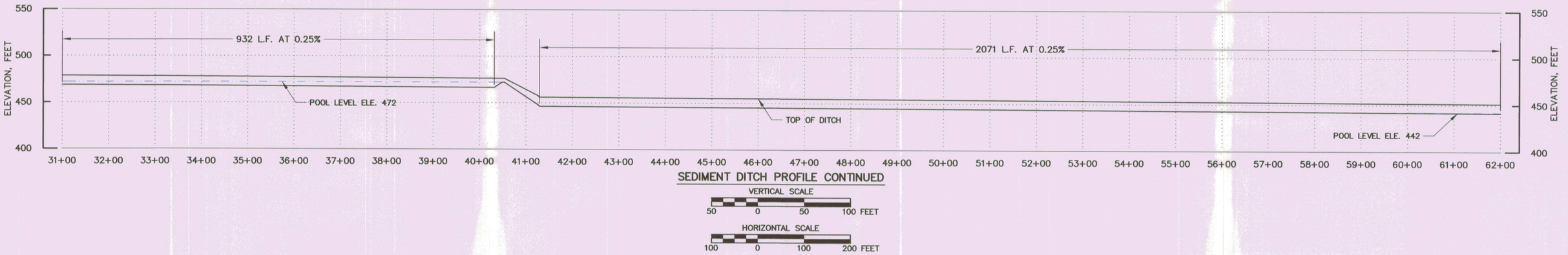
R10515



SEDIMENT DITCH PROFILE

VERTICAL SCALE
50 0 50 100 FEET

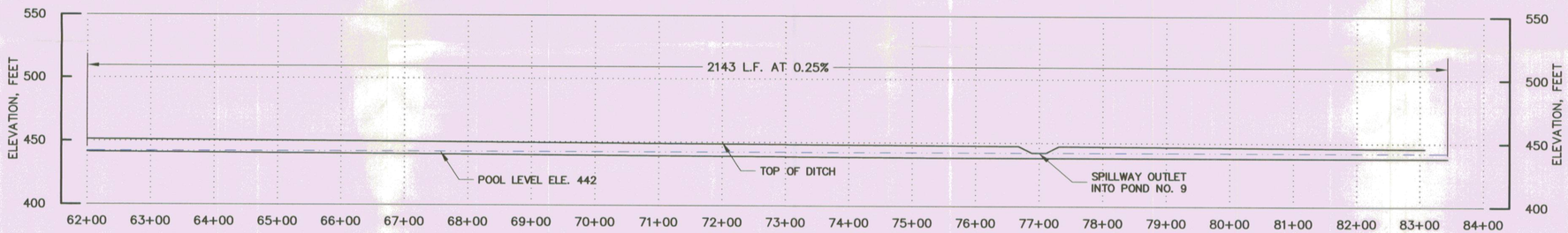
HORIZONTAL SCALE
100 0 100 200 FEET



SEDIMENT DITCH PROFILE CONTINUED

VERTICAL SCALE
50 0 50 100 FEET

HORIZONTAL SCALE
100 0 100 200 FEET

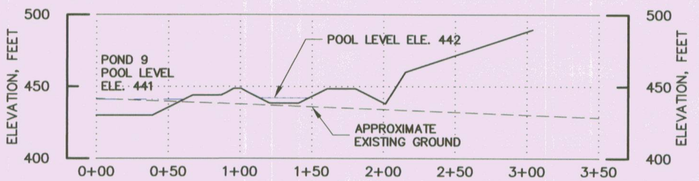


SEDIMENT DITCH PROFILE CONTINUED

VERTICAL SCALE
50 0 50 100 FEET

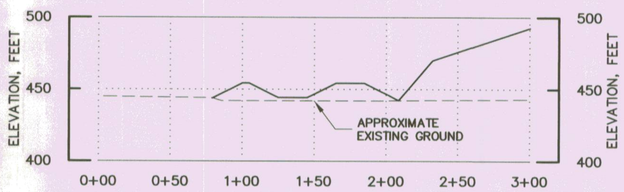
HORIZONTAL SCALE
100 0 100 200 FEET

NOTE:
REFER TO DRAWING NO. B12-271-M16 FOR PLAN LOCATION OF SEDIMENT DITCH PROFILE AND SECTION C-C THROUGH E-E.



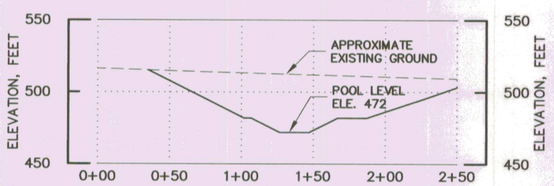
SECTION C-C

SCALE
50 0 50 100 FEET



SECTION D-D

SCALE
50 0 50 100 FEET



SECTION E-E

SCALE
50 0 50 100 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08-03141-02
I.D.N.R. PERMIT NOS. 375 AND 417

SEDIMENT DITCH PROFILE AND SECTIONS

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DJS	07/25/14	PROJECT NO. B12-271-1413
CHECKED BY	SMS	08/14/14	
APPROVED BY	SMS	08/14/14	DRAWING NO. B12-271-E13

Drawing: Tech-esis/ACADM/M/2015/12271E13.dwg - Layout Tab: Model
Date: Dec 16, 2014 - 1:56pm - Plotted by: jmassone

R10516

MCC 25
NO SANDSTONE UNIT

GW2
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

EXISTING REFUSE AREA

GW-11
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

GW-12
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

GW-13
SANDSTONE 16'

B-4
NO SANDSTONE UNIT

B-3
NO SANDSTONE UNIT

GW-10
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

BH - 4
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

BH - 5
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

B-5
SANDSTONE 2'

B-2
SANDSTONE 0.38'

BH - 6
NO SANDSTONE UNIT

GW-14
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

R-1
SANDSTONE 8'

R-2
SANDSTONE 1.25'

R-3
SANDSTONE 1'

R-4
SANDSTONE 0.75'

GW7A
NO SANDSTONE UNIT

P-1
SANDSTONE 6'

P-2
SANDSTONE 3'

P-3
SANDSTONE 7.25'

P-4
SANDSTONE 9.75'

P-5
SANDSTONE 5.75'

P-6
NO SANDSTONE UNIT

C-1
SANDSTONE 0.75'

C-2
SANDSTONE 2.5'

C-3
SANDSTONE 5.25'

C-4
SANDSTONE 6.75'

L-2
L-1
SANDSTONE 8.5'
SANDSTONE 9'

B-7
NO SANDSTONE UNIT

C-1
CORRELATIVE SANDSTONE UNIT IS ABSENT (HOWEVER, A CONSIDERABLY HIGHER ELEVATION SANDSTONE OF VERY LIMITED AREAL EXTENT WAS EVIDENT IN THIS BOREHOLE.)

GW-28
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

B-1
SANDSTONE 9'

AA'

GW-8R
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

C-2
MAY NOT BE DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON, OR ELSE THIS CORRELATIVE UNIT IS ABSENT (HOWEVER, A CONSIDERABLY HIGHER ELEVATION SANDSTONE OF VERY LIMITED AREAL EXTENT WAS EVIDENT IN THIS BOREHOLE.)

B-6
NO SANDSTONE UNIT

EXISTING REFUSE AREA

GW5
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

MCC-31
SANDSTONE 4.5'

B1/TEMPORARY MW1
SANDSTONE 2.5'

B5
SANDSTONE 1'

SUBSOIL STOCKPILE AREA

TOPSOIL STOCKPILE AREA

GEOTEXTILE TUBE DISPOSAL AREA

B2
NO SANDSTONE UNIT

AA

B3/TEMPORARY MW3
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

B4
NOT DEEP ENOUGH TO ENCOUNTER SANDSTONE HORIZON

LEGEND:

- L-2 — BOREHOLE/WELL EXISTING PRIOR TO 2007
- B-1 — ADDITIONAL BOREHOLES DRILLED DURING APRIL 2007
- GW-12 — BOREHOLES DRILLED/WELLS INSTALLED DURING MAY 2009
- GW-8R — BOREHOLES DRILLED/WELLS INSTALLED DURING 2012
- B1 — BOREHOLES DRILLED DURING JULY 2014
- SS 2.5' — SANDSTONE UNIT THICKNESS (IN FEET)
- SANDSTONE UNIT ISOPACH LINE (1-FOOT THICKNESS CONTOUR INTERVAL)
- GEOLOGIC CROSS SECTION AA-AA'
- 0-1' SANDSTONE THICKNESS
- 1'-3' SANDSTONE THICKNESS
- 3'-6' SANDSTONE THICKNESS
- 6'-10' SANDSTONE THICKNESS
- 10'+ SANDSTONE THICKNESS

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers • Constructors • Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-3361 · CANONSBURG, PA (724) 745-3630

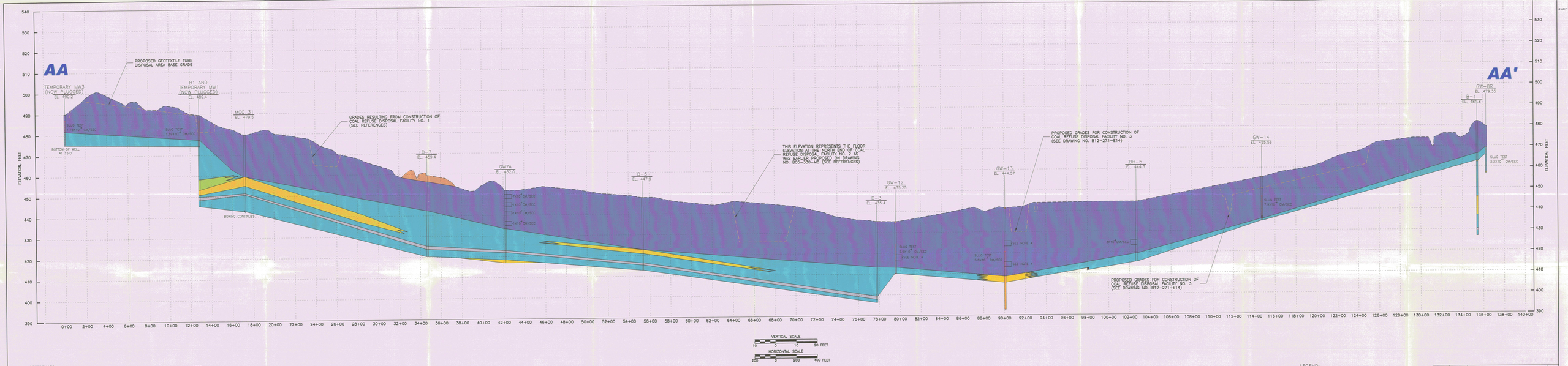
I.D.N.R. PERMIT NOS. 375 AND 417 MSHA ID NO. IL08-03141-02

SANDSTONE UNIT ISOPACH MAP

COAL REFUSE FACILITY NO. 3
POND CREEK NO. 1 MINE
WILLIAMSON COUNTY, ILLINOIS
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

CAD BY	JSC	10/13/14	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-E14

Drawing: Task work\CAD\AWW\B12271\271E14.dwg - Layout: Fab1 Model
Date: Mon, 10, 2014 1:21pm - Plotted by: mmcclain
Xrefs: WORK TOPO #1.dwg



VERTICAL SCALE
10 0 10 20 FEET

HORIZONTAL SCALE
200 0 200 400 FEET

REFERENCES:

1. INFORMATION FOR BOREHOLE MCC 31 WAS PROVIDED BY MACH MINING, LLC.
2. DRILLING LOGS FOR BOREHOLES B-1, B-3, B-5 AND B-7 (DRILLED DURING APRIL, 2007) WERE PROVIDED BY HOLCOMB FOUNDATION ENGINEERING CO., INC. (HOLCOMB)
3. GW7A DATA WERE OBTAINED FROM HOLCOMB'S SOIL BORING AND WELL INSTALLATION SUBMITTAL TO STEELHEAD DEVELOPMENT COMPANY, LLC, DATED MAY 6, 2005.
4. COAL REFUSE FACILITY NO. 2's INFORMATION WAS OBTAINED FROM ALLIANCE CONSULTING, INC.'S (ALLIANCE) DRAWING NO. B05-330-M8 ENTITLED "PLAN PHASE 7".
5. INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NO. 1 WAS OBTAINED FROM THE AFOREMENTIONED ALLIANCE DRAWING NO. B05-330-M8, AND A CONSTRUCTION DETAIL PROVIDED BY MACH MINING, LLC ON MAY 14, 2007.
6. PROPOSED GEOTEXTILE TUBE DISPOSAL AREA BASE GRADE OBTAINED FROM ALLIANCE'S DRAWING NO. B14-364-E3.
7. COAL REFUSE FACILITY NO. 3's INFORMATION WAS OBTAINED FROM ALLIANCE'S DRAWING NO. B12-271-E14.

NOTES:

1) TEMPORARY MONITORING WELL MW1 WAS INSTALLED AT THE LOCATION OF BOREHOLE B1, AND THEREFORE THEY ARE DEPICTED AS THE SAME LOCATION ON THIS DRAWING.
2) TEMPORARY MONITORING WELLS MW1 AND MW3 WERE BOTH INSTALLED TO A DEPTH OF 15', THE VERTICAL MONITORING INTERVAL IS 12' IN BOTH WELLS, AND SPANS BETWEEN THE DEPTHS OF 3' AND 15'. THIS MONITORING INTERVAL IS DENOTED BY THE RED HORIZONTAL PATTERN EVIDENT WITHIN THESE WELLS AS SHOWN ON THIS DRAWING.
3) SLUG TESTING OF THE ABOVE-REFERENCED 12-FOOT INTERVAL IN BOTH WELLS MW1 AND MW3 WAS CONDUCTED ON JULY 31, 2014 AND WAS REPORTED WITHIN HOLCOMB'S DATA TRANSMITTAL DATED AUGUST 1, 2014. BOTH TEMPORARY MONITORING WELL MW1 AND MW3 HAVE SINCE BEEN PLUGGED.
4) A COMPOSITE SAMPLE WAS GENERATED FROM THE MATERIAL RETRIEVED FROM THE 16'-18.5' SHELBY TUBE INTERVAL IN GW-12 AND THE SHELBY TUBE INTERVALS OF 16'-18.5' AND 26'-28.5' IN GW-13. THIS COMPOSITE SAMPLE WAS REMODELED AT 95% STANDARD PROCTOR DRY DENSITY AND THEN SUBJECTED TO PERMEABILITY TESTING, WITH A TEST RESULT OF 1 X 10⁻⁷CM/SEC.
5) INFORMATION FOR BH-5, GW-12, GW-13 AND GW-14 WAS ACQUIRED FROM HOLCOMB'S MAY 2009 DRILLING LOGS, AND HOLCOMB'S ACCOMPANYING JULY 21, 2009 REPORTING OF PERMEABILITY TEST RESULTS.
6) INFORMATION FOR GW-8R WAS ACQUIRED FROM HOLCOMB'S DATA TRANSMITTAL DATED NOVEMBER 14, 2012, WHICH REPORTS THE DRILLING/WELL INSTALLATION DATE AS NOVEMBER 13, 2012.
7) SLUG TESTING OF GROUNDWATER MONITORING WELLS GW-8R, GW-12, GW-13 AND GW-14 WAS CONDUCTED ON SEPTEMBER 30, 2014, AND REPORTED WITHIN HOLCOMB'S DATA TRANSMITTAL DATED OCTOBER 6, 2014.

LEGEND:

- TOPSOIL
- CLAY/CLAYEY SILT } TILL
- SILT
- SILTY CLAY WITH COAL
- COAL
- SHALE
- SANDSTONE
- LIMESTONE
- 1X10⁻⁶ CM/SEC — SHELBY TUBE PUSH INTERVAL OF MATERIAL TESTED AND PERMEABILITY TEST RESULT
- GROUNDWATER MONITORING ZONE AND CORRESPONDING SLUG TESTING INTERVAL WITHIN WELL

REV.	DATE	DESCRIPTION	P.M.

BECKLEY, WV (304) 930-0460 — Alliance Consulting, Inc. — CADIZ, OH (740) 942-8844

Engineers • Constructors • Scientists

D.N.R. PERMIT NOS. 375 AND 417 MSHA ID NO. 4608-03141-02

GEOLOGIC CROSS SECTION AA-AA'

COAL REFUSE FACILITY NO. 3
POND CREEK NO. 1 MINE
WILLIAMSON COUNTY, ILLINOIS

Prepared for:
WILLIAMSON ENERGY, LLC
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

CAD BY	JSC	10/09/14
CHECKED BY		
APPROVED BY		

PROJECT NO. B12-271-1413

DRAWING NO. B12-271-E15

R10518

DRAINAGE AREA FOR POND CREEK

FRANKLIN CO

WILLIAMSON CO

RANKLIN CO

KIAMSON CO

WILLIAMSON Creek

4385.20 Acres

AREA 2
180.86 Acres

AREA 4
97.75 Acres

Pond

Creek

NPDES 009

PERMIT NO. 417 AREA

AREA 1
708.62 Acres

AREA 3
229.78 Acres

AREA 5
27.57 Acres

263.44 Acres

PERMIT NO. 375 AREA

2,049.71 Acres

1,337.99 Acres

4385.20 Acres

DRAINAGE AREA FOR 417

DRAINAGE AREA FOR 375

Prairi

LEGEND:

	PERMIT NO. 417 AREA	229.78 AC.
	PERMIT NO. 375 AREA	*561.35 AC.
	OVERBONDED PERMIT AREA (NOS. 375 AND 417)	16.52 AC.
	DRAINAGE AREA	
	AREA 5 GROUNDWATER CUMULATIVE IMPACT AREA	
	AREAS 1, 2, 3, AND 4, SURFACE WATER AND GROUNDWATER CUMULATIVE IMPACT AREA	

NOTES:

AREA 1 – 708.62 AC.
AREA 2 – 180.86 AC.
AREA 3 – 229.78 AC.
AREA 4 – 97.75 AC.
AREA 5 – 27.57 AC.

TOTAL POND FORK DRAINAGE AREA UPSTREAM AND INCLUDING PERMIT AREA (1, 2, 3, AND 4) = 8036.34 AC.

CURRENTLY PERMITTED AREA/TOTAL = $\frac{561.35}{8036.34}$ X 100 = 7.0%

ADDITIONAL
ADDED PERMIT AREA/ TOTAL $\frac{229.78-16.52}{8036.34}$ X 100 = 2.7%

*EXCLUDES AREAS OUTSIDE OF WATERSHED THAT ARE NOT CONTIGUOUS. TOTAL ACREAGE FOR PERMIT NO. 375 IS 679.49 AC.

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE-MINING LAWS OF THIS STATE."

P.E. NO. 062-050632

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, THIS 14 DAY OF NOV 2014 MY COMMISSION EXPIRES Oct 2016

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

SCALE
1000 0 1000 2000 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

IDNR–M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

CUMULATIVE IMPACT AREAS PERMITS 375 AND 417

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DJS	10/13/14	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-E16

Drawing file: I:\acad\CADD\MINING\12-271\12-271E16.dwg - Layout Tab: Layout1
Date Plotted: 10/14/2014 Plotted By: jamesmorris
Xrefs: MAIN MINING UPDATED TOPO.dwg - Section-Range Grid - LargeArea.dwg - PITTSBURG QUAD.dwg - USGS TOPO MAPPING.dwg

Drawing: \\aci-acad\CADDRAWINGS\08467\08467E20R.dwg - Layout Tab: Model
Date: Dec 18, 2014-2:03pm - Plotted by: smeadows
Xrefs: WILLIAMSON CTY 2012_IL-E27.dwg



LEGEND

- MINING PERMIT #375 SURFACE FACILITIES
- MINING PERMIT #417 PENDING PERMIT AREA
- DELINEATED DRAINAGE PATTERN
- UNDEFINED DRAINAGE PATTERN
- WETLAND
- TP-20W TEST PIT LOCATIONS
- DRAINAGE BASED ON AERIAL MAPPING, MAY 2007
- INTERMITTENT STREAM CHANNEL
- EPHEMERAL STREAM CHANNEL
- EPHEMERAL/INTERMITTENT STREAM INTERFACE POINT
- EOC (END OF CHANNEL)
- OPEN WATER SITE

NOTE:
BOTH DRAINAGE PATTERNS A AND B ARE EPHEMERAL SWALES.
USAGE PRELIMINARY VERIFICATION, AUGUST 3, 2011.

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.
1	08/22/13	AS PER C.O.E. REQUEST	

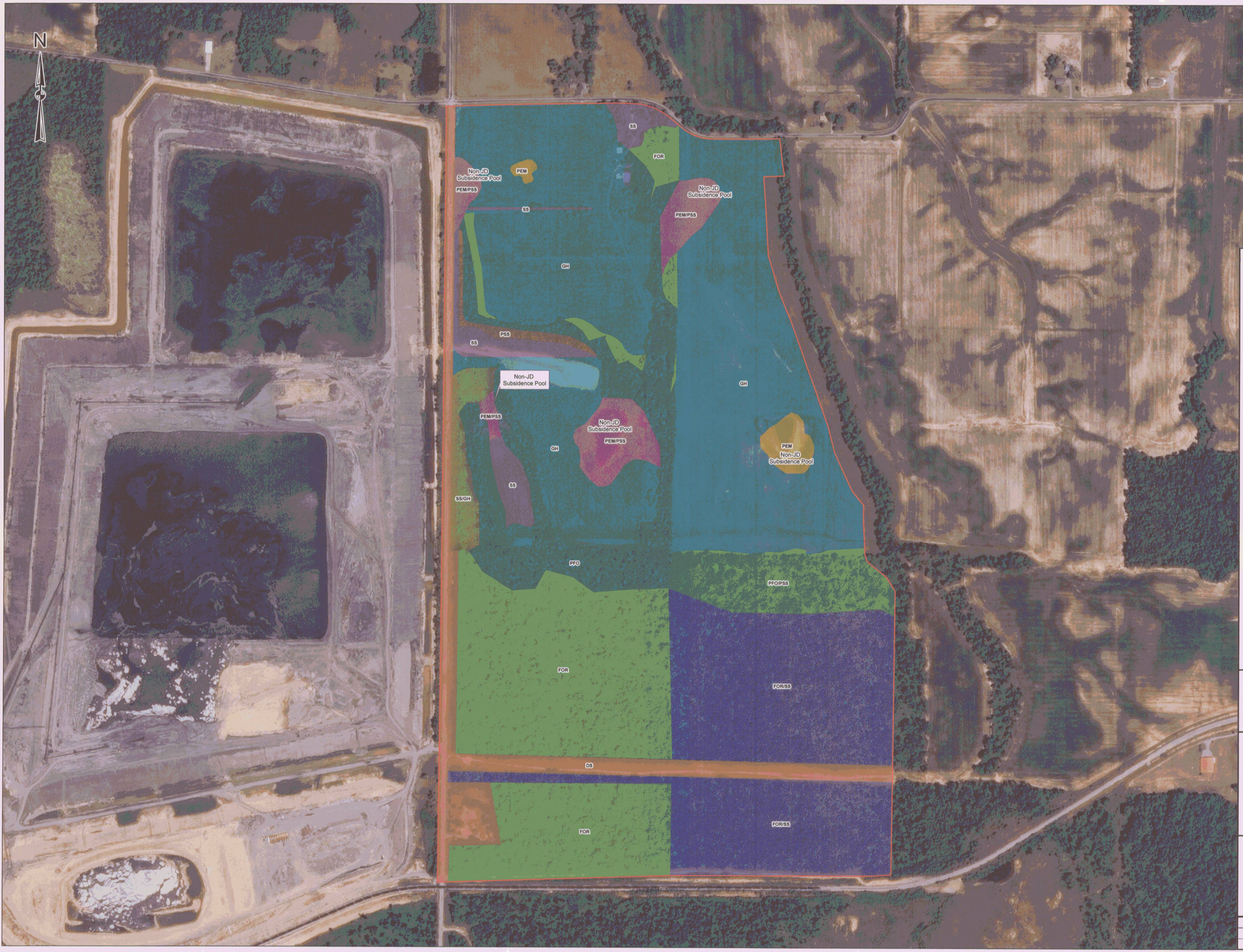
Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491
SUMMERSVILLE, WV (304) 883-2360
CANONSBURG, PA (724) 745-3630

AQUATIC RESOURCES DELINEATION MAP

OPERATIONS PLAN MAP (SURFACE FACILITIES)
POND CREEK 1 MINE
COAL REFUSE DISPOSAL FACILITY NO. 3
Prepared For
WILLIAMSON ENERGY LLC.
JOHNSTON CITY, IL

3001-/15

CAD BY	DJS	07/02/12	PROJECT NO. B08-467-1413
CHECKED BY			DRAWING NO. B08-467-E20



Legend

PERMIT 417 BOUNDARY

HABITAT CATEGORIES

- Developed, Open Space (DS) 14.4ac
- Forest, Upland (FOR) 45.2ac
- Forest/Scrub Shrub, Upland (FOR/SS) 43.6ac
- Grassland/Herbaceous (GH) 77.4ac
- Palustrine Emergent (PEM) 2.0ac
- Palustrine Emergent/Scrub Shrub (PEM/PSS) 7.4ac
- Palustrine Forest (PFO) 20.0ac
- Palustrine Forest/Scrub Shrub (PFO/PSS) 9.3ac
- Palustrine Scrub Shrub (PSS) 1.1ac
- Scrub Shrub, Upland (SS) 5.6ac
- Scrub Shrub/Grassland/Herbaceous (SS/GH) 3.2ac

SCALE

0 250 500 750 1,000 Feet

HABITAT MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

3001-/15

BECKLEY, WV
(304) 255-0491

CANONSBURG, PA
(724) 745-3630

SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	10/07/11		B08-467-1413
CHECKED BY	ACL	07/02/12		
APPROVED BY			B08-467-D4	

R10521



SURVEY LOCATIONS

- DAWN / DUSK BIRD SURVEY LOCATIONS
- BIRD / PLANT POINT SURVEY LOCATIONS
- DIURNAL SURVEY TRANSECTS
- STREAM RESOURCES
- PERMIT 417 BOUNDARY
- JURISDICTIONAL WETLANDS

SCALE

0 200 400 600 800 Feet

POTENTIALLY THREATENED / ENDANGERED BIRD AND PLANT SURVEY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

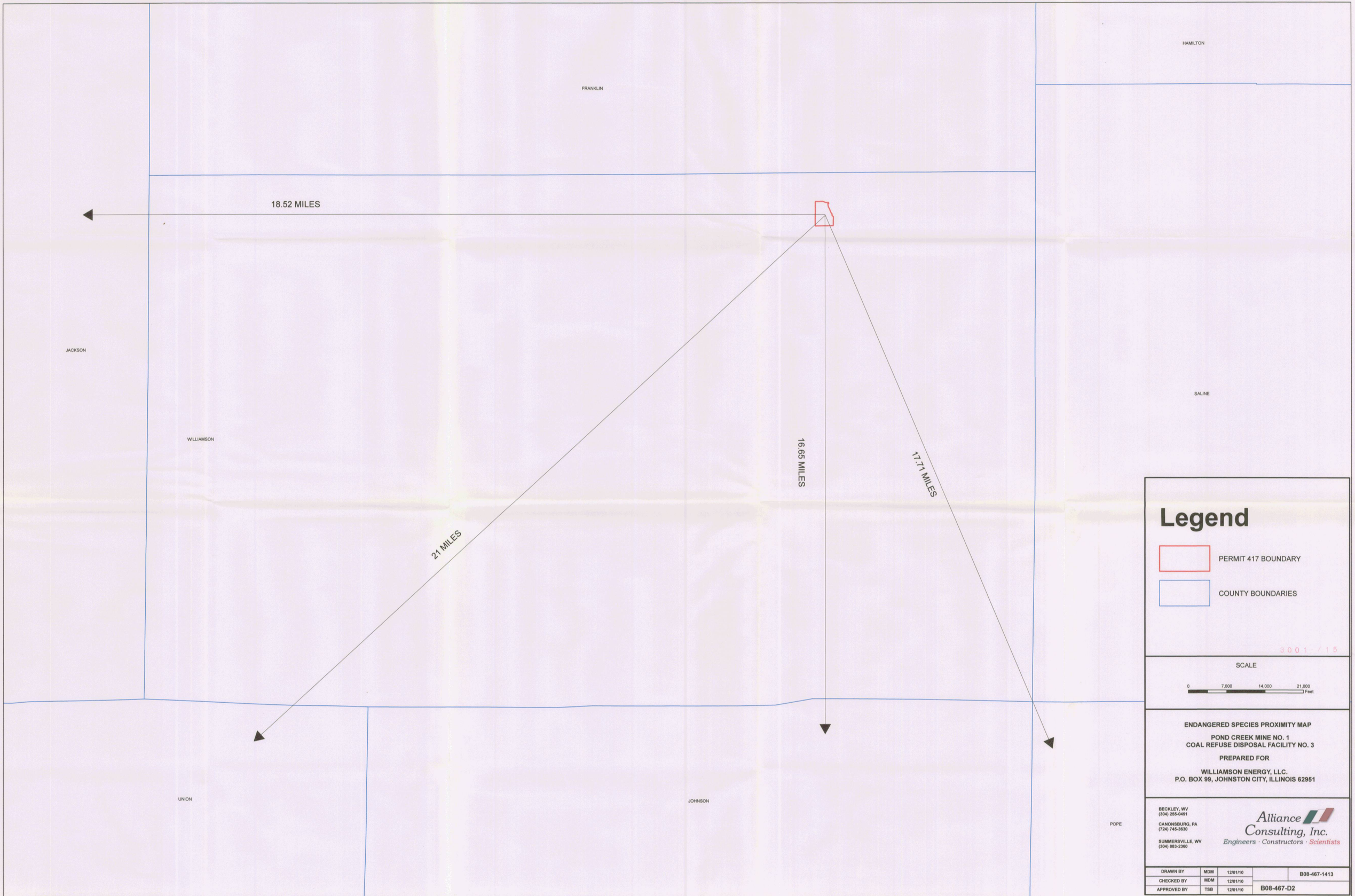
WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV (304) 255-0491
CANONSBURG, PA (724) 745-3630
SUMMERSVILLE, WV (304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	09/16/11		B08-467-1413
CHECKED BY	ACL	11/17/11		
APPROVED BY			B08-467-D1	

R10522



Legend

PERMIT 417 BOUNDARY

COUNTY BOUNDARIES

3001 / 15

SCALE

0 7,000 14,000 21,000 Feet

ENDANGERED SPECIES PROXIMITY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO. 3

PREPARED FOR

WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV
(304) 255-0491

CANONSBURG, PA
(724) 745-3630

SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	MDM	12/01/10		B08-467-1413
CHECKED BY	MDM	12/01/10		
APPROVED BY	TSB	12/01/10	B08-467-D2	

R10523

N

LEGEND

- BAT SURVEY LOCATIONS
- MIST NET LOCATIONS
- FISH SURVEY SITES
- RICE RAT CAPTURE LOCATIONS
- SMALL MAMMAL TRAP LOCATIONS
- DAWN / DUST BIRD SURVEY LOCATIONS
- BIRD / PLANT POINT SURVEY LOCATIONS
- BIRD / PLANT SURVEY TRANSECTS
- STREAM RESOURCES
- PERMIT 417 BOUNDARY
- SHADOW AREA
- JURISDICTIONAL WETLANDS

REFERENCES:

STREAM RESOURCES FROM THE ILLIONOIS GEOSPATIAL DATA CLEARINGHOUSE AVAILABLE AT www.isgs.illinois.edu/nsdihome

0 1,000 2,000 3,000 Feet

THREATENED / ENDANGERED SPECIES SURVEY MAP

POND CREEK MINE NO. 1
COAL REFUSE DISPOSAL FACILITY NO.3

PREPARED FOR
WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

BECKLEY, WV
(304) 255-0491

CANONSBURG, PA
(724) 745-3630

SUMMERSVILLE, WV
(304) 883-2360

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

DRAWN BY	ACL	11/30/11		B08-467-1413
CHECKED BY	ACL	11/30/11		
APPROVED BY				B08-467-D5 R1

R10524

FLUME NO. 1

FLUME NO. 2

FLUME NO. 3

FLUME NO. 4

FLUME NO. 5

FLUME NO. 6

FLUME NO. 7

FLUME NO. 8

FLUME NO. 9

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 17)

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 17)

CONSTRUCT ABANDONMENT PERIMETER DITCH (SEE FIGURE NO. 17)

CULVERT C-1 (3) 42" CMPS

N

SCALE

200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.
3	11/05/14	ADDRESS C. KOLAR'S 10/29/14 COMMENTS	SMS
2	10/06/14	ADDRESS C. KOLAR'S 08/04/14 COMMENTS	SMS
1	07/25/14	GENERAL REVISIONS PER I.D.N.R. COMMENTS	SMS

LEGEND:

ADJACENT PERMIT NO. 375 BOUNDARY

PERMIT NO. 417 BOUNDARY

WL	FISH & WILDLIFE HERBACEOUS (WARM SEASON GRASSES)	91.08 AC.
WL	FISH & WILDLIFE HERBACEOUS (COOL SEASON GRASSES)	117.45 AC.
WL	FISH & WILDLIFE WOODY	17.58 AC.
W	FISH & WILDLIFE WATER	3.67 AC.

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

IDNR-M&M PERMIT NO. 417 IEPA PERMIT NO. PENDING

MAP 7 – RECLAMATION MAP

PROPOSED COAL REFUSE DISPOSAL FACILITY NO. 3
EAST OF DWINA

Prepared For

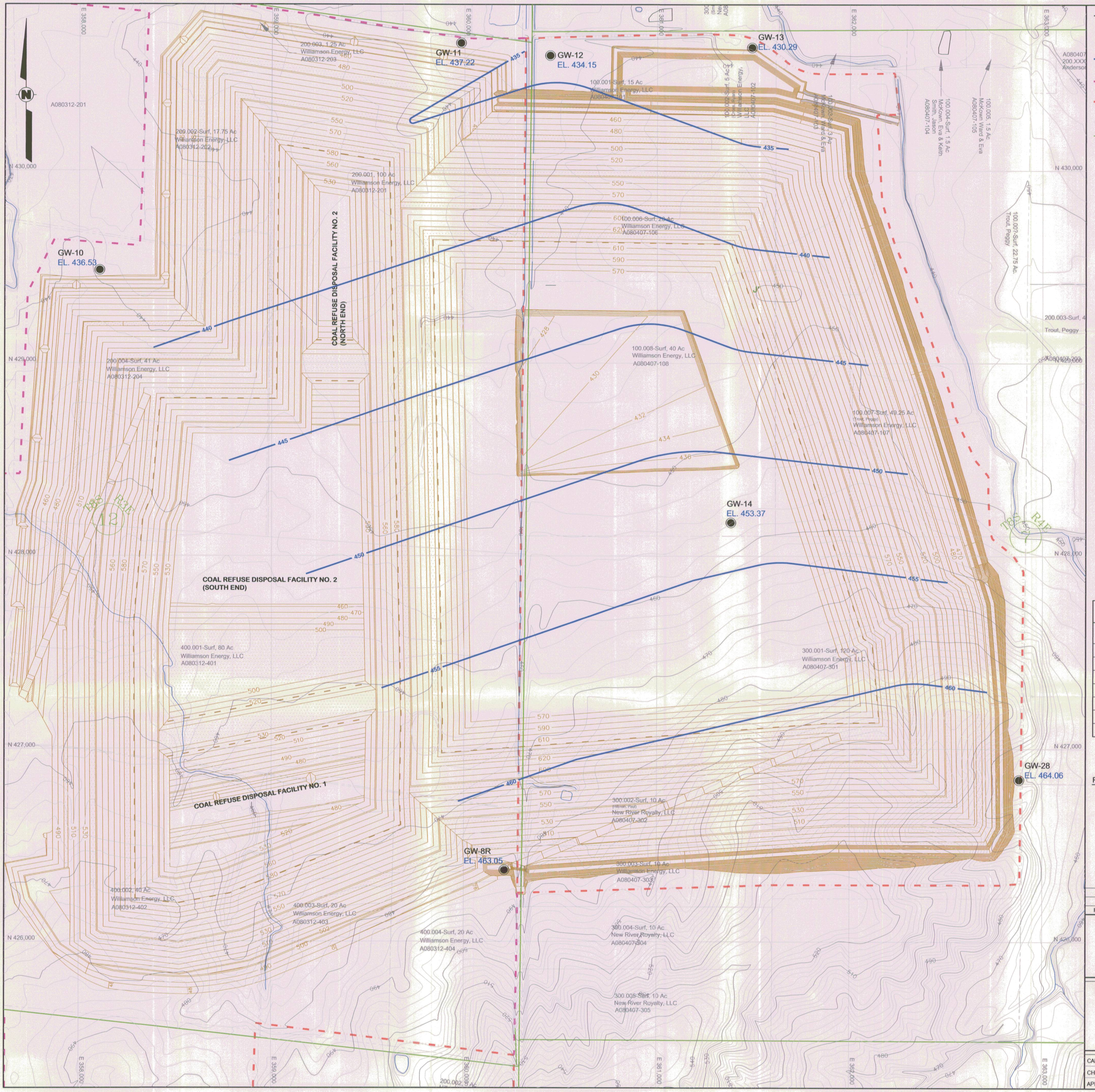
WILLIAMSON ENERGY LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	06/21/12
CHECKED BY	JLP	06/21/13
APPROVED BY	CEY	06/28/13

PROJECT NO. B12-271-1413

DRAWING NO. B12-271-M25

R10525



LEGEND

- GW-13 — GROUNDWATER MONITORING WELL USED FOR GROUNDWATER ELEVATION CONTOURING
- 440 — GROUNDWATER ELEVATION CONTOUR (5–FOOT CONTOUR INTERVAL)
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- PROPERTY LINE
- TOWNSHIP/RANGE

SURVEYED GROUNDWATER MONITORING WELL LOCATIONS

WELL NUMBER	NORTHING	EASTING	TOP OF PIPE	GROUND ELEVATION
GW-8R	426371	360211	482.5	--
GW-10	429483	358105	437.88	435.17
GW-11	430660	359981	440.50	437.77
GW-12	430596	360443	438.13	435.25
GW-13	430637	361492	444.57	441.57
GW-14	428172	361383	458.52	455.56
GW-28	426840	362879	467.73	--

REFERENCES:

1) TOPOGRAPHIC MAPPING PROVIDED BY WILLIAMSON ENERGY, LLC.
2) GROUNDWATER MONITORING WELL WATER ELEVATION DATA PROVIDED BY WILLIAMSON ENERGY, LLC.

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2361 · CANONSBURG, PA (724) 745-3630

POTENTIOMETRIC SURFACE/WATER TABLE MAP FOR GROUNDWATER LEVELS RECORDED ON FEBRUARY 27, 2014

COAL REFUSE DISPOSAL FACILITY NO. 3
POND CREEK MINE NO. 1
PERMIT NO. 375
Prepared For
WILLIAMSON ENERGY, LLC

CAD BY	DJS	10/14/14	PROJECT NO. B12-271-1413
CHECKED BY			DRAWING NO. B12-271-E17
APPROVED BY			

DOCUMENT

53

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

NPDES RENEWAL #2
FOR
PERMIT NO. IL0077666
(IDNR PERMIT 375 & 417)

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: SAB

POND CREEK MINE NO. 1 &
REFUSE DISPOSAL AREA NO. 3
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-626-1413
DECEMBER 2014

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Drive
Suite 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

February 13, 2015

Project No. B14-626-1413

Mr. Bob Mosher
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Water Quality Standards Unit
Division of Water Pollution Control
1021 North Grand Av. E.
Springfield, IL 62794-9276

RECEIVED
FEB 19 2015
BUREAU OF WATER
BUREAU CHIEF'S OFFICE
IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
AUG 02 2019
REVIEWER: SAB

Williamson Energy LLC - NPDES No. 0077666
Renewal No. 1
Pond Creek Mine
Williamson County, Illinois

Dear Mr. Mosher:

Attached, please find the Permit Renewal application for Williamson Energy LLC; Pond Creek Mine located in Williamson County, Illinois. This renewal package includes:

- EPA Form 1
- EPA Form 2C
- Water analysis from each sediment pond. Ponds were not discharging, therefore grab samples were taken.
- Receiving stream samples - Un-named tributary of Pond Creek
- Schedule A identifying each outfall.
- Water Flow Diagram
- 1" = 1000' Operation Map showing the current permit boundary with acreages, NPDES outfall locations and stream monitoring point.
- 1" = 400' Supplemental Operations Map with a orthophotographs background
- Proposed Pond 9 – Plan View and Sections
- Proposed Pond 9 – Sediment Ditch Profile and Sections
- Proposed Pond 9 – SedCAD Report (10 yr. / 24 hr.)
- Proposed Pond 9 – SedCAD Report (100 yr. / 6 hr.)

Should you have any questions, or require additional information, please contact us.

Respectfully submitted for Williamson Energy LLC,

Stephen M. Sutphin
Senior Project Manager
ALLIANCE CONSULTING, INC.

SMS:sms
Enclosures

FILE: 14626-02

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

February 13, 2015

Project No. B14-626-1413

Mr. Joe Stitely
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
2309 West Main Street, Suite 116
Marion, IL 62959

Williamson Energy LLC - NPDES No. 0077666
Renewal No. 1
Pond Creek Mine
Williamson County, Illinois

Dear Mr. Stitely:

Attached, please find the Permit Renewal application for Williamson Energy LLC; Pond Creek Mine located in Williamson County, Illinois. This renewal package includes:

- EPA Form 1
- EPA Form 2C
- Water analysis from each sediment pond. Ponds were not discharging, therefore grab samples were taken.
- Receiving stream samples - Un-named tributary of Pond Creek
- Schedule A identifying each outfall.
- Water Flow Diagram
- 1" = 1000' Operation Map showing the current permit boundary with acreages, NPDES outfall locations and stream monitoring point.
- 1" = 400' Supplemental Operations Map with a orthophotographs background
- Proposed Pond 9 – Plan View and Sections
- Proposed Pond 9 – Sediment Ditch Profile and Sections
- Proposed Pond 9 – SedCAD Report (10 yr. / 24 hr.)
- Proposed Pond 9 – SedCAD Report (100 yr. / 6 hr.)

Should you have any questions, or require additional information, please contact us.

Respectfully submitted for Williamson Energy LLC,

Stephen M. Sutphin
Senior Project Manager
ALLIANCE CONSULTING, INC.

SMS:sms
Enclosures

FILE: 14626-01

NPDES RENEWAL #2
FOR
PERMIT NO. IL0077666
(IDNR PERMIT 375 & 417)

POND CREEK MINE NO. 1 &
REFUSE DISPOSAL AREA NO. 3
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-626-1413
DECEMBER 2014

EPA FORM 1

CAS

R10532

Please print or type in the unshaded areas only.

Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER: F IL 0077666 D

LABEL ITEMS

- I. EPA I.D. NUMBER
- III. FACILITY NAME
- V. FACILITY MAILING ADDRESS
- VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)		X	
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X			D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)		X		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment** area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP: POND CREEK 1 MINE

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 ALLAMAN, MARK - CHIEF MINING ENGINEER	(618) 683-3020

V. FACILTY MAILING ADDRESS

A. STREET OR P.O. BOX	B. CITY OR TOWN	C. STATE	D. ZIP CODE
3 16468 LIBERTY SCHOOL ROAD	4 MARION	IL	62959

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER	B. COUNTY NAME
5 16468 LIBERTY SCHOOL ROAD	WILLIAMSON

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6 MARION	IL	62959	

RECEIVED
FEB 19 2015
BUREAU OF WATER
BUREAU CHIEF'S OFFICE

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST		B. SECOND	
1222	*(specify)* COAL MINING - UNDERGROUND		*(specify)* N/A
C. THIRD		**D. FOURTH**	
	(specify) N/A		*(specify)* N/A

VIII. OPERATOR INFORMATION

A. NAME	B. Is the name listed in Item VIII-A also the owner?
WILLIAMSON ENERGY LLC	☒ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other," specify.)*

F = FEDERAL; M = PUBLIC (other than federal or state); S = STATE; O = OTHER (specify); P = PRIVATE

P — *(specify)* -

D. PHONE *(area code & no.)*: 618 983 3020

E. STREET OR PO BOX: 16468 LIBERTY SCHOOL ROAD

F. CITY OR TOWN	G. STATE	H. ZIP CODE
MARION	IL	62959

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	IL0077666	D. PSD *(Air Emissions from Proposed Sources)*	05040012
B. UIC (Underground Injection of Fluids	N/A	E. OTHER *(specify)*	375 — *(Specify)* IDNR
C. RCRA (Hazardous Wastes)	N/A	E. OTHER *(specify)*	417 — *(Specify)* IDNR-PENDING

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

UNDERGROUND BITUMINOUS COAL MINE WITH COAL PREPARATION PLANT, REFUSE DISPOSAL FACILITIES AND COAL HANDLING FACILITIES.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
DWAYNE FRANCISCO	Dwayne Francisco	12/29/14

COMMENTS FOR OFFICIAL USE ONLY

EPA FORM 3510-1(8-90)

*Any person who knowingly makes a false, fictitous, or fraudulent statement, orally or in writing, to the Illinois EPA commits a Class 4 felony. A second or subsequent offense after conviction is a Class 3 felony. (415 ILCS 5/44(h)).

R10534

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*): IL0077666

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	37	50	59.2	88	49	37.5	Unnamed tributary of Pond Creek
002	37	50	26	88	49	51.5	Unnamed tributary of Pond Creek
003	37	50	26	88	49	58	Unnamed tributary of Pond Creek
004	37	50	25	88	49	56.6	Unnamed tributary of Pond Creek
005	37	50	9.1	88	50	0.0	Unnamed tributary of Pond Creek
006	37	50	28.4	88	50	40.6	Unnamed tributary of Pond Creek
007	37	50	29.5	88	49	34	Unnamed tributary of Pond Creek
008	37	50	31.4	88	49	33.9	Unnamed tributary of Pond Creek
009	37	50	52.3	88	48	43.7	Unnamed tributary of Pond Creek

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Alkaline Mine Drainage	2 gpm	Sedimentation	1-U	4-A
	Storm Water Runoff			1-U	4-A
002	Alkaline Mine Drainage	1 gpm	Sedimentation	1-U	4-A
	Storm Water Runoff			1-U	4-A
003	Alkaline Mine Drainage	1 gpm	Sedimentation	1-U	4-A
	Storm Water Runoff			1-U	4-A
004	Alkaline Mine Drainage	2 gpm	Sedimentation	1-U	4-A
	Storm Water Runoff			1-U	4-A
005	Alkaline Mine Drainage	5 gpm	Sedimentation	1-U	4-A
	Storm Water Runoff			1-U	4-A
006	Acid Mine Drainage		Sedimentation	1-U	4-A
	Storm Water Runoff	2 gpm		1-U	4-A
	Process Wastewater	3 gpm			
	Deep Mine Drainage	10 gpm			

007	Acid Mine Drainage		Sedimentation	1-U	4-A
	Storm Water Runoff	1 gpm		1-U	4-A
	Process Wastewater	3 gpm			
	Deep Mine Drainage	10 gpm			
008	Acid Mine Drainage		Sedimentation	1-U	4-A
	Storm Water Runoff	1 gpm		1-U	4-A
	Process Wastewater	3 gpm			
	Deep Mine Drainage	10 gpm			
009	Acid Mine Drainage		Sedimentation	1-U	4-A
	Storm Water Runoff	1 gpm		1-U	4-A

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☐ YES (*complete the following table*) ☒ NO (*go to Section*

1. OUTFALL NUMBER (*list*)	2. OPERATION(s) CONTRIBUTING FLOW (*list*)	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK (*specify average*)	b. MONTHS PER YEAR (*specify average*)	a. FLOW RATE (*in mgd*)		B. TOTAL VOLUME (*specify with units*)		C. DURATION (*in days*)
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☐ YES (*complete Item III-B*) ☒ NO (*go to Section*

B. Are the limitations in the applicable effluent guideline expressed in terms of production (*or other measure of operation*)?

☐ YES (*complete Item III-C*) ☒ NO (*go to Section*

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION			2. AFFECTED OUTFALLS (*list outfall numbers*)
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (*specify*)	

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operations of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES (*complete the following table*) ☒ NO (*go to Item IV-B*)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE	
	a. NO	b. SOURCE OF DISCHARGE		a. REQUIRED	b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (*or other environmental projects which may affect your discharges*) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
IL0077666

V. INTAKE AND EFFLUENT CHARACTERISTICS

B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
N/A			

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES (*list all such pollutants below*) ☒ NO (*go to Item VI-B*)

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ YES *(identify the test(s) and describe their purpose below)* ☒ NO *(go to Section VIII)*

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☒ YES *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ NO *(go to Section IX)*

A. NAME	B. ADDRESS	C. TELEPHONE *(area code & no.)*	D. POLLUTANTS ANALYZED *(list)*
Summit Environmental Services, Inc	17650 Route 37, West Frankfort, IL 62896	(618) 983-8280	1M - 15M
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	
		( )	

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE *(type or print)*	B. PHONE NO. *(area code & no.)*
Dwanye Francisco, AUTHORIZED AGENT	( )
C. SIGNATURE	D. DATE SIGNED
	12/29/14

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
IL 0077666

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* 001

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	***46***	***mg/L***					***1***					
e. Ammonia *(as N)*												
f. Flow	Value ***0***		Value		Value		***1***			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum ***7.2***	Minimum	Maximum			***1***	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

R10539

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	*5,150*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*17.81*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

R10540

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	001

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	<0.040	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.018	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	<0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	0.067	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	0.025	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764-01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. Acrolein *(107-02-8)*	☐	☐	☒												
2V Acrylonitrile *(107-13-1)*	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis *(Chloromethyl)* Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 001

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-60-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azo-benzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*001*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from item 1 of Form 1)*
IL 0077666

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* 002

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	***36***	***mg/L***					***1***					
e. Ammonia *(as N)*												
f. Flow	Value ***0***		Value		Value		***1***			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum ***7.8***	Minimum	Maximum			***1***	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

R10548

ITEM V-... CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'		2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (as N)	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus (as P), Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate (as SO_4) (14808-79-8)	☒	☐	92	mg/L					1					
l. Sulfide (as S)	☐	☒												
m. Sulfite (as SO_3)(14265-45-3)	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	1.982	mg/L					1					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy fr...tem 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	002

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	<0.040	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.031	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	<0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	<0.001	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☐	☐	☒												
2V Acrylonitrile (107-13-1)	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis (Chloromethyl) Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 002

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-80-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 002

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azo-benzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosodi-N-Propylamine (621-64-7)	☐	☐	☒												

R10554

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*002*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* 003

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*66*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *8.0*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* (14808-79-8)	☒	☐	*88*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)*(14265-45-3)	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*2.910*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy fr...tem 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	003

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	0.069	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.024	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	<0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	<0.001	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. *Acrolein (107-02-8)*	☐	☐	☒												
2V *Acrylonitrile (107-13-1)*	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis *(Chloromethyl)* Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'			2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS (continued)															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-80-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER (copy from Item 1 of Form 1): Error! Reference source not found.

OUTFALL NUMBER: 003

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'			2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine (as Azobenzene) (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno (1,2,3-cd) Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*003*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS ***(continued from page 3 of Form 2-C)*** 004

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*58*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *7.9*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	*210*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*0.463*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

R10567

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	004

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. LONG TERM AVERAGE VALUE				b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	<0.040	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.024	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	<0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	<0.001	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764-01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☐	☐	☒												
2V Acrylonitrile (107-13-1)	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis (Chloromethyl) Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: *004*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-60-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 004

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azo-benzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

R10572

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*004*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS ***(continued from page 3 of Form 2-C)*** 005

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	2. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	2. EFFLUENT b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	2. EFFLUENT b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	2. EFFLUENT c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	2. EFFLUENT c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	2. EFFLUENT d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS *(specify if blank)* b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE *(optional)* b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*65*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *8.1*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	2. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	2. EFFLUENT b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	2. EFFLUENT b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	2. EFFLUENT c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	2. EFFLUENT c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	2. EFFLUENT d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS *(specify if blank)* b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE *(optional)* b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	*390*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*1.408*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

R10576

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	005

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	<0.040	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.043	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	<0.001	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS		a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V *Acrolein (107-02-8)*	☐	☐	☒												
2V *Acrylonitrile (107-13-1)*	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis *(Chloromethyl)* Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 005

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-60-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

EPA I.D. NUMBER (copy from Item 1 of Form 1): Error! Reference source not found.

OUTFALL NUMBER: 005

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azo-benzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosodi-N-Propylamine (621-64-7)	☐	☐	☒												

R10581

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUE ON PAGE V-9

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*005*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS ***(continued from page 3 of Form 2-C)*** 006

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*24*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *7.6*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVRG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVRG. VALUE *(if available)* (2) MASS	d. NO. OF ANALYSIS	3. UNITS *(specify if blank)* a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE *(optional)* a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-C CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	***3800***	***mg/L***					***1***					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	***1.595***	***mg/L***					***1***					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*006*

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	<0.040	mg/L					1					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	0.030	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	<0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	0.014	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.002	mg/L					1					
15M Phenols, Total	☐	☒	☐	<0.01	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☐	☐	☒												
2V Acrylonitrile (107-13-1)	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis (Chloromethyl) Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER (copy from Item 1 of Form 1): Error! Reference source not found.

OUTFALL NUMBER: 006

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'			2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS (continued)															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-80-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER (copy from Item 1 of Form 1): Error! Reference source not found.

OUTFALL NUMBER: 006

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'			2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine (as Azo-benzene) (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno (1,2,3-cd) Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

R10590

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*006*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* 007

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*15*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *7.8*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS			a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	*3450*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*1.454*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☐	☒												
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-8)	☐	☒												

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER *(copy fro… m 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*007*

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m. Antimony, Total (7440-36-0)	☐	☒	☐	*<0.040*	*mg/L*					*1*					
2M. Arsenic, Total (7440-38-2)	☐	☒	☐	*<0.002*	*mg/L*					*1*					
3M. Beryllium, Total (7440-41-7)	☐	☒	☐	*<0.001*	*mg/L*					*1*					
4M. Cadmium, Total (7440-43-9)	☐	☒	☐	*0.044*	*mg/L*					*1*					
5M Chromium, Total (7440-47-3)	☐	☒	☐	*<0.006*	*mg/L*					*1*					
6M Copper, Total (7440-50-8)	☐	☒	☐	*<0.003*	*mg/L*					*1*					
7M lead, Total (7439-92-1)	☐	☒	☐	*<0.0075*	*mg/L*					*1*					
8M Mercury, Total (7439-97-6)	☐	☒	☐	*<0.002*	*mg/L*					*1*					
9M Nickel, Total (7440-02-0)	☐	☒	☐	*<0.010*	*mg/L*					*1*					
10M Selenium, Total (7782-49-2)	☐	☒	☐	*<0.002*	*mg/L*					*1*					
11M Silver, Total (7440-22-4)	☐	☒	☐	*<0.002*	*mg/L*					*1*					
12M Thallium, Total (7440-28-0)	☐	☒	☐	*<0.020*	*mg/L*					*1*					
13M Zinc, Total (7440-66-6)	☐	☒	☐	*0.028*	*mg/L*					*1*					
14M Cyanide, Total (57-12-5)	☐	☒	☐	*<0.002*	*mg/L*					*1*					
15M Phenols, Total	☐	☒	☐	*<0.01*	*mg/L*					*1*					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☐	☐	☒												
2V Acrylonitrile (107-13-1)	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis (Chloromethyl) Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy fro... ...m 1 of Form 1)*: *Error! Reference source not found.*

OUTFALL NUMBER: *007*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-60-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 007

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

R10599

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*	OUTFALL NUMBER
Error! Reference source not found.	*007*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSIS
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*
Error! Reference source not found.

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* 008

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		b. NO. OF ANALYSES
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*	*19*	*mg/L*					*1*					
e. Ammonia *(as N)*												
f. Flow	Value *0*		Value		Value		*1*			Value		
g. Temperature *(winter)*	Value		Value		Value			°C		Value		
h. Temperature *(summer)*	Value		Value		Value			°C		Value		
i. pH	Minimum -	Maximum *8.7*	Minimum	Maximum			*1*	STANDARD UNTIS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitation guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		b. NO. OF ANALYSES
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	☐	☒												
b. Chlorine, Total Residual	☐	☒												
c. Color	☐	☒												
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☐	☒												
f. Nitrate-Nitrite *(as N)*	☐	☒												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic *(as N)*	☐	☒												
h. Oil and Grease	☐	☒												
i. Phosphorus *(as P)*, Total (7723-14-0)	☐	☐												
j. Radioactivity														
(1) Alpha, Total	☐	☒												
(2) Bets, Total	☐	☒												
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate *(as SO_4)* *(14808-79-8)*	☒	☐	*1100*	*mg/L*					*1*					
l. Sulfide (as S)	☐	☒												
m. Sulfite *(as SO_3)(14265-45-3)*	☐	☒												
n. Surfactants	☐	☒												
o. Aluminum, Total (7429-90-5)	☐	☒												
p. Barium, Total (7440-39-3)	☐	☒												
q. Boron, Total (7440-42-8)	☐	☒												
r. Cobalt, Total (7440-48-4)	☐	☒												
s. Iron, Total (7439-89-4)	☒	☐	*<0.006*	*mg/L*					*1*					
t. Magnesium, Total (7439-95-4)	☐	☒												
u. Molybdenum, Total (7439-98-7)	☐	☒												
v. Manganese, Total (7439-96-5)	☒	☐	*0.011*	*mg/L*					*1*					
w. Tin, Total (7440-31-5)	☐	☒												
x. Titanium, Total (7440-32-6)	☐	☒												

R10603

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
Error! Reference source not found.	008

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant. If you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*					a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS		a. CONCENTRATION	b. MASS	(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1m Antimony, Total (7440-36-0)	☐	☒	☐	<0.002	mg/L					1					
2M Arsenic, Total (7440-38-2)	☐	☒	☐	<0.002	mg/L					1					
3M Beryllium, Total (7440-41-7)	☐	☒	☐	<0.001	mg/L					1					
4M Cadmium, Total (7440-43-9)	☐	☒	☐	0.008	mg/L					1					
5M Chromium, Total (7440-47-3)	☐	☒	☐	<0.006	mg/L					1					
6M Copper, Total (7440-50-8)	☐	☒	☐	0.003	mg/L					1					
7M lead, Total (7439-92-1)	☐	☒	☐	<0.0075	mg/L					1					
8M Mercury, Total (7439-97-6)	☐	☒	☐	<0.002	mg/L					1					
9M Nickel, Total (7440-02-0)	☐	☒	☐	<0.010	mg/L					1					
10M Selenium, Total (7782-49-2)	☐	☒	☐	<0.002	mg/L					1					
11M Silver, Total (7440-22-4)	☐	☒	☐	<0.002	mg/L					1					
12M Thallium, Total (7440-28-0)	☐	☒	☐	<0.020	mg/L					1					
13M Zinc, Total (7440-66-6)	☐	☒	☐	<0.001	mg/L					1					
14M Cyanide, Total (57-12-5)	☐	☒	☐	<0.007	mg/L					1					
15M Phenols, Total	☐	☒	☐	0.005	mg/L					1					
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764--01-6)	☐	☐	☒	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS															
1V. *Acrolein (107-02-8)*	☐	☐	☒												
2V *Acrylonitrile (107-13-1)*	☐	☐	☒												
3V Benzene (71-43-2)	☐	☐	☒												
4V Bis *(Chloromethyl)* Ether (542-88-1)	☐	☐	☒												
5V Bromoform (75-25-2)	☐	☐	☒												
6V Carbon Tetrachloride (56-23-5)	☐	☐	☒												
7V Chlorobenzene (108-90-7)	☐	☐	☒												
8V Chlorodibromomethane (124-48-1)	☐	☐	☒												
9V Chloroethane (75-00-3)	☐	☐	☒												
10V 2-Chloroethylvinyl Ether (110-75-8)	☐	☐	☒												
11V Chloroform (67-66-3)	☐	☐	☒												
12V Dichlorobromoethane (75-71-8)	☐	☐	☒												
13V Dichlorodifluoromethane (75-71-8)	☐	☐	☒												
14V 1,1-Dichloroethane (75-34-3)	☐	☐	☒												
15V 1,2-Dichloroethane (107-06-2)	☐	☐	☒												
16V 1,1-Dichloroethylene (75335-4)	☐	☐	☒												
17V 1,2-Dichloropropane (78-87-5)	☐	☐	☒												
18V 1,3-Dichloropropylene (542-76-6)	☐	☐	☒												
19V Ethylbenzene (100-41-4)	☐	☐	☒												
20V Methyl Bromide (74-83-9)	☐	☐	☒												
21V Methyl Chloride (74-87-3)	☐	☐	☒												

CONTINUED FROM PAGE V-4

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: *Error! Reference source not found.*

OUTFALL NUMBER: *008*

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - VOLATILE COMPOUNDS *(continued)*															
22 V Methylene Chloride (75-09-2)	☐	☐	☒												
23V 1,1,2,2-Tetra-Chloroethane (79-34-5)	☐	☐	☒												
24V Tetrachloro-ethylene (127-18-4)	☐	☐	☒												
25V Toluene (108-88-3)	☐	☐	☒												
26V 1,2-Trans-Dichloroethylene (156-60-5)	☐	☐	☒												
27V 1,1,1-Tri-chloroethane (71-55-6)	☐	☐	☒												
28V 1,1,2-Tri-chloroethane (79-00-5)	☐	☐	☒												
29V Trichloro-ethylene (79-01-6)	☐	☐	☒												
30V Trichloro-fluoromethane (75-69-4)	☐	☐	☒												
31V Vinyl Chloride (75-01-4)	☐	☐	☒												
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	☐	☐	☒												
2A 2,4-Dichloro-phenol (120-83-2)	☐	☐	☒												
3A 2,4-Dimethyl-phenol (105-67-9)	☐	☐	☒												
4A 4,6-Dinitro-O-cresol (534-52-1)	☐	☐	☒												
5A 2,4-Dinitro-phenol (51-28-5)	☐	☐	☒												
6A 2-Nitro-phenol (88-75-5)	☐	☐	☒												
7A 4-Nitro-phenol (100-02-7)	☐	☐	☒												
8A P-Chloro-M-Cresol (59-50-7)	☐	☐	☒												
9A Penta-chlorophenol (87-86-5)	☐	☐	☒												
10A Phenol (10/-95-2)	☐	☐	☒												
11A 2,4,6-Tri-chlorophenol (88-06-2)	☐	☐	☒												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenphthene (83-32-9)	☐	☐	☒												
2B Acenaphtylene (208-96-8)	☐	☐	☒												
3B Anthracene (120-12-7)	☐	☐	☒												
4B Benzidine (92-87-5)	☐	☐	☒												
5B Benzo (a) Anthracene (56-55-3)	☐	☐	☒												
6B Benzo (a) Pyrene (50-32-8)	☐	☐	☒												
7B 3,4-Benzo-fluoranthene (205-99-2)	☐	☐	☒												
8B Benzo *(ghi)* Perylene (191-24-2)	☐	☐	☒												
9B Benzo *(k)* Fluoranthene (207-08-9)	☐	☐	☒												
10B Bis *(2-Chloroethoxy)* Methane (111-91-1)	☐	☐	☒												
11B Bis *(2-Chloro-ethyl)* Ether (111-44-4)	☐	☐	☒												
12B Bis *(2-Chloroisepropyl)* Ether (102-60-1	☐	☐	☒												
13B Bis*(2-Ethyl-hexyl)* Phthalate (117-81-7)	☐	☐	☒												
14 B 4-Bromo-phenyl Phenyl Ether (101-55-3)	☐	☐	☒												
15B Butyl Benzyl Phthalate (85-68-7)	☐	☐	☒												
16B 2-Chloro-naphthalene (91-68-7)	☐	☐	☒												
17B 4-Chloro-phenyl Phenyl Ether (7005-72-3)	☐	☐	☒												
18B Chrysene (218-01-9)	☐	☐	☒												
19B Dibenzo *(a,h)* Anthracene (53-70-3)	☐	☐	☒												
20B 1,2-Dichloro-benzene (95-50-1)	☐	☐	☒												
21B 1,3-Dichloro-benzene (541-73-1)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 008

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT						d. NO. OF ANALYSIS	3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - BASE/NEUTRAL COMPOUNDS *(continued)*															
22B 1,4-Dichlorobenzene (106-46-7)	☐	☐	☒												
23B 3,3'-Dichlorobenzidine (91-94-1)	☐	☐	☒												
24B Diethyl Phthalate (84-66-2)	☐	☐	☒												
25B Dimethyl Phthalate (131-11-3)	☐	☐	☒												
26B Di-N-Butyl Phthalate (131-11-3)	☐	☐	☒												
27B 2,4-Dinitrotoluene (121-14-2)	☐	☐	☒												
28B 2,6-Dinitrotoluene (606-20-2)	☐	☐	☒												
29B Di-N-Octyl Phthalate (117-84-0)	☐	☐	☒												
30B 1,2-Diphenylhydrazine *(as Azo-benzene)* (122-66-7)	☐	☐	☒												
31B Fluoranthene (206-44-0)	☐	☐	☒												
32B Fluorene (86-73-7)	☐	☐	☒												
33B Hexachlorobenzene (118-74-1)	☐	☐	☒												
34B Hexachlorobutadiene (87-68-3)	☐	☐	☒												
35B Hexachlorocyclopentadiene (77-47-4)	☐	☐	☒												
36B Hexachloroethane (67-72-1)	☐	☐	☒												
37B Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☐	☐	☒												
38B Isophorone (78-59-1)	☐	☐	☒												
39B Napthalene (91-20-3)	☐	☐	☒												
40B Nitrobenzene (98-95-3)	☐	☐	☒												
41B N-Nitrosodimethylamine (62-75-9)	☐	☐	☒												
42B N-Nitrosdi-N-Propylamine (621-64-7)	☐	☐	☒												

R10608

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS *(continued)*															
43B N-Nitrosodiphenylamine (86-30-6)	☐	☐	☒												
44B Phenanthrene (85-01-/	☐	☐	☒												
45B Pyrene (129-00-0)	☐	☐	☒												
46B 1,2,4-Trichlorobenzene (120-82-1)	☐	☐	☒												
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	☐	☐	☒												
2P β-Bhc (319-85-7)	☐	☐	☒												
4P γ-BHC (58-89-9)	☐	☐	☒												
5P δ-BHC (319-86-8)	☐	☐	☒												
6P Chlordane (57-74-9)	☐	☐	☒												
7P 4,4'-DDT (50-29-3)	☐	☐	☒												
8P 4,4'-DDE (72-55-9)	☐	☐	☒												
9P 4,4'-DDD (72-54-8)	☐	☐	☒												
10P Dieldrin (60-57-1)	☐	☐	☒												
11P α-Endosulfan (115-29-7)	☐	☐	☒												
12P β-Endosulfan (115-29-7	☐	☐	☒												
13P Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P Endrin (72-20-8)	☐	☐	☒												
15P Endrin Aldehyde (7421-93-4)	☐	☐	☒												
16P Heptachlor (76-44-8)	☐	☐	☒												

CONTINUED FROM PAGE V-6

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*: Error! Reference source not found.

OUTFALL NUMBER: 008

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'			2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSIS	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS - PESTICIDES *(continued)*															
17P Heptachlor Expxide (1024-57-3)	☐	☐	☒												
18P PCB-1242 (53469-21-9)	☐	☐	☒												
19P PCB-1254 (11097-69-1)	☐	☐	☒												
20P PCB-1221 (11104-28-2)	☐	☐	☒												
21P PCB-1232 (11141-16-5)	☐	☐	☒												
22P PCB-1248 (12672-29-6)	☐	☐	☒												
23P PCB-1260 (11096-82-5)	☐	☐	☒												
24P PCB-1016 (12674-11-2)	☐	☐	☒												
25P Toxaphene (8001-35-2)	☐	☐	☒												

GRAB SAMPLES
FROM SEDIMENT PONDS

LAB ANALYSIS SHEETS
POND SAMPLES

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Mach Mining
PDL: 16455-1
SAMPLE ID: Pond #1
DATE SAMPLED: 12/16/14

REPORT DATE: 1/5/15
COMMENT:
SAMPLED BY: Client - CS
DATE RECEIVED: 12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.2	Unit	1 - 14	150.1	12/16/14 AK
Acidity	52	mg/L	10	305.1	12/29/14 KE
Alkalinity	488	mg/L	10	310.1	12/29/14 KE
Chlorides	4,434	mg/L	5	325.3	12/22/14 KE
Sulfates	5,150	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	46	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.018	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	17.81	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	0.067	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	0.025	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Mach Mining
PDL: 16455-2
SAMPLE ID: Pond #2
DATE SAMPLED: 12/16/14

REPORT DATE: 1/5/15
COMMENT:
SAMPLED BY: Client - CS
DATE RECEIVED: 12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.8	Unit	1 - 14	150.1	12/16/14 AK
Acidity	< 10	mg/L	10	305.1	12/29/14 KE
Alkalinity	60	mg/L	10	310.1	12/29/14 KE
Chlorides	60	mg/L	5	325.3	12/22/14 KE
Sulfates	92	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	36	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.031	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	1.982	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	< 0.001	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Mach Mining	**REPORT DATE:**	1/5/15
PDL:	16455-3	**COMMENT:**	
SAMPLE ID:	Pond #3	**SAMPLED BY:**	Client - CS
DATE SAMPLED:	12/16/14	**DATE RECEIVED:**	12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	8.0	Unit	1 - 14	150.1	12/16/14 AK
Acidity	< 10	mg/L	10	305.1	12/29/14 KE
Alkalinity	64	mg/L	10	310.1	12/29/14 KE
Chlorides	28	mg/L	5	325.3	12/22/14 KE
Sulfates	88	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	66	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	0.069	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.024	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	2.910	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	< 0.001	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Mach Mining	**REPORT DATE:**	1/5/15
PDL:	16455-4	**COMMENT:**	
SAMPLE ID:	Pond #4	**SAMPLED BY:**	Client - CS
DATE SAMPLED:	12/16/14	**DATE RECEIVED:**	12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.9	Unit	1 - 14	150.1	12/16/14 AK
Acidity	< 10	mg/L	10	305.1	12/29/14 KE
Alkalinity	88	mg/L	10	310.1	12/29/14 KE
Chlorides	38	mg/L	5	325.3	12/22/14 KE
Sulfates	210	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	58	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.024	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	0.463	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	< 0.001	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Mach Mining
PDL: 16455-5
SAMPLE ID: Pond #5
DATE SAMPLED: 12/16/14

REPORT DATE: 1/5/15
COMMENT:
SAMPLED BY: Client - CS
DATE RECEIVED: 12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	8.1	Unit	1 - 14	150.1	12/16/14 AK
Acidity	10	mg/L	10	305.1	12/29/14 KE
Alkalinity	72	mg/L	10	310.1	12/29/14 KE
Chlorides	88	mg/L	5	325.3	12/22/14 KE
Sulfates	390	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	65	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.043	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	1.408	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	< 0.001	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT: Mach Mining
PDL: 16455-6
SAMPLE ID: Pond #6
DATE SAMPLED: 12/16/14

REPORT DATE: 1/5/15
COMMENT:
SAMPLED BY: Client - CS
DATE RECEIVED: 12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit	1 - 14	150.1	12/16/14 AK
Acidity	< 10	mg/L	10	305.1	12/29/14 KE
Alkalinity	520	mg/L	10	310.1	12/29/14 KE
Chlorides	3,209	mg/L	5	325.3	12/22/14 KE
Sulfates	3,800	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	24	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.030	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	1.595	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	0.014	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT: Mach Mining
PDL: 16455-7
SAMPLE ID: Pond #7
DATE SAMPLED: 12/16/14

REPORT DATE: 1/5/15
COMMENT:
SAMPLED BY: Client - CS
DATE RECEIVED: 12/16/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.8	Unit	1 - 14	150.1	12/16/14 AK
Acidity	10	mg/L	10	305.1	12/29/14 KE
Alkalinity	384	mg/L	10	310.1	12/29/14 KE
Chlorides	3,149	mg/L	5	325.3	12/22/14 KE
Sulfates	3,450	mg/L	5	375.4	12/22/14 KE
Total Suspended Solids	15	mg/L	5	160.2	12/22/14 KE
Cyanide	< 0.002	mg/L	0.002	335.4	12/30/14 KE
Phenols, Total Recoverable	< 0.01	mg/L	0.01	420.4	1/2/15 KE
Antimony	< 0.040	mg/L	0.040	204.1	12/30/14 AK
Arsenic	< 0.002	mg/L	0.002	206.4	12/30/14 AK
Beryllium	< 0.001	mg/L	0.001	210.1	12/30/14 AK
Cadmium	0.044	mg/L	0.002	213.1	12/30/14 AK
Chromium	< 0.006	mg/L	0.006	218.1	12/30/14 AK
Copper	< 0.003	mg/L	0.003	220.1	12/30/14 AK
Iron, Total	1.454	mg/L	0.006	236.1	12/30/14 AK
Lead	< 0.0075	mg/L	0.0075	239.1	12/30/14 AK
Mercury	< 0.002	mg/L	0.002	245.1	12/30/14 AK
Nickel	< 0.010	mg/L	0.010	249.1	12/30/14 AK
Selenium	< 0.002	mg/L	0.002	270.2	12/30/14 AK
Silver	< 0.002	mg/L	0.002	272.1	12/30/14 AK
Thallium	< 0.020	mg/L	0.020	279.1	12/30/14 AK
Zinc	0.028	mg/L	0.001	289.1	12/30/14 AK

Reviewed By: Jeff Gough

UN-NAMED TRIBUTARY OF POND CREEK STREAM SAMPLES

LAB ANALYSIS SHEETS
STREAM SAMPLES

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-13	**COMMENT:**	1.2 cfs
SAMPLE ID:	PC 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	120	mg/L	10	310.1	6/12/14 KE
Chlorides	43	mg/L	5	325.3	6/9/14 AK
Sulfates	333	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	564	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	10	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.258	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.160	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.357	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	0.045	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-14	**COMMENT:**	3.0 cfs
SAMPLE ID:	PC 2	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.6	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	110	mg/L	10	310.1	6/12/14 KE
Chlorides	470	mg/L	5	325.3	6/9/14 AK
Sulfates	750	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	1,844	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	5	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.279	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.132	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.138	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

CHEMICAL ANALYSTS & CONSULTANTS

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208
Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-15	**COMMENT:**	0.5 cfs
SAMPLE ID:	PC 3	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	5/30/14 TG
Acidity	10	mg/L	10	305.1	6/12/14 KE
Alkalinity	94	mg/L	10	310.1	6/12/14 KE
Chlorides	34	mg/L	5	325.3	6/9/14 AK
Sulfates	306	mg/L	5	375.4	6/12/14 AK
Hardness	260	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	520	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	6	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.355	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.192	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.311	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-16	**COMMENT:**	100 GPM
SAMPLE ID:	PC 4	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.2	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	94	mg/L	10	310.1	6/12/14 KE
Chlorides	9	mg/L	5	325.3	6/9/14 AK
Sulfates	370	mg/L	5	375.4	6/12/14 AK
Hardness	340	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	536	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	15	mg/L	5	160.2	6/19/14 KE
Iron, Total	0.381	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.150	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	5.214	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	2.028	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT ENVIRONMENTAL SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-17	**COMMENT:**	20 GPM
SAMPLE ID:	C 1	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.4	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	172	mg/L	10	310.1	6/12/14 KE
Chlorides	22	mg/L	5	325.3	6/9/14 AK
Sulfates	110	mg/L	5	375.4	6/12/14 AK
Hardness	170	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	304	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	147	mg/L	5	160.2	6/19/14 KE
Iron, Total	1.312	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.337	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.729	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	0.021	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SUMMIT
ENVIRONMENTAL
SERVICES, INC.

17650 Route 37
West Frankfort, Illinois 62896
Phone (618) 983-8280
Fax (618) 983-8208

CHEMICAL ANALYSTS & CONSULTANTS

Website: www.summitenviro.com

CLIENT:	Pond Creek	**REPORT DATE:**	6/20/14
PDL:	16038-18	**COMMENT:**	20 GPM
SAMPLE ID:	C 2	**SAMPLED BY:**	Client-TG
DATE SAMPLED:	5/30/14	**DATE RECEIVED:**	5/30/14

TEST DESCRIPTION	RESULT	UNITS	DETECTION LIMIT	METHOD	DATE/ ANALYST
pH	7.5	Unit		150.1	5/30/14 TG
Acidity	< 10	mg/L	10	305.1	6/12/14 KE
Alkalinity	62	mg/L	10	310.1	6/12/14 KE
Chlorides	11	mg/L	5	325.3	6/9/14 AK
Sulfates	80	mg/L	5	375.4	6/12/14 AK
Hardness	100	mg/L	10	130.2	6/12/14 KE
Total Dissolved Solids	160	mg/L	50	160.1	6/19/14 KE
Total Suspended Solids	260	mg/L	5	160.2	6/19/14 KE
Iron, Total	1.735	mg/L	0.006	236.1	6/12/14 JB
Iron , Dissolved	0.585	mg/L	0.006	236.1	6/12/14 JB
Manganese, Total	0.310	mg/L	0.002	243.1	6/12/14 JB
Manganese, Dissolved	< 0.002	mg/L	0.002	243.1	6/12/14 JB

Reviewed By: Jeff Gough

SCHEDULE A INFORMATION

Modifications to the Existing Permit

Proposed Outlet 009

Williamson Energy LLC currently has a pending IDNR-OMM permit application (Permit 417) in review and proposes a new NPDES Outlet, 009. The applicant is requesting that Outlet 009 be added to the IEPA Permit IL0077666. Permit 417 is the proposed Refuse Disposal Area No. 3 for Williamson Energy, LLC. This proposed disposal area will tie into the existing Refuse Disposal Area Nos. 1 & 2 and will eliminate a portion of the sediment control structure currently in-place. Refer to the enclosed Surface Facilities Map for additional details.

Drainage Modification – Outlet 005

Williamson Energy has converted the originally permitted soil storage area to a geotextile bag farm and is utilizing pumps to prevent a discharge from the sediment ditches. The water collected in the ditches is being pumped to the Refuse Disposal Area Nos. 1 & 2 impoundments. The pumps will operate by a float system that automatically starts and stops the pumps based on the water elevation in the pond. A minimum freeboard level of 2 feet and the pumping capacity will be maintained at all times to keep the pond from discharging. The pumps and attached discharge lines will have the capacity to evacuate 3,600 gpm from the pond.

In addition to adding Outlet 009 to IEPA Permit IL0077666, Williamson Energy, LLC is also requesting a minor drainage modification to Outlet 005. IEPA Permit No. 2014-MW-4275 was issued to Williamson Energy, LLC on October 2, 2014. The permit allowed the development and operation of an area in which fine refuse was pumped into geotextile tubes. In accordance with the permit, surface runoff and dewatering of the geotextile tubes is collected in a "no-discharge" perimeter containment basin. All water pumped from the containment basin is directed to the existing refuse disposal area or the coal preparation plant for use in the coal processing circuit. The pumps operate by a float system that automatically starts and stops the pumps based on the water elevation in the pond. A minimum freeboard level of 2 feet and the pumping capacity are being maintained to keep the pond from discharging. Upon the issuance of this permit and the construction of the new refuse facility, the geotextile tube area is no longer necessary. Williamson Energy, LLC is requesting to modify the drainage control plan to allow stormwater runoff from the area to discharge through sediment ditches and spillway, into existing Ditch D-5C and through Pond 005. This drainage pattern is not a deviation from the originally approved drainage plan. This change is being requested to eliminate stormwater being pumped into the impoundment and thus limiting the available operation life of the facility. Furthermore, due to the nature of the geotextile tubes, surface water quality is not anticipated to be affected once they are out of service and no longer being utilized. All groundwater protections and the reclamation plan for the area will remain as approved in the permit.

Mixing Zone

Williamson Energy LLC's Pond Creek Mine is proposing to use a stormwater mixing zone for the discharge of Pond 007/008 during certain precipitation events and corresponding flows in Pond Creek. Regulatory mixing zones, as contained in the general policies of the Illinois WQS (Title 35; Subtitle C; Chapter I; Part 302.102), are allowed at the discretion of the state. A physical mixing zone can be

calculated and, if approved, implemented on a site specific basis through the Pond Creek Mine's NPDES permit.

Refer to the report included within this document titled Pond Creek Mine Stormwater Analysis preliminary study for storm event sizes and corresponding allowable discharge.

SCHEDULE A

DISCHARGE #	001	002	003	004	005
QUARTER SECTION	NW	SW	SW	SW	SW
SECTION	12	12	12	12	12
TOWNSHIP	8 South	8 South	8 South	8 South	8 South
RANGE	3 East	3 East	3 East	3 East	3 East
COUNTY	Williamson	Williamson	Williamson	Williamson	Williamson
AVERAGE FLOW (gpd) if discharge does not result from precipitation.	Precipitation	Precipitation	Precipitation	Precipitation	Precipitation
MAX FLOW (gpd) if discharge does not result from precipitation.	Precipitation	Precipitation	Precipitation	Precipitation	Precipitation
SOURCE OF DISCHARGE	Surface Runoff	Surface Runoff	Surface Runoff	Surface Runoff	Surface Runoff
SAMPLING METHOD	Grab	Grab	Grab	Grab	Grab
Acidity (mg/l)	20	20	20	20	20
Alkalinity (mg/l)	300	300	300	300	300
Lead (mg/l)	0.05	0.05	0.05	0.05	0.05
Iron (mg/l)	1.5	3	1.0	3	3
Magnanese (mg/l)	0.2	0.2	0.2	0.2	0.2
pH (range)	6.5 - 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Zinc (mg/l)	0.1	0.1	0.1	0.1	0.1
Fluoride (mg/l)	1.0	1.0	0.8	1.0	1.0
Total Suspended Solids (mg/l)	10 – 50	10 – 50	5 – 20	10 – 50	10 – 50
Sulfate (mg/l)	2000	2000	2000	2000	2000
Total Dissolved Solids (mg/l)	450	450	450	450	450
Chloride (mg/l)	500	500	500	500	500
Receiving Stream	Unnamed	Unnamed	Unnamed	Unnamed	Unnamed
Tributary to	Pond Creek	Pond Creek	Pond Creek	Pond Creek	Pond Creek
Tributary to	Big Muddy River	Big Muddy River	Big Muddy River	Big Muddy River	Big Muddy River
Tributary to	Mississippi River	Mississippi River	Mississippi River	Mississippi River	Mississippi River

SCHEDULE A

DISCHARGE #	006	007	008	009 (Proposed)	
QUARTER SECTION	SW	NW	NW	NW	
SECTION	12	12	12	7	
TOWNSHIP	8 South	8 South	8 South	T8S	
RANGE	3 East	3 East	3 East	R4E	
COUNTY	Williamson	Williamson	Williamson	Williamson	
AVERAGE FLOW (gpd) if discharge does not result from precipitation.	Precipitation	Precipitation	Precipitation	Precipitation	
MAX FLOW (gpd) if discharge does not result from precipitation.	Precipitation	Precipitation	Precipitation	Precipitation	
SOURCE OF DISCHARGE	Surface Runoff	Surface Runoff	Surface Runoff	Surface Runoff	
SAMPLING METHOD	Grab	Grab	Grab	Grab	
Acidity (mg/l)	20	20	20	30-905	
Alkalinity (mg/l)	300	300	300	200	
Lead (mg/l)	0.05	0.05	0.05	0.5	
Iron (mg/l)	3	3	3	3 – 6	
Magnanese (mg/l)	0.2	0.2	0.2	4	
pH (range)	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6 – 9	
Zinc (mg/l)	0.1	0.1	0.1	0.5 – 1.0	
Fluoride (mg/l)	1.0	1.0	1.0	1.0	
Total Suspended Solids (mg/l)	10 – 50	10 – 50	10 – 50	35 – 70	
Sulfate (mg/l)	2000	2000	2000	2100	
Total Dissolved Solids (mg/l)	450	450	450	3500	
Chloride (mg/l)	500	500	500	1000	
Receiving Stream	Unnamed	Unnamed	Unnamed	Unnamed	
Tributary to	Pond Creek	Pond Creek	Pond Creek	Pond Creek	
Tributary to	Big Muddy River	Big Muddy River	Big Muddy River	Big Muddy River	
Tributary to	Mississippi River	Mississippi River	Mississippi River	Mississippi River	

WATER FLOW DIAGRAM

R10634

East Shaft VTP#1
- 900,000 gpd

010
37°51'16.1"
88°49'25.5"

Pond Creek Stormwater Mixing Zone

Electric Pump in Pond 007/008 to send water to Pond Creek Mixing Zone. See Mixing Zone Calculations for proposed flow rates.

District #1 Bleeder Shaft VTP - 0 gpd

TG#1 XC 136 VTP - 0 gpd

District #2 Bleeder Shaft VTP - 300,000 gpd

TG#2 XC 142 VTP - 300,000 gpd

TG#2 XC 104 VTP - 200,000 gpd

TG#2 2 XC 49 VTP - 200,000 gpd

TG#2 XC 27 VTP - 100,000 gpd

Pump in Pond 001 set to automatically turn on as water level increases. A minimum of 2' of freeboard is maintained below the spillway to prevent discharge.

Pond pumps run as necessary to supply additional processing water for the preparation plant.

001
37°50'59.2"
88°49'37.5"

POND 001

003
37°50'26"
88°49'58"

POND 003

004
37°50'25"
88°49'56.6"

POND 004

002
37°50'26"
88°49'51.5"

POND 002

006
37°50'28.4"
88°50'40.6"

POND 006

008
37°50'31.4"
88°49'33.9"

007
37°50'29.5"
88°49'34"

POND 007/008

Impoundment Decant Pumps - 900,000 gpd

Clarified decant water is not always available. During these times water required for processing will come from sedimentation ponds.

POND 009

009
37°50'52.3"
88°48'43.7"

Slurry Impoundments (RDA 1& 2)

Slurry Impoundment (RDA 3)

Mixing Zone (Future)

Water Holding Cell (Future)

Abandoned Mine (Future)

Mine

Prep-aration Plant

PREPARATION PLANT WATER SUPPLY RESERVOIR

Prep Plant Supply - 2,900,000 gpd

Mine Intake - 720,000 gpd

005
37°50'09.1"
88°50'00"

POND 005

Johnston City Lake Pumps - 720,000 gpd

Zeigler No. 4 Pump - 0 gpd
Only utilized for fresh water supply during periods of severe drought

LEGEND

- Mine/Plant Fresh Water Supply
- Pond Dewatering
- Fresh Water Intake Supply
- Mine Pumpage
- RDA Decant Water
- Zeigler No. 4 Pump
- Pond Creek Mixing Zone
- Plant Slurry Pumpage
- Natural Drainage
- Future

Special Notes: Flow rates are given for a typical day and do not take into account stormwater.

Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

NPDES PERMIT No. IL0077666
WATER FLOW DIAGRAM

DATE: 01/22/2015

SCALE: NTS

ACI DRAWING NO. B14-626-B1

Drawing: \\Acl-econ\acddrawings\14626\14626B1.dwg - Layout Tab: Model
Date: Feb 13, 2015-4:29pm - Plotted by: sauphin
Xrefs:

WILLIAMSON ENERGY. LLC
POND CREEK MINE NO. 1
ANTI-DEGRADATION ASSESTMENT

February 13, 2015

Antidegradation Assessment
Williamson Energy LLC
Renewal of NPDES Permit IL0077666 with Modifications
Williamson County, IL

Introduction

In conjunction with IDMM Permit No. 417, the subject facility has applied for a NPDES permit for one additional discharge point from sediment control structures for the subject permit area. This point will be in addition to the eight discharge points authorized under NPDES Permit IL0077666. The proposed discharge will report to an unnamed tributary of Pond Creek.

Williamson Energy, LLC is applying for a renewal of NPDES Permit No. IL0077666. In addition to the renewal application, Williamson Energy, LLC is requesting to add a new outlet, Outlet 009, which is associated with the pending IDNR-OMM permit, Permit 417; Pond 009. The purpose for Permit 417 is to permit a new refuse disposal area for the underground mining operation associated with Permit 375. Williamson Energy submitted a joint application for an Individual Section 404 Permit from the U.S. Army Corps of Engineers (USACE)and a Section 401 water quality certification for impacts associated with modifications to and expansions of the Pond Creek 1 mine refuse disposal areas located approximately 6 miles Northeast of Johnston City, IL.

Details of the pond designs, collection ditches and outfall points were included in the original permit submittal as well as in the pending IDNR-OMM Permit 417 application and subsequent revisions/modifications to Permit No. IL0077666. Included within this document are attachments that indicate project location, general mine surface facility layout, and water quality reports for each outfall. All sediment control structures (ponds) have been constructed and have been operating with the exception of Pond 009. Since Pond 009 will be a sediment control structure receiving drainage from a refuse area, the water quality of this pond would be comparable to the existing Pond 007 which receives runoff from the existing refuse facility. At this time, Williamson Energy, LLC is requesting authorization for this pond and the proposed outfall to be included in this permit renewal.

In addition to adding Outlet 009 to IEPA Permit IL0077666, Williamson Energy, LLC is also requesting a minor drainage modification to Outlet 005. IEPA Permit No. 2014-MW-4275 was issued to Williamson Energy, LLC on October 2, 2014. The permit allowed the development and operation of an area in which fine refuse was pumped into geotextile tubes. In accordance with the permit, surface runoff and dewatering of the geotextile tubes is collected in a "no-discharge" perimeter containment basin. All water pumped from the containment basin is directed to the existing refuse disposal area or the coal preparation plant for use in the coal processing circuit. The pumps operate by a float system that automatically starts and stops the pumps based on the water elevation in the pond. A minimum freeboard level of 2 feet and the pumping capacity are being

maintained to keep the pond from discharging. Upon the issuance of this permit and the construction of the new refuse facility, the geotextile tube area is no longer necessary. Williamson Energy, LLC is requesting to modify the drainage control plan to allow stormwater runoff from the area to discharge through sediment ditches and spillway, into existing Ditch D-5C and through Pond 005. This drainage pattern is not a deviation from the originally approved drainage plan. This change is being requested to eliminate stormwater being pumped into the impoundment and thus limiting the available operation life of the facility. Furthermore, due to the nature of the geotextile tubes, surface water quality is not anticipated to be affected once they are out of service and no longer being utilized. All groundwater protections and the reclamation plan for the area will remain as approved in the permit.

Purpose and Anticipated Benefits of the Proposed Activity

Pond Creek Mine commenced construction in July of 2005 and the first coal was produced in November of 2006. The estimated annual clean coal production is 6.0 million tons per year. The mine has a life expectancy of more than 20 years.

The purpose of this project is to allow the continued operation of a longwall coal mine that employees many persons and provides a significant contribution toward the energy security of our nation. The mine makes a substantial contribution to the local community through economic benefit and employment opportunities. The following is a discussion of the importance of the mine from an economic and social development perspective with emphasis on the negative effect should the mine be unable to continue operation.

Illinois ranks fifth among the states producing coal in the United States. Many other coal producing states have experienced declining coal production in the last few years. Illinois, however, is actually producing at a rate in excess of 2013 with production up by approximately 5.6% by the end of the year. Illinois coal mining ended the year of 2014 with clean coal production in excess of 52 million tons.

Assuming an average price of $50 per ton, the State's 2014 coal production generated $2.6 billion in gross revenues for the State's producers. Illinois has the largest reported bituminous coal resources with almost 25% of our nations reserves (ICA). Illinois coal is classified as bituminous with energy content ranging from 10,000 to 14,000 Btu/lb and is said to contain more energy than the oil reserves of Saudi Arabia and Kuwait combined. The coal industry remains a mainstay of the economy in downstate Illinois. For many decades, coal mining has been a major impact on the employment of Illinoisans, on their culture and on their communities.

Pond Creek Mine produced approximately 6.48 million tons of coal in 2014. The coal produced was capable of generating over 12 billion kilowatt hours of electricity, enough to power over 1.1 million average American households for the year, based on U.S. Energy Information Administration data.

Put another way, this single coal mine produced enough energy to power every household in the state of Arkansas in 2014.

Pond Creek Mine directly employs 170 full time personnel with an annual payroll of approximately $20 million. In addition to these 170 direct employees, it is estimated that another 179 persons are employed in daily work associated with the mine's production. This includes truck drivers, supply and support personnel, train crews, and technical personnel. Further, based on an economic formula widely accepted in the state of three persons employed in indirect or induced jobs per each direct coal industry job (ICA), an additional 514 persons are employed as a result of this mine. All told, approximately 859 persons should enjoy continued employment by the continuation of mining at this site.

Supplies and services purchased from local and regional vendors results in expenditures of about $30 million per year. This expenditure includes items such as equipment, maintenance, fuel, tires, equipment supplies, oil, filters, rock dust, roof bolts, cribbing, props, and numerous miscellaneous supply and service items. Employment statistics indicate the November 2014 unemployment rate for Williamson County was at 6.5%. With an estimated available work force of 40,690 persons, this would equate to in excess of 2,600 persons without employment. Due to the relative size of the employment base in this County and the high rate of unemployment, the importance of the continued operation of this mine on the economy of the region is significant.

Estimated annual sales tax paid by Pond Creek Mine is $497,000 which includes state and local tax shares. The estimated tax paid on coal production is $8.5 million. The estimated real estate replacement tax and real estate tax totals $1.3 million per year. The total local, state, and federal revenues generated by the continuation of this mine should be in excess of $31.8 million annually.

Summarizing, continuation of mining and coal sales at the Pond Creek Mine will benefit the local community in many ways including the employment of approximately 859 people and local and regional economic development. Coal mined at the site will provide economic benefits that are necessary to power the state and national economy and assist in improving the quality of life for the citizenry. The benefit to the local, state, and regional social climate and economic development provided by continuation of mining at this location clearly justifies the minimal discharge of waters from this mine.

Identification and Characterization of Receiving Stream

As indicated above, an unnamed tributary to Pond Creek will receive the discharge from the pond outlets within the permit area. The unnamed tributary has not been assessed by the IEPA and therefore is not listed as impaired in the draft 2012 Illinois Integrated water quality report and section 303 (d) list.

Prior to making application for NPDES permit IL0077666, sampling was undertaken by Williamson Energy of the receiving stream. All data from that pre-mining sampling period is included in the original application materials for the NDPES permit.

A review of the data from this sampling period indicates the stream water quality has been well within the limits as set in Title 35, Subtitle C, Chapter 1, Part 302, Subpart B, Section 302.208. This serves to validate the success in the performance of the water quality control measures being taken at the Pond Creek Mine.

Identification of Proposed Pollutant Load Increases and Potential Impacts on Affected Waters

Considering that the discharge from the mines' sediment control ponds will ultimately report to waters of the state in response to surface water runoff from storms of larger magnitude, it is appropriate to evaluate the effect of such pollutant load increases on the receiving stream system. Surface water runoff from the permit area first reports to the designed sediment control ponds. The ponds then discharge to the aforementioned unnamed tributary to Pond Creek. The relevant preliminary monitoring points for Refuse Area #1 are two (2) surface water monitoring stations: PC-1, which is upstream in the watershed of the project location, and PC-2, which is downstream in the watershed of the project location (See Drawing No. B14-626-M1, Operational Plan Map). The location of PC-2 is downstream from the discharge of the NPDES Outlets 001 through 008 and the newly proposed NPDES Outlet 009.

Outlets 006 and 007/008, responsible for the discharge of waters from RDA#1 & 2, discharge into an unnamed tributary of Pond Creek, and has a 7Q10 flow of zero (0) cfs. The unnamed tributary is a "general-use" water, with no segment code. The most suitable preliminary water quality monitoring stations for the proposed RDA#3 are PC-4, which is located furthest upstream within the watershed outside of any surface activity, and PC-3, located just upstream of RDA#3 (See Drawing No. B14-626-M1, Operational Plan Map). It is expected that the surface activity and scope of RDA#3 will be similar in nature to RDA#1 & 2. Thus, the preliminary monitoring of the surface water quality stations for RDA#1&2 are also representative of waters from the area surrounding RDA#3. These locations can be used as a secondary resource to establish baseline water quality values for RDA#3 as well.

Mixing Zone

Williamson Energy LLC's Pond Creek Mine is proposing to use a stormwater mixing zone for the discharge of Pond 007/008 during certain precipitation events and corresponding flows in Pond Creek. Regulatory mixing zones, as contained in the general policies of the Illinois WQS (Title 35; Subtitle C; Chapter I; Part 302.102), are allowed at the discretion of the state. A physical mixing zone can be calculated and, if approved, implemented on a site specific basis through the Pond Creek Mine's NPDES permit.

Refer to the report included within this document titled Pond Creek Mine Stormwater Analysis preliminary study for storm event sizes and corresponding allowable discharge.

Water Conservation at Pond Creek Mine

Considering the continuous need for water in numerous mining activities and in coal processing, harvesting of surface runoff from rain events and water reuse is of utmost importance to the success of the Pond Creek Mine's need to have adequate water for operations, especially during dry periods. Williamson Energy, LLC has established a water recirculation system, which incorporates mine pumpage and pumping water collected in the existing sediment control structures (ponds) into HDPE pipelines. The pumped water is utilized in the mining and cleaning operations.

Fresh water (purchased from Johnston City, IL) is pumped to the property and stored in Pond 005. Water pumped from the Johnston City Lake is automatically controlled when the pool elevation of Pond 005 drops. The water in Pond 005 functions as the source for underground mine usage, and storage in times of drought.

The majority of water used at the mine site is required for separating raw coal from rock in the preparation plant. The larger rocks are screened off from the incoming feed to the plant where they are deposited onto the refuse belt. This material is used to construct the refuse impoundment. The fine material ultimately ends at the thickener units. The static thickener unit attached to the preparation plant requires approximately 2,000 gpm of incoming water while in operation. The underflow from the static thickener is pumped into the fine coal refuse slurry impoundment of Refuse Disposal Facilities 1 & 2.

Over time, the fine solid particles settle to the bottom of the impoundment leaving clean water on the surface. At this point, the clarified water is able to be recycled by pumping it back into the system (a process known as "decanting"). The decant pump is located on the opposite side of the slurry impoundment from the thickener underflow discharge. This maximizes retention time and ensures water clarity at the decant pump. This decant water is piped back into the preparation plant and reused in the process.

It should be noted that clarified decant water is not always available. When clarified water is not available, fresh water is pumped from Ponds 001, 002, 003, 004, 006, and/or 009.

Assessment of Alternatives to Proposed Increases in Pollutant Loading or Activities

Pond Creek Mine will use sediment ponds for treating collected mine water and stormwater. The use of sediment ponds is standard practice in the mining industry for treating settable solids. It is technically and economically the most effective and efficient way to hold water, preventing discharge, and for treating mine water and stormwater for discharge. All water discharged from the Pond Creek Mine permit area will pass through sediment ponds. Sediment ponds treat mine water

and stormwater by retaining the influent for a sufficient amount of time for the majority of the settable solids to settle out and be retained in the pond.

This assessment includes consideration of the following alternatives: 1) no mining; 2) no discharge of stormwater from the site; 3) reduction in the number of outfall points; 4) alternative on-site treatment technologies, 5) use of alternative sediment control and treatment devices, 6) collect and treat surface water in accordance with the proposed permit, and 6) Alternative Treatment Technologies: A) Filtration, B) Reverse Osmosis, C) Bioremediation, D) Coagulation (Chemical) Precipitation, E) Ion Exchange, F) Cost Effective Sulfate Removal (CESR), G) Supervac.

Pollutants of concerns are settable solids, chloride and sulfate. The options listed above were examined to determine whether the measure is technically feasible and economically reasonable and would result in a lesser load increase, no load increase or minimal environmental degradation.

ALTERNATIVE NO. 1

Do Not Mine

Presently, and for the foreseeable future, coal is essential to the generation of electricity in Illinois, the United States and most countries around the world. The need for low cost electricity in today's economy is essential to allow recovery from what has been termed the most serious economic downturn in our life times. The coal industry is crucial to the economic health of Illinois and the country. Hundreds of millions of dollars are generated for the people of Illinois through direct mining jobs, taxes and support industry jobs.

If no mining is conducted at this site, the following economic losses are estimated to occur:

- Loss of approximately 170 direct jobs with a payroll of approximately $20 million annually. Many of these employees are long term miners and are not currently trained for other employment. In addition to the direct employees, approximately 179 additional persons such as truck drivers, engineers, and support personnel are employed full time through operation of the mine. Further, based on an economic formula widely accepted in the state of three persons employed in indirect or induced jobs per each direct coal industry job (ICA), an additional 514 persons are employed as a result of this mine.
- The mining industry is vitally important to the local economy of Williamson County and the surrounding counties as well as to the region and state.
- Since over 40% of the electricity produced in the U.S. and nearly 47% of the electricity produced in Illinois comes from coal-fired plants, it is, therefore, vital to the local, state and national economy that available high quality coal be mined to maintain a continuous supply of fuel to the coal-fired plants. Economic losses will occur if sufficient electricity is not provided to private and commercial energy consumers. If the Pond Creek Mine produced no coal, approximately 1.1 million

American households' worth of energy would have to be replaced (likely at a higher cost) or foregone to meet the world's energy demand.

- The loss in tax revenue to Illinois and Williamson County, both direct and indirect, would be significant, particularly when a replacement industry is unknown.

In addition, Pond Creek Mine has significant resources invested in the acquisition of land, coal reserves, permitting expenses, mining equipment, and etc. in this project. The economic loss to the company should mining at the site cease would be substantial because of the significant investment in land, coal reserves, permitting expenses, and mining equipment made by the company using a business plan dependent on maximizing recovery of the coal reserve.

Considering the above economic contributions and the importance of coal to our society, the "Do Not Mine" alternative is not considered a reasonable alternative.

ALTERNATIVE NO. 2

No Discharge of Stormwater

Ponds which are used to collect and treat mine water and stormwater are frequently no discharge facilities except for the periods during which sufficient precipitation has fallen to generate surface runoff that exceeds the storage capacity within the ponds. Mine water that is collected in ponds during non-precipitation periods is normally recirculated and reused for the ongoing mining and coal processing operations.

Considering that the area of the proposed Pond Creek Mine receives in excess of 40 inches of precipitation as an annual average, often times in high intensity over short periods, total containment with no discharge of stormwater is not technically feasible. The surface area required to accomplish such a feat is massive, and would begin to crowd out other productive land uses, such as farming. Even if held through the precipitation event there is not a feasible way to perpetually store the water, never discharging it. Discharges from sedimentation ponds are in accordance with applicable regulation in the State of Illinois so long as the quality of discharged water remains within the water quality parameters required.

Total elimination of stormwater discharges from the mine is not an available option.

ALTERNATIVE NO. 3

Reduce The Number of Outfalls

While combining certain outfall points from within the permit area is possible, such combinations would not result in any improvements in receiving stream water quality. Any combination of

outfalls will result in the same amount of total water discharge to the receiving streams. It is likely that the resulting water quality would remain the same as the total of the water quality from the planned discharge points.

Since a reduction in the number of outfalls will not result in improvement in water quality or quantity, this option is ruled out for further consideration.

ALTERNATIVE NO. 4

Use Alternative Sediment Control and Treatment Devices

Alternatives to the use of sediment control ponds exist for control of discharge of settable solids. Such alternatives include chemical soil stabilizers, erosion control blankets, geotextile filter bags, fiber rolls, silt fencing, straw mulch, straw bale dikes, and temporary seeding. These measures are aimed at minimization of the generation of settable solids. Most of these measures have been used during the construction and operations of the Pond Creek permit which is under review for renewal. They have been used to provide supplemental treatment and prevention of generation of settable solids. No discharges are made without additional treatment through retention time in sediment control ponds.

The use of alternative sediment control measures is considered practical and cost effective for the surface runoff in conjunction with sediment control ponds. However, the use of these practices to eliminate the proposed sediment control ponds is not feasible.

ALTERNATIVE NO. 5

Collect and Treat Surface Water Runoff in Accordance With the Proposed Permit Application

As referenced in Alternative #4 above, the use of sediment control ponds has proven very effective in the treatment of settable solids in surface runoff from the mine operations. By placement of such ponds in the down-gradient portions of the permit area, collection ditches are very effective in collecting and conveying surface runoff to the respective treatment ponds. It should also be noted that the SMCRA provisions administered by IDNR at 62 ILL. Adm. Code 1816.46(b)(2) and 1817.46(b)(2) require all surface discharge from the disturbed permit area be passed through a siltation structure (defined as sediment pond) before leaving the permit area except were exemptions are granted for small drainage areas.

Alternative #5 is presented as the most cost-effective and practical alternative to the effective treatment of surface water runoff from the proposed mine operation.

ALTERNATIVE NO. 6

Alternative Treatment Technologies

A. Filtration

Filtration is a water treatment process by which discharge water is passed through a physical barrier which removes particulate matter from the water stream. Filtration of mine water and stormwater would involve installation of a very large and elaborate filtration system. These systems would remove settable solids and produce an effluent with similar characteristics as those to proposed settling ponds. Dissolved solids would not be filtered and removed by this technology. It is considerably more expensive to operate a full-scale filtration system than the sediment ponds proposed for this facility. Filtration systems generate a sludge that must then be disposed of. Another impracticality associated with filtration is that a relatively steady flow of water is required into the system. This is not the case for stormwater runoff from mining operations, as storm surges would need to be held for processing.

Filtration is a technology that is not feasible for the proposed facility because: 1) filtration does not remove dissolved solids, 2) filtration is much more expensive than sediment ponds both in initial cost and long-term maintenance and operation, 3) filtration processes require a steady stream of water for treatment which is not the case in treating stormwater runoff, 4) a large area of land would be required for such a facility, and 5) maintenance and supervision of the filtration and sludge disposal operation would be burdensome and would increase production costs.

B. Reverse Osmosis

Reverse Osmosis systems treat dissolved solids. In reverse osmosis, water for treatment is pumped through a closed membrane system at extremely high pressures. Purified water is produced and the contaminant is trapped on the membrane. The contaminants are periodically released from the membrane by backwashing at high pressure. This creates a waste stream of water with a high concentration of contaminants.

Pond Creek's affiliate, Sugar Camp Energy operates a Reverse Osmosis system as a treatment system process to be able to create more clean water suitable for use in the mining and cleaning process.

Several problems are present with this system as it would be applied to treatment of both mine discharge and stormwater at the Pond Creek Mine. These systems

are extremely expensive to install and to operate. The concentration (the reject stream) requires disposal. The concentration of Chlorides is too high to dispose of through an NPDES outlet, including any conceivable mixing zone. The volume of concentration is about 25% of feed water. That volume is too high to simply store perpetually. Sugar Camp is injecting the concentrate into deep Class I injection wells. That process is very expensive and reliability and longevity is unknown.

Stormwater runoff from a mining operation will contain settable solids. Such particle size is not suitable for treatment in RO systems. Additionally, the intermittent nature of stormwater flows is not suited for RO, which requires a steady input of influent water.

Considering the above, reverse osmosis technology is not considered either applicable or feasible for the proposed operation. IEPA has consistently agreed this conclusion as applied to mining operations. *See,* Illinois Pollution Control Board case R07-09.

C. Bioremediation

Bioremediation is the use of treatment wetlands to create anaerobic and aerobic environments to remove sulfates, some metals, and other contaminants. It is not suitable for treatment of settable solids, the primary pollution in stormwater runoff. Water would have to be pumped into the wetland in a controlled flow rate and allowed to slowly travel through the system to achieve treatment. Anaerobic bacteria would be expected to remove sulfates by converting sulfates to sulfides. Under aerobic conditions, plant life would serve to remove certain metals through plant uptake.

Constructed wetlands have proven to be effective for treatment of some dissolved solids with several limitations. These limitations include 1) low and consistent rates of inflow, 2) reduced or stoppage of winter condition inflow due to reduced biological activity of the sulfate reducing bacteria and aerobic plant life, 3) eventual sludge accumulation requiring dredging and wetland reconstruction, and 4) release of hydrogen sulfide and other digestive gases into the atmosphere from sulfate digestion processes. Use of wetlands in mine stormwater runoff treatment would be limited by the enormous amount of land required to construct a wetland of sufficient size for the flow rates to be expected from such an operation.

Pond Creek affiliates, Sugar Camp Energy and Hillsboro Energy, both have pilot wetlands. These are experiments that are designed to determine if Bioremediation will benefit an already compliant NPDES discharge. The wetlands are each designed to treat less than 100 gpm, which is a small fraction of the total mine water and stormwater managed at the operations. Even at the small flow rate, the surface area used by the wetlands is significant. Even if the wetlands can sufficiently and reliably treat effluent, the surface area required for the amount of water generated by the Pond Creek Mine would be enormous and would begin to crowd out other beneficial land uses. The wetlands are in the early stages of development. Water has been running into the systems for less than a year. It is too early to tell if the systems are beneficial.

Evan if shown to be beneficial, Bioremediation will not be a primary treatment system.

D. Coagulation (chemical) Precipitation

This process consists of the addition of alkaline chemicals to acid mine effluent to induce metals to precipitate and to reduce acidity. Chemicals typically used include hydrated lime, limestone, soda ash, caustic soda and ammonia. Variables that are considered in the design and application of such a system include the level of acidity, suspended solids, iron and manganese concentrations, and flow rates.

Concerns with the use of chemical precipitation at the proposed coal mine include 1) worker safety regarding the chemicals to be used, 2) treatment cost, 3) process operation and maintenance, 4) disposal of precipitate sludge in a landfill possibly considered a hazardous substance, 5) necessity of such treatment considering that acid water is not considered a factor for the proposed operation, 6) susceptibility to system malfunction due to high volume flows from storm events, 7) improbability of actual improvement in overall water quality when compared to the use of sedimentation ponds.

Considering the above, the use of this technology is considered inappropriate at the proposed Pond Creek Mine.

E. Ion Exchange

Ion exchange removes unwanted ions, generally metals, by passing the effluent stream through a resin designed specifically for the individual ion to be removed.

These processes are designed for very specific removal applications, usually low flow regimes such as softening of hard water (calcium and magnesium removal) for human consumption purposes or for metal removal in industrial plating processes. For ion exchange to be successful, input water that is relatively free of suspended solids is essential to avoid fouling of the resin. Ion exchange is just that – it involves "swapping" one ion for ions considered less objectionable. For example, ion exchange as it relates to water softening involves removal of calcium and magnesium ions and replacing them with sodium ions. This results in an output stream that is not reduced in the amount of chemical components.

Additional operational considerations with ion exchange include large amounts of water needed for regeneration of the resins and disposal of brine that is produced in the process. Further, the processes require large amounts of water and energy for operation.

Considering the above, ion exchange technology is not feasible, nor applicable for use at the proposed Pond Creek Mine.

F. Cost Effective Sulfate Removal (CESR) Process

CESR is a proprietary technology developed to improve sulfate removing technology.

It is a four step process as follows: Step one includes the addition of hydrated lime to the feed water to precipitate gypsum; the non-hazardous gypsum sludge is removed by dewatering and filtration. Step two involves additional liming to raise the pH to 10.5 and results in the precipitation of dissolved metals as metal hydroxides which is also removed by dewatering and filtration. Step 3 involves additional liming to increase pH to 11.5 and the addition of a proprietary reagent to precipitate ettringite. Step four involves reducing the pH with CO2 to meet local discharge criteria. This step also involves clarification with accompanying sludge removal from the clarifier.

With additional consideration to the extreme complexity and unproven theory aspect of this technology, it is considered impractical for use at the Pond Creek Mine because 1) each precipitation step is time consuming and would require the use of large amounts of land 2) infrastructure costs, including the installations of tanks and storage handling equipment is high, 3) this proprietary technology is still being developed and is cost-prohibitive at this time, 4) this technology is plagued by severe scaling and precipitation of minerals, 5) the very large amounts

of resultant sludge would need to be disposed of as solid or hazardous waste, 6) the water treated in this system has a high specific conductivity and a high concentration of total dissolved solids, and 7) there is a high supervision and maintenance requirement to use this technology.

G. Supervac

Supervac is a technology to handle solid wastes and sludge that result from other water treatment technologies. This technology would be appropriate only in conjunction with another water treatment technology. This technology would not be feasible for use at the Pond Creek Mine because it is not a stand-alone water treatment technology.

POND CREEK MINE STORMWATER ANALYSIS

AquAeTer

optimizing
resources | water, air, earth

MEMORANDUM

TO: **Simon Stepp**
CC:
FROM: John Michael Corn
DATE: February 10, 2015
JOB NO.: 142336
RE: **Pond Creek Mine Stormwater Analysis**

INTRODUCTION

The Pond Creek Mine ("Mine") utilizes ponds on-site for site process water. Stormwater that falls on-site is also directed into various ponds. During these storm events, it is possible that the ponds need to discharge the excess water. The wet weather tributaries nearest the site are too small to have a discharge from the site and still maintain water quality standards. The closest tributary, Pond Creek, has a larger drainage basin that includes the site drainage. This analysis assumes that Pond Creek is a 0 7Q10 low flow stream. The Illinois Environmental Protection Agency allows the full use of the stream during a storm event for these streams.

The Mine site currently plans to pipe the stormwater from Pond 7 or Pond 8 to Pond Creek directly, rather than discharging to the smaller tributary of Pond Creek. The maximum allowable discharge was calculated based on meeting the WQS based on the volumetric flowrate in the stream and the concentrations in the Pond and in the Creek.

SUMMARY

A range of rainfall amounts for 6-hour storm events and 24-hour storm events were modeled for the discharge event from Pond 7 at the Mine site into Pond Creek, which is located north of the facility. A peak flow and an average flow over the 36-hour period beginning with the storm are shown in Table 1. The allowable discharge was based on meeting the chloride water quality standard, as it was more stringent than the sulfate water quality standard. The allowable discharges are presented in Table 1. The average discharge is based on meeting the water quality standard during the 36-hour period following the beginning of the storm. At the average discharge calculated, the total volume predicted to enter the pond due to the storm event can be discharged over a period of less than 2 hours. However, the peak discharge from the pond predicted is greater than the average flow condition. Therefore, a peak discharge was calculated based on the predicted peak flow in the creek. The peak discharge condition is intended to relieve the pond during its peak condition, which is predicted to occur in the same time frame as the peak in the Creek.

Table 1. Peak Flow from 6-hr and 24-hr Storm Events

	BASIN	POND CREEK FLOW		ALLOWABLE DISCHARGE			
	Rainfall Amount	Peak Drainage Basin Flow (cfs)	36-hour Average Basin Flow (cfs)	Average (cfs)	Average (gpm)	Peak (cfs)	Peak (gpm)
6-hr Storm	0.5"	3,433	437	70.1	31,449	550	247,045
	1.0"	4,018	505	81.0	36,341	644	289,205
	1.5"	4,428	585	93.7	42,076	710	318,655
	2.0"	4,738	670	107.4	48,194	760	641,016
	2.45"	4,961	749	120.1	53,890	796	357,245
	3.04"	5,066	793	127.2	57,072	812	364,426
	3.51"	5,337	941	150.9	67,706	856	384,173
	4.17"	5,499	1,062	170.2	76,412	882	395,842
	4.72"	5,610	1,168	187.2	84,033	900	403,920
	5.29"	6,204	1,270	203.7	91,408	995	446,556
	5.59"	6,709	1,325	212.5	95,356	1076	482,812
	5.8"	7,084	1,366	219.0	98,310	1136	509,858
24-hr Storm	0.5"	111	30	4.8	2,132	17.8	7,989
	1.0"	116	43	6.9	3,083	18.6	8,348
	1.5"	241	90	14.4	6,459	38.7	17,369
	2.0"	508	144	23.1	10,378	81.4	36,532
	2.5"	805	201	32.3	14,483	129	57,895
	3.0"	1,127	272	43.6	19,555	181	81,233
	3.48"	1,160	341	54.7	24,557	186	83,477
	4.33"	2,060	474	76.0	34,129	330	148,104
	4.62"	2,294	722	115.7	51,936	368	165,107
	4.65"	2,338	739	118.5	53,181	375	168,230
	5.04"	2,750	585	93.8	42,110	441	197,921
	5.95"	3,325	756	121.2	54,409	533	239,210
	6.71"	3,926	885	141.9	63,685	630	282,744
	7.51"	4,607	1,034	165.9	74,451	739	331,633
	7.73"	4,754	1,065	170.7	76,629	762	342,132

Note: The Maximum Discharge allowable is based on the more stringent standard. In this case, it is the chloride standard.

WATER QUALITY STANDARD

The Illinois Water Quality standard for chloride concentration is 500 mg/L and the standard for sulfate is 2,000 mg/L. The sulfate concentration is based on hardness of the receiving stream. Historic hardness data was gathered at a USGS gage located on Pond Creek from 1980-1997. The dispersion from Pond 7 to Pond Creek was then determined for both sulfate and chloride using historic USGS gage data, the specified water quality standard, and

laboratory concentration data obtained from Pond 7. The dispersion needed to meet the sulfate water quality standard is 1.76 and the dispersion needed to meet the chloride water quality standard is 7.24. The dispersion will be used to determine the maximum discharge allowed from Pond 7 into Pond Creek.

PEAK FLOW DETERMINATION

To determine the peak flow at this discharge point in Pond Creek, the USGS StreamStats program was utilized. The drainage basin was delineated from the discharge location at Pond Creek (Latitude: 37° 51' 19"N, Longitude: 88° 49' 36"W). The program produced peak flow values for 24-hour 2-yr-, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr storm events. This program is limited to producing 24-hour storm events, so the HEC-HMS modeling program was used to determine peak flows for the 6-hour storm events.

First, HEC-HMS was used to produce peak flow values for 24-hour storm events to compare results from this program to results obtained from USGS StreamStats. The HEC-HMS program utilized the SCS Curve Number loss method to estimate flows. A curve number of 77 was used based on land use; the drainage area is open space in good condition with a combination of C and D soil types. The drainage area was determined using GIS software with a 10-meter digital elevation model; for the previously mentioned discharge location in Pond Creek, the drainage area was 7,176 acres. Rainfall data was also input into the HEC-HMS model to calculate flows for this drainage area. Historic rainfall amounts at Pond 7 were obtained from the National Oceanic and Atmospheric Administration (NOAA) Hydrometeorological Design Studies Center Precipitation Frequency Data Server (PFDS). These amounts are listed in Table 2 below. The distribution of the rainfall over the 24-hour period was taken from the Huff and Angel report "Rainfall Frequency Atlas of the Midwest." For the 24-hour storm, the third-quartile distribution was used.

Table 2. Rainfall Amounts for Storm Events

Storm Duration	Recurrence Interval (Years)					
	2	5	10	25	50	100
6-hr	2.45"	3.04"	3.51"	4.17"	4.72"	5.29"
24-hr	3.48"	4.33"	5.01"	5.95"	6.71"	7.51"

The HEC-HMS model produced peak flows that were comparable to the peak flows obtained from the StreamStats model. The 2-yr, 5-yr, and 10-yr storms were run and percent differences between these two models were found to be 22%, 0.25%, and 5.68%, respectively. Next, the 6-hr storms were calculated using HEC-HMS. For the 6-hr storm, the first quartile rainfall distribution from the Huff and Angel report was used. The peak flows can be found in Table 1.

In addition to the storm events, peak flows for more frequent storm events for 6-hour and 24-hour storm durations were also modeled using the HEC-HMS program. The rainfall amounts for each storm event can be found in Table 1. The peak flows for each storm event can be found in Table 1.

DISPERSION CALCULATION

The maximum allowable discharges for each storm event, which are based on Illinois Water Quality Standards of chloride and sulfate, were determined using the dispersion values previously calculated (1.76 for sulfate and 7.24 for chloride) and the peak discharges obtained from HEC-HMS. The flowrates presented in Table 1 are based on meeting the more stringent water quality standard for chloride.

If you should have questions or comments concerning our assessment, please call us at (615) 373-8532 or by FAX at (615) 373-8512 or by e-mail at jmcorn@aquaeter.com.

OPEARATIONS MAP
(SCALE: 1" = 1000')

R10655

PC-2
PC-1
PC-3
Stormwater Mixing Zone Location
Pipeline to Stormwater Mixing Zone
NPDES 001
NPDES 006
NPDES 002
NPDES 008
NPDES 007
NPDES 004
NPDES 003
NPDES 005
COAL REFUSE DISPOSAL FACILITY NO. 2
SEDIMENT DITCH 2
SEDIMENT DITCH 1
SEDIMENT DITCH 4
COAL REFUSE DISPOSAL FACILITY NO. 3
COAL REFUSE DISPOSAL FACILITY NO. 1
PROPOSED POND 9
NPDES 009 (PROPOSED)
PROPOSED PERMIT 417
PC-4
FRY CEMETERY (100' RAD)(US)
REFERENCE POINT
SUBSOIL STORAGE AREA
TOPSOIL STORAGE AREA
EXISTING TOPSOIL STOCKPILE AREA
GEOTEXTILE TUBE REFUSE DISPOSAL AREA
C-2
C-1
OLD THORN ROAD
Stewart Cemetery
Oil Well
OIL WELLS
Harmony Church Rd
Liberty School Rd
Garrett Rd
Williams Prairie Ch
Stilley Cem
Dean Rd
Dwina Rd
Pond Creek
Jordans Fort Rd
Fancy Farm Rd
Jordans Fort Rd
Thorn Rd
Locust Grove Rd
Locust Grove Cem
Allens Chapel
Crawford Rd
Africa Rd
CENTRAL
Kuepper Ln
Williams Prarie Rd
Pittsburg Road
Pirates Ln
Log Cabin Rd
Liberty Ch
Corinth Rd
Church of God
Jordan's Fort Rd
Lighthouse Rd
Oak Grove Rd
No 6 Chapel
Lincoln Sch
Thompsonville Rd
Shooting Club Ln
Malone Rd
Prairie Creek Ln
Dillingham Rd
Dillingaana Ch
Detroit City Rd
Prairie Creek
Streetcar Rd

LEGEND

- MINING PERMIT #375 SURFACE FACILITIES
- MINING PERMIT #417 (PENDING PERMIT)
- DRAINAGE DITCHES (CONSTRUCTED)
- ROADS
- PROPERTY BOUNDARY
- FENCE LINE
- PERENNIAL STREAMS
- NON-PERENNIAL STREAMS
- C-2 ● STREAM MONITORING POINTS
- LAKES
- △ NPDES OUTLET
- TOWNSHIP/RANGE/SECTION ID

PITTSBURG, ILL.
SE/4 WEST FRANKFORT 15' QUADRANGLE
N3745-W8845/7.5
1963
AMS 3259 IV SE-SERIES V863

1000' 0' 1000' 2000'
SCALE : 1" = 1000'

RECEIVED
AUG 02 2015
DIVISION OF RECORDS MANAGEMENT

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers • Constructors • Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

IEPA PERMIT IL0077666 IDNR-OMM PERMIT NO. 375

OPERATIONS PLAN MAP

POND CREEK 1 MINE
Prepared For
WILLIAMSON ENERGY LLC.
WILLIAMSON COUNTY, IL

CAD BY	SMS	12/10/14	PROJECT NO. B14-626-1413
CHECKED BY	SMS	12/17/14	
APPROVED BY	CEY	02/13/15	DRAWING NO. B14-626-M1

SUPPLEMENTAL OPERATIONS MAP
(SCALE: 1" = 400')

R10657



NOTE:
MINE SITE ORTHO DATED JUNE, 2014
BASE ORTHO FROM WILLIAMSON COUNTY, 2012

LEGEND
- PERMIT 375 BOUNDARY
- PERMIT 417 BOUNDARY (PENDING)
- DRAINAGE AREAS
- DRAINAGE AREA FOR POND 006
- 001 NPDES OUTLET LOCATION / ID
- PROPOSED REFUSE INDEX CONTOURS
- PROPOSED REFUSE INTERMEDIATE CONTOURS
- STREAMS

400' 0' 400' 800'
SCALE : 1" = 400'

AUG 0 2 2019
REVIEWER SAB

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 883-2360 · CANONSBURG, PA (724) 745-3630

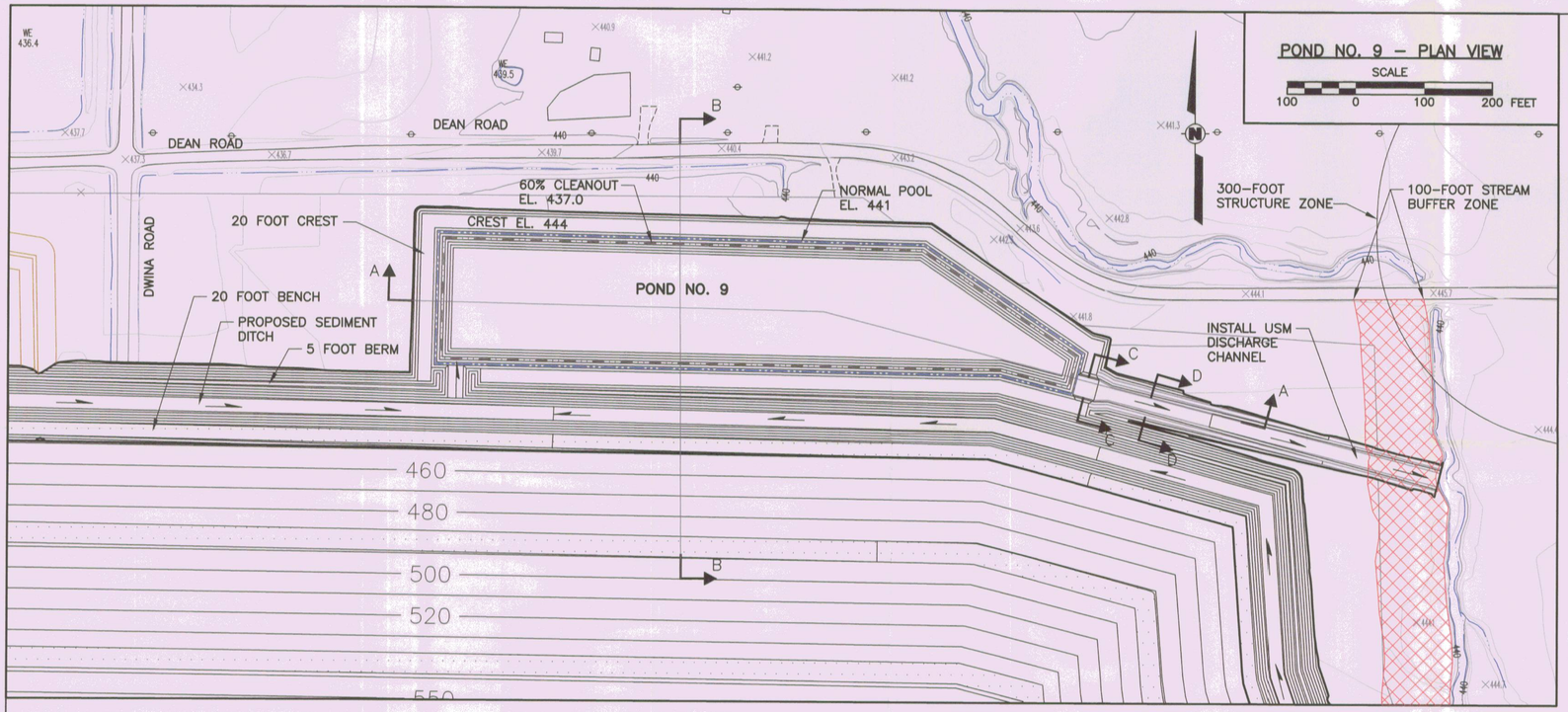
IEPA PERMIT IL0077666 IDNR-OMM PERMIT NO. 375

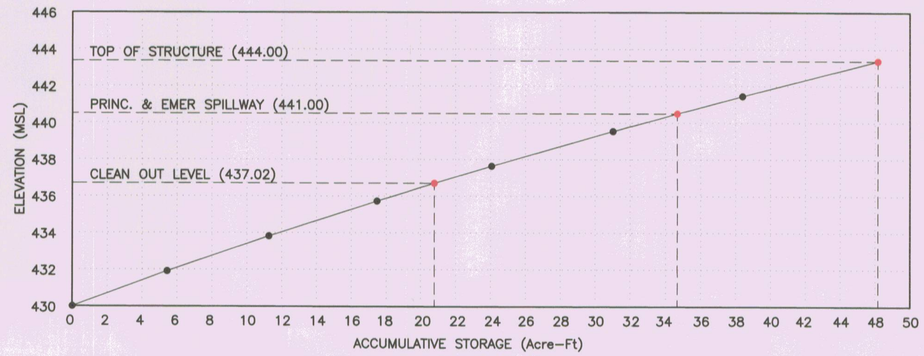
SUPPLEMENTAL OPERATIONS PLAN MAP
POND CREEK 1 MINE
Prepared For
WILLIAMSON ENERGY LLC.
WILLIAMSON COUNTY, IL

CAD BY	SMS	12/17/14	PROJECT NO. B14-626-1413
CHECKED BY	SMS	12/17/14	
APPROVED BY	CEY	02/13/15	DRAWING NO. B14-626-E1

PROPOSED POND 9 – SEDIMENT DITCH PROFILE & SECTIONS

R10659





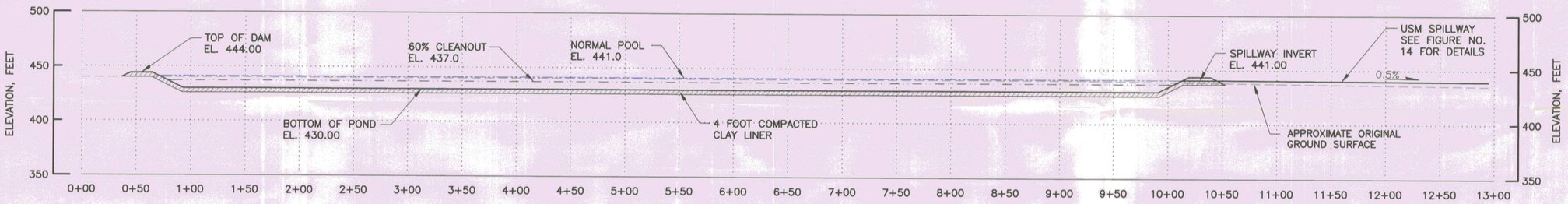
STAGE–STORAGE AREA CURVE

SEDIMENTATION POND NO. 9

SEDIMENT STORAGE REQUIRED	60% CLEANOUT VOLUME	STORAGE PROVIDED (TO NORMAL POOL)
24.60 ACRE–FEET	20.79 ACRE–FEET (EL. 437.0)	34.67 ACRE–FEET

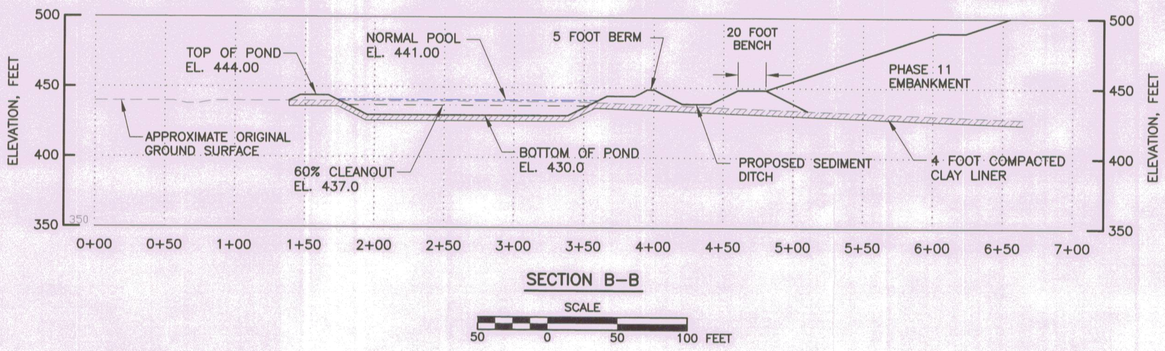
NOTES:

1. CONSTRUCTION OF POND NO. 9 WILL NOT EXCEED MSHA OR OWR REGULATIONS GOVERNING STRUCTURE CLASSIFICATION.
2. POND NO. 9 WILL BE INCISED AND WILL NOT EXCEED A HEIGHT OF FIVE FEET ABOVE THE UPSTREAM TOE OF THE STRUCTURE MEASURED FROM ORIGINAL GROUND.



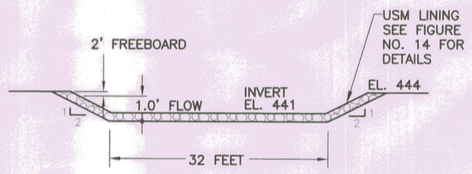
SECTION A–A

SCALE
50 0 50 100 FEET



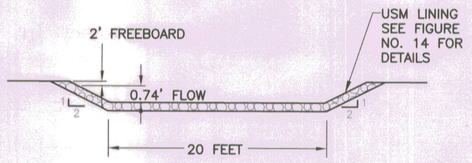
SECTION B–B

SCALE
50 0 50 100 FEET



SPILLWAY CONTROL SECTION C–C

N.T.S.



SPILLWAY SLOPE SECTION D–D

N.T.S.

"I, THE UNDERSIGNED, HEREBY CERTIFY* THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE SURFACE–MINING LAWS OF THIS STATE."

_____ R.P.E. NO. _____

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC, _____

THIS ____ DAY OF _____, _____ MY COMMISSION EXPIRES _____

*THE TERM "CERTIFY" AS USED HEREIN IS DEFINED AS FOLLOWS: "AN ENGINEER'S CERTIFICATION OF CONDITIONS IS A DECLARATION OF PROFESSIONAL JUDGEMENT. IT DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EITHER EXPRESSED OR IMPLIED, NOR DOES IT RELIEVE ANY OTHER PARTY OF THEIR RESPONSIBILITY TO ABIDE BY CONTRACT DOCUMENTS, APPLICABLE CODES, STANDARDS, REGULATIONS AND ORDINANCES".

RECEIVED
DIVISION OF RECORDS MANAGEMENT
AUG 02 2019
REVIEWER: SAB

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491 · SUMMERSVILLE, WV (304) 863-2360 · CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

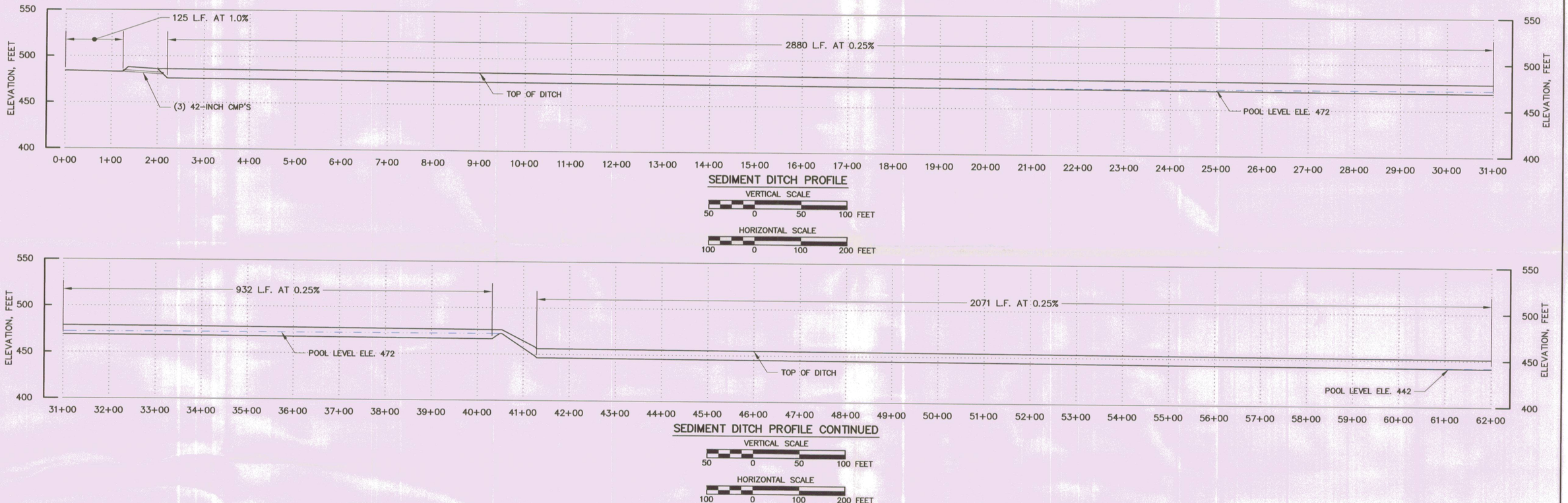
POND NO. 9 – PLAN AND SECTIONS

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	RAL	02/27/12	PROJECT NO. B14–626–1413
CHECKED BY	RPC	12/19/12	
APPROVED BY	CEY	12/19/12	DRAWING NO. B14–626–E2

PROPOSED POND NO. 9 – PLAN AND SECTIONS

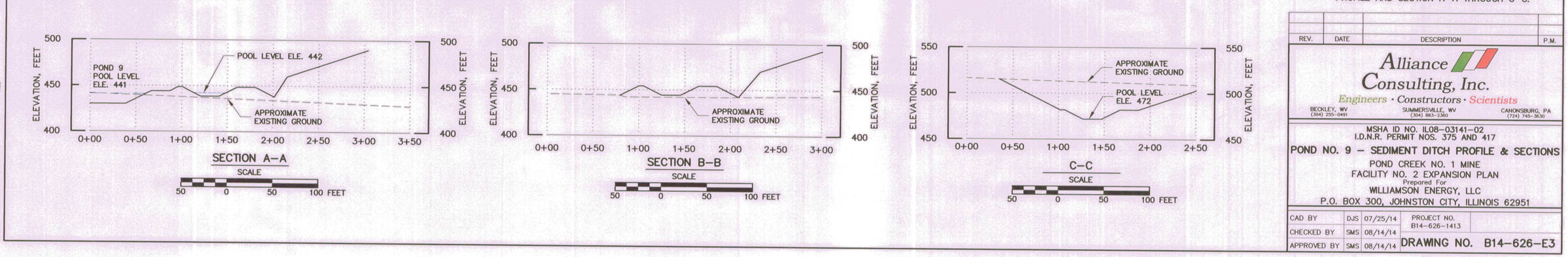
R10661



SEDIMENT DITCH PROFILE

VERTICAL SCALE
50 0 50 100 FEET

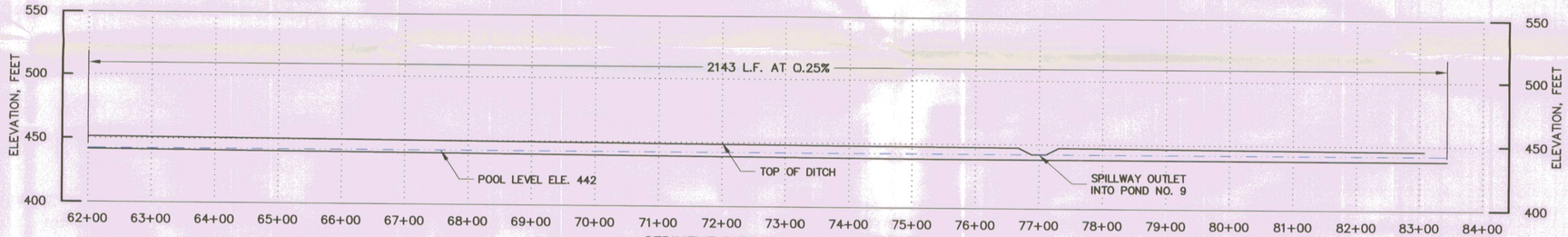
HORIZONTAL SCALE
100 0 100 200 FEET



SEDIMENT DITCH PROFILE CONTINUED

VERTICAL SCALE
50 0 50 100 FEET

HORIZONTAL SCALE
100 0 100 200 FEET



SEDIMENT DITCH PROFILE CONTINUED

VERTICAL SCALE
50 0 50 100 FEET

HORIZONTAL SCALE
100 0 100 200 FEET

SECTION A–A

SCALE
50 0 50 100 FEET

SECTION B–B

SCALE
50 0 50 100 FEET

C–C

SCALE
50 0 50 100 FEET

NOTE:
REFER TO DRAWING NO. B14–606–E1 FOR PLAN LOCATION OF SEDIMENT DITCH PROFILE AND SECTION A–A THROUGH C–C.

REV.	DATE	DESCRIPTION	P.M.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
BECKLEY, WV (304) 255-0491
SUMMERSVILLE, WV (304) 883-2360
CANONSBURG, PA (724) 745-3630

MSHA ID NO. IL08–03141–02
I.D.N.R. PERMIT NOS. 375 AND 417

POND NO. 9 – SEDIMENT DITCH PROFILE & SECTIONS

POND CREEK NO. 1 MINE
FACILITY NO. 2 EXPANSION PLAN
Prepared For
WILLIAMSON ENERGY, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

CAD BY	DJS	07/25/14	PROJECT NO. B14–626–1413
CHECKED BY	SMS	08/14/14	
APPROVED BY	SMS	08/14/14	DRAWING NO. B14–626–E3

IEPA-DIVISION OF HAZARDOUS MATERIALS MANAGEMENT
Received
AUG 02 2019
REVIEWER: SAB

Drawing: Tech-exe\CADD\WINDEF\14626E3.dwg - Layout Tab: Model
Date: Feb 16, 2015-8:53am - Plotted by: smeadows
Xrefs:

PROPOSED POND 9 – SEDCAD REPORT (10 YR / 24 HR)

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	65.61	65.61

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	65.61	65.610
	Σ	**265.100**						**65.61**	**65.610**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

PROPOSED POND 9 – SEDCAD REPORT (100 YR / 6 HR)

Pond Creek No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Pond and Sediment Ditch Capacity

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	1



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	265.100	265.100	100.58	82.95

Structure Detail:

Structure #1 (Null)

1

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	265.100	9.977	0.000	0.000	87.000	M	100.58	82.950
	Σ	**265.100**						**100.58**	**82.950**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.00	8.10	811.00	3.000	0.075
		8. Large gullies, diversions, and low flowing streams	33.33	8.00	24.00	17.320	0.000
		8. Large gullies, diversions, and low flowing streams	1.00	9.64	965.00	3.000	0.089
		8. Large gullies, diversions, and low flowing streams	16.44	108.00	657.00	12.160	0.015
		8. Large gullies, diversions, and low flowing streams	0.01	0.50	8,113.00	0.230	9.798
#1	**1**	**Time of Concentration:**					**9.977**

GENERAL INFORMATION
Permit No. 375 / 417
Structure ID: **Sediment Pond No. 9**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	6.21	in	
B.	Estimated Runoff Area:	265.10	acres	
C.	Estimated Distrubed Area:	265.10	acres	
D.	Runoff Coefficient:	100.00	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr stor	27.34	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	26.51	ac/ft	
G.	Pit Pumpage:	2000.00	gpm	
H.	Pit Pumpage Treatment:	None		
I.	Basin Volume (Required at Normal Pool*):	58.27	ac/ft	
	Basin Volume (Provided at Normal Pool):		ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	2.00	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (100yr/6hr):	-	acres	
L.	Diversion Ditching:	None		
M.	Inlet Elevation**:	N/A	feet	
	Outlet Elevation	N/A	feet	
	Outfall Elevation	N/A	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	None		

Notes:

* Basin Volume Required = (0.416 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Pond Creek - Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413
DESCRIPTION:

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :

TOTAL AREA =	265.10	ACRES	DISTURBED AREA =	265.10	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	26.51	AC. FT.
10 YR - 24 HR RUNOFF VOL =	65.61	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	27.34	AC. FT.
PUMPAGE =	2000	GPM	PUMPAGE VOLUME =	4.42	AC. FT.
LINEAR FEET OF DITCHLINE =	8105	FEET	SEDIMENT CAPACITY REQD =	58.27	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	20.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	8		BARRIER SPACING =	1013.13	FEET
NUMBER OF BARRIERS =	7		TOP WIDTH (TOTAL) =	53.91	FEET
POOL AREA=	4.22	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	32.44	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.22	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	32.22	ACRE FEET
60% CLEANOUT DEPTH = 6.08 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 100.58 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	42.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.88	FEET
AREA OF FLOW =	38.70	SQ.FT.
VELOCITY =	2.60	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	53.91	FEET

Q ACTUAL = 100.64 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.88 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.48 FEET

POND CAPACITY REQUIRED:

(SEDIMENT CAPACITY REQD - SEDIMENT DITCH STORAGE AVAILABLE) = (58.83 - 32.22) = 26.05 AC. FT.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

PROJECT NUMBER: B12-495-1413

CALCS BY: RPC

PROJECT NAME: Facility No. 2 Expansion Plan

CHECKED BY:

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)

REF.: (MESA MANUAL, Pg. 6.136)

WHERE:

COEFFICIENT C =	3
BOTTOM WIDTH L =	32
SIDE SLOPE Z1 =	2
SIDE SLOPE Z2 =	2
SPILLWAY INVERT EL. =	441

REF.: (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

ELEVATION (FEET)	HEAD (FEET)	Q CFS
441	0	0.00
442.5	1.5	189.59
443	2	298.68
443.5	2.5	426.91
444.5	3.5	738.60
445	4	921.60
445.5	4.5	1122.60
446	5	1341.64

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.58
BOTTOM WIDTH (ft), b=	32.00
CHANNEL SLOPE (%), So=	0.25
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	1.00
AREA OF FLOW (sq ft), A=	34.00
WETTED PERIMETER (ft), P=	36.47
HYDRAULIC RADIUS (ft), R=	0.93
VELOCITY OF FLOW (fps), V=	4.73
LINING PERIMETER (ft)=	41.47
TOP WIDTH (ft)=	40.47
FREEBOARD (ft)=	1.12
TOTAL DITCH DEPTH (ft), d=	2.12

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.15

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.11

TOTAL STRESS

t (psf) = 0.15
T (lb/ft) = 5.30

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.22
(lb/ft) = 7.96

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\tan(d)-So\right)$$ (psf)= 14.87

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.29

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.51 Tr,t (lb/ft) = 601.74

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-485-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY CONTROL SECTION

ANCHOR RESISTING STRESS

REMAINING RESISTANCE REQUIRED (psf)= -14.29 (lb/ft) = -593.78

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.55
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 15.31

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

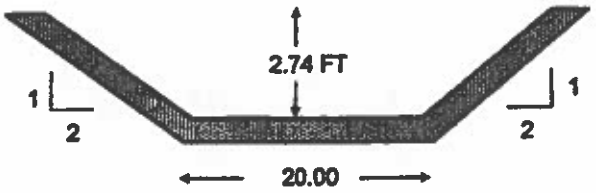
DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

INPUT: ***SPILLWAY SLOPE SECTION***

PEAK FLOW (REQ'D) =	100.58 CFS
BOTTOM WIDTH =	20.00 FT
SIDE SLOPES =	2.00:1
CHANNEL SLOPE =	0.007 FT/FT
MANNING'S N =	0.015 FT^(1/6)



CHANNEL LINING :
USM

OUTPUT: ***TRAPEZOIDAL DITCH***

STARTING DEPTH =	0.0
DEPTH OF FLOW =	0.74 FT

WETTED PERIMETER =	23.31 FT
AREA OF FLOW =	15.90 SQ.FT.
HYDRAULIC RADIUS, Rh =	0.68 FT
CALC. VELOCITY =	6.44 FPS
CALC. FLOW =	102.35 CFS

mean depth= 0.69
froude no.= 1.36 *SUPERCRITICAL*

FREEBOARD REQUIRED = 2.00 FT

TOTAL DEPTH = 2.74 FT USE 2.74
TOTAL WIDTH = 30.96 FT

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

DITCH PROPERTIES

	ENTERED VALUES
DESIGN DISCHARGE (cfs), Q=	100.56
BOTTOM WIDTH (ft), b=	20.00
CHANNEL SLOPE (%), So=	0.70
SIDE SLOPES, Z=	2.00
TYPE OF MAT TO BE DESIGNED=	USM
UNIT WEIGHT OF CONCRETE (pcf), Gc=	140.00
UNIT WEIGHT OF WATER (pcf), Gw=	62.40
SUBGRADE FRICTION ANGLE (deg), δ=	30.00

	CALCULATED VALUES
MANNING'S COEFFICIENT, n=	0.015
DEPTH OF FLOW (ft), y=	0.74
AREA OF FLOW (sq ft), A=	15.90
WETTED PERIMETER (ft), P=	23.31
HYDRAULIC RADIUS (ft), R=	0.68
VELOCITY OF FLOW (fps), V=	6.42
LINING PERIMETER (ft)=	28.43
TOP WIDTH (ft)=	27.54
FREEBOARD (ft)=	1.15
TOTAL DITCH DEPTH (ft), d=	1.89

SIDE SLOPE	COEFFICIENT
<1.5	0.76
2	0.79
3	0.85
4	0.94

MAT TYPE	n
ABM	0.045
FPM	0.025
USM	0.015

TRACTIVE STRESSES DUE TO FLOW OF WATER

BOTTOM STRESS

tb=Gw*R*So (psf)= 0.30

SIDE SLOPE STRESS

SIDE SLOPE COEFFICIENT= 0.79

ts=0.79*tb (psf)= 0.24

TOTAL STRESS

t (psf) = 0.30
T (lb/ft) = 6.94

CONDITION	COARSE GRAINED	FINE GRAINED NO COHESION	FINE GRAINED LOW COHESION	COHESIVE
ARMORFORM ON SOIL	25	25	30	45
ARMORFORM ON FABRIC	30	25	25	32.5

REQUIRED RESISTING STRESS

DESIRED FACTOR OF SAFETY= 1.5

REQUIRED RESISTING STRESS (psf)= 0.45
(lb/ft) = 10.41

RESISTING STRESS

BOTTOM STRESS

MAT THICKNESS (in), t= 4

$$tr,b = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}(\tan(d)-So)$$ (psf)= 14.75

SIDE SLOPE STRESS

$$tr,s = \frac{t(Gc-Gw)}{\sqrt{1+So^2}}\left(\frac{Z\tan(d)}{\sqrt{1+Z^2}}-So\right)$$ (psf)= 13.18

NOTE: TOTAL RESISTING STRESS INCLUDES FREEBOARD PORTION OF MAT, CONSERVATIVELY USING MAT'S SUBMERGED UNIT WEIGHT FOR FREEBOARD ZONE.

AVERAGE TOTAL RESISTING STRESS FROM MAT

Tr,t (psf)= 14.29 Tr,t (lb/ft) = 406.14

ANCHOR RESISTING STRESS

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/22/2012 CHKD BY: _____ DATE: _____
PROJECT NAME: Pond Creek No. 1 Mine, Facility No. 2 Expansion Plan
PROJECT NUMBER: B12-495-1413 SHEET: _____ OF: _____
DESCRIPTION: ARMORFORM DITCH LINING SPILLWAY SLOPE SECTION

REMAINING RESISTANCE REQUIRED (psf)= -13.84 (lb/ft) = -395.73

ANCHOR RESISTANCE (PSF)= As*(Phi)(fs)/L^2

As=CROSS-SECTIONAL AREA OF REBAR TO BE USED (sq in)
Phi=SHEAR FACTOR=0.85
fs=ALLOWABLE STRESS FOR STEEL=20,000 psi
L=ANCHOR SPACING

REBAR SIZE (#)= 5

SOLVE FOR REQUIRED ANCHOR SPACING

L (ft)= #NUM!

USE REBAR SPACING OF #NUM! #NUM!

RESISTANCE PROVIDED (psf)= #NUM!

REBAR#	As (sq in)
3	0.11
4	0.20
5	0.31
6	0.44
7	0.60
8	0.79

NOTE: ABOVE IS BASED ON YIELD SHEAR STRESS ON BOLT, MUST ALSO CHECK GROUND ANCHORAGE CAPACITY OF BOLT!

CHECK UPLIFT

REQUIRED WEIGHT (lbs), W= $\frac{Cw*H*Gw}{12*Z^{.33}}$

CW= 1.3 FOR USM OR FPM, SHORT TERM
3.7 FOR USM OR FPM, LONG TERM
2.0 FOR ABM

Cw= 3.7

W (lbs)= 11.33

MAT WEIGHT (lbs), Wm= $\frac{t(Gc-Gw)}{12}$

Wm= 25.87

Wm IS GREATER THAN W. NO ADDITIONAL UPLIFT RESISTANCE IS NEEDED.

DESIGN: USE 4 INCH USM WITH ROOF BOLT (#5) ANCHORS ON 20 FOOT SPACING.

Design procedure based on Nicolon Corporation, Design Theory Manual for Armorform Erosion Protection Mats, dated September 25, 1989.

3117-/15
R10685

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

RECEIVED
FEB 19 2015
BUREAU OF WATER
BUREAU CHIEF'S OFFICE

Transmittal Letter

Project No. B14-626-1413

To: Illinois Environmental Protection Agency
Water Quality Standards Unit
Division of Water Pollution Control
1021 N. Grand East
Springfield, IL 62794-9276

Date: February 17, 2015

Attention: Mr. Bob Mosher

If enclosures are not as noted, please inform us immediately

We Transmit:

☒ Herewith ☐ Under Separate Cover

For Your:

☐ Approval ☐ Record

☐ Review & Comment

☒ Use

The Following:

☐ Drawings ☐ Laboratory Data ☒ Other

☐ Specifications ☐ Field Data

Copies	Dat	No.	Description
2			Copies of the Pond Creek NPDES Renewal

Remarks:

If you have any questions, please call me at 1-800-355-0491 ext. 113

By: Steve Sutphin

Copies To: File

124 Philpott Lane, Beaver, WV 25813 Telephone: 304 / 255-0491 Fax: 304 / 255-4232

DOCUMENT

54

4275 - 114 - B
Due date: 11-7-14
R10687

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

ORIGINAL

State of Illinois
Environmental Protection Agency
Mine Pollution Control Program
Bureau of Water
2309 W. Main Street, Suite 116
Marion, IL 62959

SUPPLEMENTAL INFORMATION
SEPTEMBER 2014
PERMIT # 375
GEOTEXTILE TUBE IPR

POND CREEK MINE NO. 1
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-537-1413
SEPTEMBER 2014

Summersville, WV

848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV

Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA

3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

September 26, 2014

Project No. B14-537-1413

Mr. Larry D. Crislip, P.E.
Manager, Permit Section
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Mine Pollution Control Program
Bureau of Water
2309 W. Main Street, Suite 116
Marion, IL 62959

Supplemental Information For Permit No. 375
Williamson Energy, LLC
Geotextile Tube IPR Area
Pond Creek Mine No. 1
Williamson County, Illinois

Dear Mr. Crislip:

On behalf of our client, Williamson Energy, LLC, please find enclosed one original and one copy of "Supplemental Information" for the above-referenced application submitted to the IDNR. Two copies have been sent to Mr. Bill Buscher. This submittal contains the response to the request for additional information based on a meeting between representatives of IDNR, IEPA and Williamson Energy, LLC on September 2, 2014. The information also addresses concerns from your letter dated September 26, 2014.

The following information is included in this application:

- Technical Summary
- Letter Report to Scott Fowler/Victoria Broomhead – Groundwater Characterization and Protective Measures (Attachment III(2)(D)(1)(a) with Drawing Nos. B14-537-E6, entitled "Sandstone Unit Isopach Map".
- Response to Clay Kolar comments emailed August 27, 2014, Attachment V.1.A with Drawing No. B14-537-B3 entitled, "Reclamation Plan Map".
- Figures:
  - B14-537-M1 - Map 6 S.F.
  - B14-537-E2 - Supplemental Map 6 S.F.
  - B14-537-E3 - Geotextile Tube Disposal Area Plan
  - B14-537-E4 - Section A-A' and B-B' and Underdrain Details
  - B14-537-E7 - Drainage Area Map
  - B14-537-E5 - Sediment Ditch Profiles and Sections C-C' and D-D'
  - B14-537-E8 – Geotextile Tube Disposal Area Abandonment Plan

RECEIVED
SEP 29 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

We trust this submittal satisfies your informational request. Should you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Senior Project Manager

Claudio E. Yon, P.E.
Senior Project Manager

SMS/CEY:kjs
Enclosures

cc: Bill Buscher

FILE: 14537-01

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

September 26, 2014

Project No. B14-537-1413

Mr. Bill Buscher
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 N. Grand East, PO Box 19276
Springfield, IL 62794-9276

Supplemental Information For Permit No. 375
Williamson Energy, LLC
Geotextile Tube IPR Area
Pond Creek Mine No. 1
Williamson County, Illinois

Dear Mr. Buscher:

On behalf of our client, Williamson Energy, LLC, please find enclosed two copies of "Supplemental Information" for the above-referenced application submitted to the IDNR. One copy has been sent to Mr. Larry Crislip. This submittal contains the response to the request for additional information based on a meeting between representatives of IDNR, IEPA and Williamson Energy, LLC on September 2, 2014. The information also addresses concerns from your letter dated September 26, 2014.

The following information is included in this application:

- Technical Summary
- Letter Report to Scott Fowler/Victoria Broomhead – Groundwater Characterization and Protective Measures (Attachment III(2)(D)(1)(a) with Drawing Nos. B14-537-E6, entitled "Sandstone Unit Isopach Map".
- Response to Clay Kolar comments emailed August 27, 2014, Attachment V.1.A with Drawing No. B14-537-B3 entitled, "Reclamation Plan Map".
- Figures:
  - B14-537-M1 - Map 6 S.F.
  - B14-537-E2 - Supplemental Map 6 S.F.
  - B14-537-E3 - Geotextile Tube Disposal Area Plan
  - B14-537-E4 - Sections A-A' and B-B' and Underdrain Details
  - B14-537-E7 - Drainage Area Map
  - B14-537-E5 - Sediment Ditch Profiles and Sections C-C' and D-D'
  - B14-537-E8 – Geotextile Tube Disposal Area Abandonment Plan

We trust this submittal satisfies your informational request. Should you have any questions or

require additional information, please do not hesitate to contact us.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Senior Project Manager

Claudio E. Yon, P.E.
Senior Project Manager

SMS/CEY:kjs
Enclosures

cc: Larry Crislip

FILE: 14537-02

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

September 26, 2014 618/993-7200

Mr. Mark Allaman
Williamson Energy, L.L.C.
16824 Liberty School Road
Marion, IL 62959

Re: Williamson Energy, L.L.C. – Pond Creek Mine
NPDES Permit No. IL0077666
Geotextile Tube Refuse Disposal
IEPA Log Nos. 4275-14 and 4275-14-A

Dear Mr. Allaman:

We received the information concerning the above referenced project, dated July 17 and August 11, 2014, on July 25 and August 15, 2014, respectively. This information has been reviewed, and based upon that review, the following items are offered for your consideration and appropriate action:

1. A low permeability liner should be installed under the proposed geotextile tube refuse disposal area. This low permeability liner should consist of four (4) foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s, or less. A synthetic liner capable of providing an equivalent level of groundwater protection may be utilized in lieu of the four (4) foot compacted clay.

2. At such time that fine coal refuse disposal utilizing the geotextile tubes is completed and reclamation of the area is initiated, a low permeability cap should be included and installed as part of the final cover plan. The low permeability cap should consist of four (4) foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s, or less. A synthetic liner capable of providing an equivalent level of protection may be utilized in lieu of the four (4) foot compacted clay.

3. The initial submittal of this project assigned IEPA Log No. 4275-14 proposed a monitoring well at the two (2) eastern corners of the geotextile tube placement area. The supplemental information assigned IEPA Log No. 4275-14-A relocated these two (2) proposed wells to the western corners of the geotextile tube placement area. These plans should be revised to propose a monitoring well at each of the four (4) corners of the geotextile tube placement area.

4. As discussed in a meeting held at the IEPA headquarters on September 17, 2014, the proposed hydrology and water handling system for the geotextile tube refuse disposal area should be revised to justify and demonstrate the ability to manage the disposal facility as a "no-discharge" system. As a State Construction and Operating Permit (Subtitle D Permit) is being requested to cover this facility and activity, no offsite discharge either directly or through an approved NPDES outfall, shall be allowed. Revised hydrology and water handling designs shall be provided to demonstrate that all runoff from a worse-case scenario can be contained and directed to the coal preparation closed circuit water handling system.

Should you have any questions or comments regarding the above, or need any additional information concerning Agency requirements, please contact me at the above telephone number or the Marion address listed below.

Sincerely,

Larry D. Crislip, P.E.
Manager, Permit Section
Mine Pollution Control Program
Bureau of Water

LDC:cs/6819c/9-25-14

cc: IDNR/Office of Mines and Minerals
BOW/MPCP/FOS/Marion

Insignificant Permit Revision
Permit No. 375
Williamson Energy, LLC
Technical Summary

General Scope

The purpose of this insignificant permit revision is to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes. The geotextile tubes are fabricated from high strength, woven polypropylene geotextile material. The geotextile material is resistant to ultraviolet degradation and was stable in chemical and biological environments naturally occurring in soil. They are specifically designed for dredged material disposal, dewatering material and coastal erosion control. Fine coal refuse from the existing refuse disposal facility will be dredged and pumped into the geotextile tubes for dewatering. As the geotextile tubes on the initial base layer dewater, additional layers of tubes may be placed on top by offsetting them over the previous layer. This offsetting, created by the vertical rising, creates a stair step in which the area of each new layer is smaller than the previous layer.

Soil Relocation

In order to allow for the space required for the geotextile tube operation, the subsoil stockpile and a portion of the topsoil stockpile located south of the existing refuse disposal facility was relocated. Some of the soil will be used to place a minimum of 3' of subsoil and 1' of topsoil cover on a portion of the existing refuse slopes and seeded with the approved seeding mix for reclamation. Approximately 20 acres of existing refuse slopes have been reclaimed which will decrease the net loading into the refuse disposal area sediment pond structure. Drawing B14-537-M3 shows the approximate proposed limits of the existing Refuse Disposal Area slopes to be reclaimed under this application. The remainder of the subsoil/topsoil that is required to be relocated and is not used for reclamation will be moved to a 9.89 acre IBR area that is located adjacent to and immediately west of the current stockpile area. Surface Facilities Drawing B14-537-E2 shows the location of the IBR area. This is Incidental Boundary Revision No. 60 to Williamson Energy, LLC's Pond Creek Mine and was approved by the IDNR on September 3, 2014.

Base Layer and Groundwater Protection

The soil located immediately underneath the geotextile tube area will be graded using GPS technology to match the grading and surface drainage plan shown on drawing B14-537-E3. The area will be graded to drain surface water from the southeast to northwest as shown. A four foot thick compacted clay liner with a hydraulic conductivity of $1x10^{-7}$ cm/s or less will be provided under the geotextile tubes. The clay soil liner will be compacted using a vibratory sheeps-foot roller. A final pass with a smooth drum roller will be provided to facilitate runoff and prevent infiltration into the soil. A subsurface drainage system will be installed in the soil by installing rock underdrains in the locations shown on the drawing. A detailed description of the subsurface conditions of the site and the drainage plan to be utilized is provided in a letter report included in this application entitled "Groundwater Characterization & Protective Measures". As stated in the report, groundwater in the area flows north and east and the

site is located down gradient of any residential areas and up gradient of the existing refuse disposal facility. Four additional groundwater monitoring wells are also proposed in the locations shown to verify groundwater protection is being achieved.

Water Drainage and Surface Water Runoff

Surface water runoff will be maintained by a sediment pond that will surround the perimeter of the proposed refuse disposal site. A series of pumps will be installed in the pond and will pump the water from the pond to either the slurry impoundment or to the preparation plant to be reused in the preparation process. The water being pumped by these pumps will remain on site and will not be permitted to discharge. The pumps will operate by a float system that automatically starts and stops the pumps based on the water elevation in the pond. A minimum freeboard level of 2 feet and the pumping capacity will be maintained at all times to keep the pond from discharging. The pumps and attached discharge lines will have the capacity to evacuate 3,600 gpm from the pond. According to data provided by the National Oceanic and Atmospheric Administration, the highest single day rainfall on record in nearby Marion, IL was 6.9 inches on June 17, 2000. The watershed of the sediment pond is approximately 25 acres. Therefore, this largest recorded precipitation event would produce 14.375 acre feet of water. The pumps have the capacity to pump 15.910 acre feet of water during the period that the storm event occurred. Since the pumping capacity exceeds the volume produced by the precipitation event, the freeboard would be maintained and the pond would not discharge. The minimum freeboard level and the pumping capacity will be maintained and the pond will not be permitted to discharge until subsequent approvals from the IDNR and IEPA are granted. It is anticipated by the applicant that the necessary permits will be approved and reclamation achieved by the end of 2015.

Reclamation and Life of the Facility

Reclamation of the facility will be achieved by a minimum 3' soil and 1' topsoil compacted cover over the geotextile tubes and seeded. The four foot thick cover will have a hydraulic conductivity of $1x10^{-7}$ cm/s or less. A detailed reclamation plan is provided on drawing B14-537-E8. The soil cover used to reclaim the geotextile tubes will be excavated from the proposed Permit 417 site upon approval. If Permit 417 was not issued, reclamation soil can also come from the adjacent IBR 60 area added and discussed above. It is anticipated by the applicant that the necessary permits will be approved and reclamation achieved by the end of 2015.

ATTACHMENT III(2)(D)(1)(a)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

September 9, 2014

Project No. B14-364-1413

Mr. Scott Fowler
Ms. Victoria Broomhead
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
Land Reclamation Division
One Natural Way
Springfield, IL 62702-1271

Letter Report
Groundwater Characterization And Protective Measures
Supplemental Information For Permit No. 375
Attachment III(2)(D)(1)a
Williamson Energy, LLC
Geotextile Tube IPR Area
Pond Creek Mine No. 1
Williamson County, Illinois

Dear Mr. Fowler and Ms. Broomhead:

This submittal has been prepared to provide additional subsurface information in respect to geologic and hydrogeologic characterization of the above-referenced site. This submittal addresses the expansion of the delineation area for sandstone stratigraphy beneath the proposed coal refuse disposal area (RDA) and further discusses that sandstone lithology's ability to transport groundwater at this location.

Five (5) borings, namely B1 through B5, have recently been drilled over the site to define the vertical thickness and horizontal distribution of sandstone lithologies. The correlative sandstone unit under study overlies a relatively thin coal seam, and the seam was utilized as a key marker bed for correlation of the stratigraphy across the site. The drilling was conducted during July 2014 by Holcomb Foundation Engineering Co., Inc. (Holcomb), and Holcomb's report containing a discussion of drilling methodology and submittal of borehole logs, color photographs of rock cores, and other information are submitted herein as Appendix A.

The depiction of germane site features, borehole locations, and sandstone unit thicknesses are presented on the drawing entitled Sandstone Unit Isopach Map (hereinafter simply referenced as "Sandstone Map") in the "Figures" section of this submittal. This map is an expanded version of the map previously submitted in Permit 375, SPR No. 2. The map portrays the study stratigraphic unit's thickness on a 1-foot contour interval, based upon the aforementioned on site boreholes as well as neighboring boreholes penetrating that horizon. None of the boreholes encountered the sandstone unit at a thickness of 10 feet or greater. Both upon the present study emphasis area as well former evaluation areas, the Sandstone Map clearly demonstrates that the sandstone unit is discontinuous. Specific to the proposed geotextile tube area, the map illustrates the sandstone unit to be completely absent in boring B2, and attains a thickness of only 1 foot in boring B5 and 2.5 feet in boring B1. Borings B3 and B4 on the southern extremity of the site did not penetrate to the subject sandstone horizon; however, the isopach map projects there is no discernible trend of thickening laterally toward the south end of the site.

The area beneath the footprint of the proposed geotextile tube area is demonstrated to either have none of the sandstone unit present or else has a thickness of less than 3 feet. Based upon these findings, it is our opinion that groundwater at the study area does not meet the criteria set forth in §620.210 Class I: Potable Resource Groundwater.

Furthermore, the direction of shallow groundwater flow within unconsolidated material overlying bedrock at the proposed geotextile tube IPR area is predominately oriented toward the north-northeast, coincident with the topographic higher to lower elevation expression across the site. In that respect, this site is characterized as hydraulically downgradient of any residential area and upgradient of the current RDA facility utilized by Williamson Energy, LLC (Williamson Energy).

As an additional protective measure for groundwater, Williamson Energy is proposing the installation of a drainage collection system beneath the site where the geotextile tubes would be placed. In general, this collection system would intercept any surface or shallow groundwater that may inflow the geotextile tube placement area, and such water would be directed hydraulically downgradient to a graded structurally low point from which the water would be pumped and piped to the current RDA facility or the preparation plant. Details of the grading, construction and management of this drainage collection system are provided herein on the two (2) drawings titled "Proposed Geotextile Tube Disposal Plan Area" (Drawing No. B14-364-E3) and "Sections A - A′ And B - B′ " (Drawing No. B14-364-E4). The prevailing geologic setting of this site, as well as the proposed drainage collection system, will ensure that there will be no additional hydraulic head developing on the groundwater system in this area.

The above referenced information is for inclusion into the insignificant revision submitted to your office July 17, 2014.

We trust this submittal satisfies your informational request. Should you have any questions pertaining to our submittal, please let us know.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Larry K. Lucas
Senior Scientist

Stephen M. Sutphin
Project Manager

Claudio E. Yon, P.E.
Senior Project Manager

LKL/SMS/CEY:kjs

Enclosures

cc: Larry Crislip
Brad Murphy
Jim Bowling

FILE: 14364-14

GENERAL INFORMATION
Permit No. 375
Structure ID: **Stockpile Disposal Area Sediment Ditch No. 1**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in	
B.	Estimated Runoff Area:	**12.74**	acres	
C.	Estimated Distrubed Area:	**6.67**	acres	
D.	Runoff Coefficient:	**52.35**	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr stor	**1.35**	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	**0.67**	ac/ft	
G.	Pit Pumpage:	**500.00**	gpm	
H.	Pit Pumpage Treatment:	**None**		
I.	Basin Volume (Required at Normal Pool*):	**3.13**	ac/ft	
	Basin Volume (Provided at Normal Pool):	**4.74**	ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (25yr/6hr):	-	acres	
L.	Diversion Ditching:	**None**		
M.	Inlet Elevation**:	**N/A**	feet	
	Outlet Elevation	**N/A**	feet	
	Outfall Elevation	**N/A**	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**		

Notes:

* Basin Volume Required = (0.42 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Mach Mining - Stockpile Refuse Area
PROJECT NUMBER: B14-326-1413
DESCRIPTION: *Sediment Ditch No. 1*

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :					
TOTAL AREA =	12.74	ACRES	DISTURBED AREA =	6.67	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	0.67	AC. FT.
10 YR - 24 HR RUNOFF VOL =	1.35	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	0.56	AC. FT.
PUMPAGE =	500	GPM	PUMPAGE VOLUME =	1.11	AC. FT.
LINEAR FEET OF DITCHLINE =	1951	FEET	SEDIMENT CAPACITY REQD =	2.33	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	8.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	3		BARRIER SPACING =	650.33	FEET
NUMBER OF BARRIERS =	2		TOP WIDTH (TOTAL) =	41.88	FEET
POOL AREA=	1.17	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	4.78	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.04	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	4.74	ACRE FEET
60% CLEANOUT DEPTH = 1.65	FEET	

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET
REQD SPILLWAY FLOW = 72.28 CFS (100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	30.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.87	FEET
AREA OF FLOW =	28.00	SQ.FT.
VELOCITY =	2.58	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	41.88	FEET

Q ACTUAL = 72.38 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.87 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.47 FEET

Mach Stockpile Refuse Disposal Area

Sediment Ditch No. 1

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

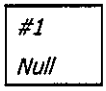
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.700	12.700	39.63	3.25

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.700	0.000	0.000	0.000	80.000	M	39.63	3.253
	Σ	**12.700**						**39.63**	**3.253**

Mach Mining Stockpile Refuse Disposal Area

Sediment Ditch No. 1

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.700	12.700	72.28	4.19

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.700	0.000	0.000	0.000	80.000	M	72.28	4.189
	Σ	**12.700**						**72.28**	**4.189**

GENERAL INFORMATION
Permit No. **375**
Structure ID: **Stockpile Disposal Area Sediment Ditch No. 2**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in	
B.	Estimated Runoff Area:	**12.87**	acres	
C.	Estimated Distrubed Area:	**6.67**	acres	
D.	Runoff Coefficient:	**51.83**	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr stor	**1.38**	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	**0.67**	ac/ft	
G.	Pit Pumpage:	**500.00**	gpm	
H.	Pit Pumpage Treatment:	**None**		
I.	Basin Volume (Required at Normal Pool*):	**3.15**	ac/ft	
	Basin Volume (Provided at Normal Pool):	**4.86**	ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (25yr/6hr):	-	acres	
L.	Diversion Ditching:	**None**		
M.	Inlet Elevation**:	**N/A**	feet	
	Outlet Elevation	**N/A**	feet	
	Outfall Elevation	**N/A**	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**		

Notes:

* Basin Volume Required = (0.42 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME:	Mach Mining - Stockpile Refuse Area
PROJECT NUMBER:	B14-326-1413
DESCRIPTION:	*Sediment Ditch No. 2*

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :					
TOTAL AREA =	12.87	ACRES	DISTURBED AREA =	6.67	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	0.67	AC. FT.
10 YR - 24 HR RUNOFF VOL =	1.38	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	0.58	AC. FT.
PUMPAGE =	500	GPM	PUMPAGE VOLUME =	1.11	AC. FT.
LINEAR FEET OF DITCHLINE =	1999	FEET	SEDIMENT CAPACITY REQD =	2.35	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	8.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	3		BARRIER SPACING =	666.33	FEET
NUMBER OF BARRIERS =	2		TOP WIDTH (TOTAL) =	41.92	FEET
POOL AREA=	1.17	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	4.90	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.04	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	4.86	ACRE FEET
60% CLEANOUT DEPTH = 1.62 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 73.42 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	30.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.88	FEET
AREA OF FLOW =	28.30	SQ.FT.
VELOCITY =	2.60	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	41.92	FEET

Q ACTUAL = 73.51 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.88 FEET

TOTAL (MINIMUM) DITCH DEPTH = 8.48 FEET

Mach Stockpile Refuse Disposal Area

Sediment Ditch No. 2

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

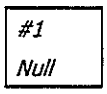
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	40.26	3.30

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.000	0.000	0.000	80.000	M	40.26	3.305
	Σ	**12.900**						**40.26**	**3.305**

Mach Mining Stockpile Refuse Disposal Area

Sediment Ditch No. 2

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

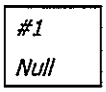
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	73.42	4.26

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.000	0.000	0.000	80.000	M	73.42	4.255
	Σ	**12.900**						**73.42**	**4.255**

Sediment Ponds 1 and 2 - Geotubes - Relief Channel

Material: Grass mixture

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
80.00	2.5:1	2.5:1	0.1	D, B				5.0

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	145.70 cfs		145.70 cfs	
Depth:	1.47 ft		2.47 ft	
Top Width:	87.37 ft		92.37 ft	
Velocity:	1.18 fps		0.68 fps	
X-Section Area:	123.35 sq ft		213.22 sq ft	
Hydraulic Radius:	1.403 ft		2.285 ft	
Froude Number:	0.18		0.08	
Roughness Coefficient:	0.0500		0.1196	

Sediment Ponds 1 and 2 - Geotubes - Relief Channel - max. slope

Material: Grass mixture

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
80.00	2.5:1	2.5:1	3.7	D, B				5.0

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	145.70 cfs		145.70 cfs	
Depth:	0.50 ft		0.82 ft	
Top Width:	82.48 ft		84.09 ft	
Velocity:	3.62 fps		2.17 fps	
X-Section Area:	40.29 sq ft		67.20 sq ft	
Hydraulic Radius:	0.487 ft		0.796 ft	
Froude Number:	0.91		0.43	
Roughness Coefficient:	0.0490		0.1134	

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

August 1, 2014

Williamson Energy
PO Box 99
Johnston City, Illinois 62951

Attention: Mr. James Plumley

Re: Slug Tests
Pond Creek Mine
Johnston City, Illinois
HFE File H-14179

Dear Sir:

On July 26 and 27, 2014, we drilled five borings at this site to core the bedrock and install two monitoring wells. We have performed slug tests on ground water monitoring wells installed in Borings #1 and #3. Results of the tests are as follows:

Well Number	Hydraulic Conductivity (cm. /sec.)
MW #1	1.69 x 10-6
MW #3	1.73 x 10-6

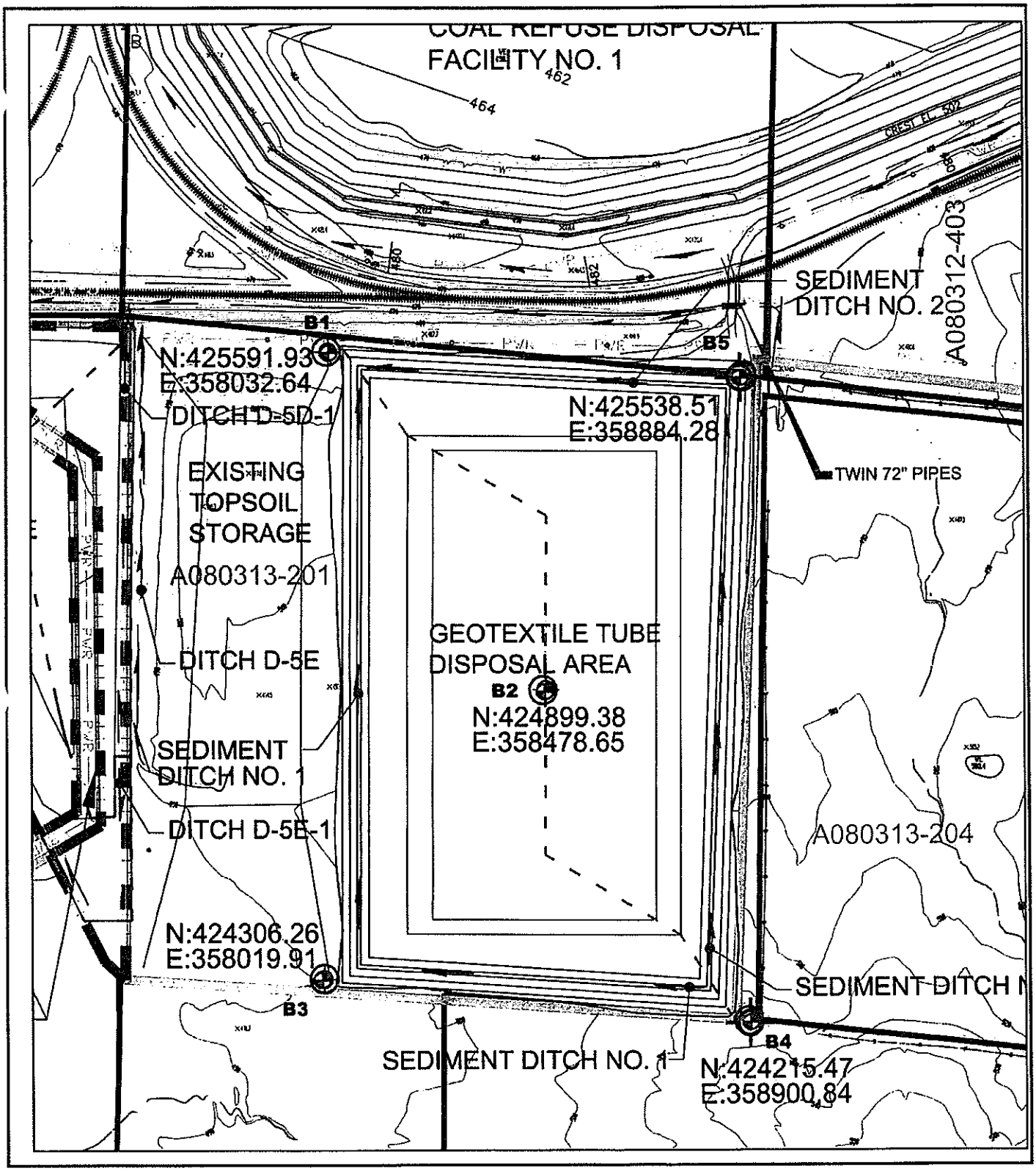
The Slug Test Analysis sheets, Boring Logs, Well Completion Reports, and Rock Core Pictures are attached. If you should have any questions or if we can be of further assistance, please feel free to contact us at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

Timothy J. Holcomb, P.E.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY J.
HOLCOMB
062-042149
Exp 11-30-15
ILLINOIS



Project: **Pond Creek #1 Mine** **Williamson County, Illinois** ***Client:*** **Williamson Energy** **Johnston City, Illinois**	**Boring Location Diagram**	North **Project No. H-14179** **Not to Scale** **July 27, 2014**

R10731

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 489.4
				Brown Mottled Gray Silty CLAY (CL)
10				Brown Weatherhed SHALE
				Gray Mottled Brown Sandy SHALE
20				
	1	rc		
30	2	rc		Gray LIMESTONE Crystalline, Sandy
	3	rc		Gray Sandstone
40	4	rc		Gray SHALE COAL Dark Gray SHALE
				End of Boring @ -44.0'
50				
60				
70				

Ground Water Data

Project: Pond Creek #1 Mine
Williamson County, Illinois

Date of Boring
July 26, 2014

Client: Williamson Energy
Johnston City, Illinois

Project No.
H-14179

R10732

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation **514.3**
				Brown Silty CLAY (CL)
10				
				Gray SHALE
				Brown Silty CLAY (CL)
20				
30				Gray SHALE
	1	rc		Gray LIMESTONE
				Gray Highly Weathered SHALE
				Gray Mottled Brown SHALE
40				Gray SHALE
	2	rc		
	3	rc		
50				
	4	rc		Gray Sandy SHALE
	5	rc		
60				
	6	rc		
				COAL
				End of Boring @ −65.0'
70				

Ground Water Data

Project: **Pond Creek #1 Mine** **Williamson County, Illinois**	Date of Boring **July 26, 2014**
Client: **Williamson Energy** **Johnston City, Illinois**	Project No. **H−14179**

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 3

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation **490.2**
				Brown Silty CLAY (CL)
10				Gray Sandy SHALE
	1	rc		
20	2	rc		
	3	rc		COAL
				Gray SHALE
30				End of Boring @ −29.0'
40				
50				
60				
70				

Ground Water Data

Project: **Pond Creek #1 Mine**
Williamson County, Illinois

Date of Boring
July 26, 2014

Client: **Williamson Energy**
Johnston City, Illinois

Project No.
H-14179

R10734

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 4

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation **522.2**
				Brown Silty CLAY (CL)
10				
				Gray SHALE
20	1	rc		Gray Mottled Brown SHALE
	2	rc		Black LIMESTONE
30	3	rc		COAL Gray LIMESTONE Fire CLAY
				End of Boring @ −35.0'
40				
50				
60				
70				

Ground Water Data

Project: **Pond Creek #1 Mine**
Williamson County, Illinois

Date of Boring
July 27, 2014

Client: **Williamson Energy**
Johnston City, Illinois

Project No.
H-14179

R10735

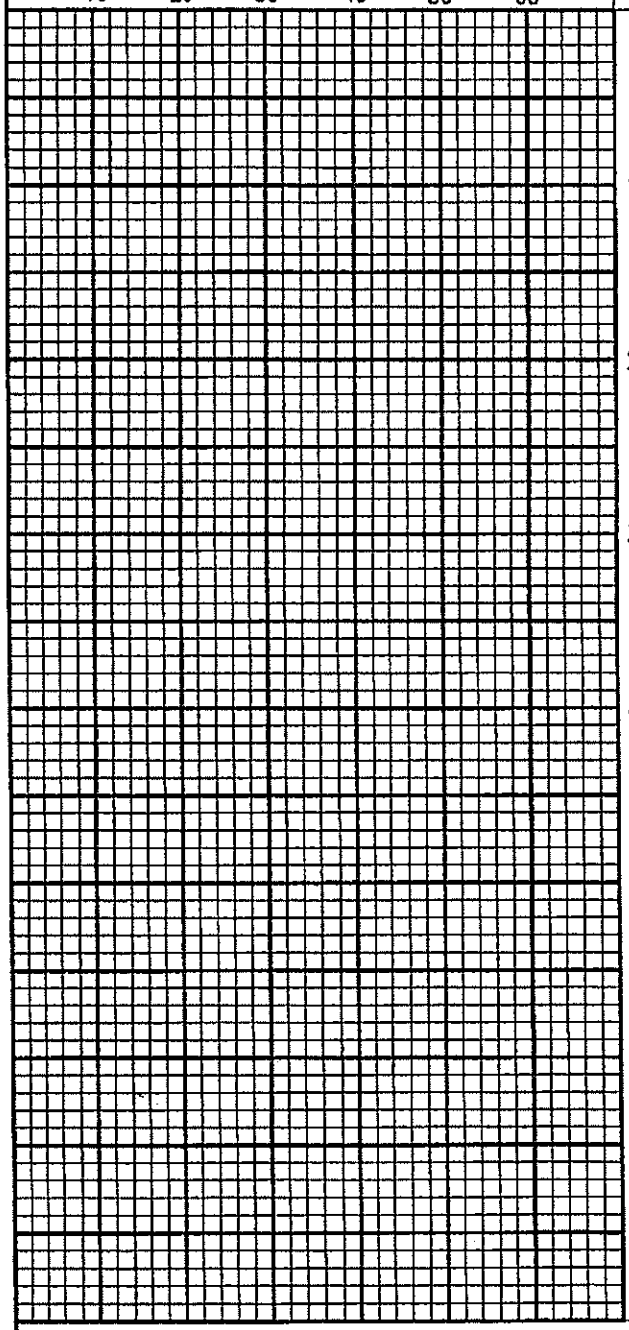
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 5

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation 477.0
				Brown Silty CLAY (CL)
10				
				Brown Weathered SHALE
20				
	1	ss		Gray SHALE
30	2	ss		
	3	ss		Gray SANDSTONE
				Gray Fire CLAY (CL)
				COAL
40				Gray Fire Clay
				Gray SHALE
				End of Boring @ -40.0'
50				
60				
70				

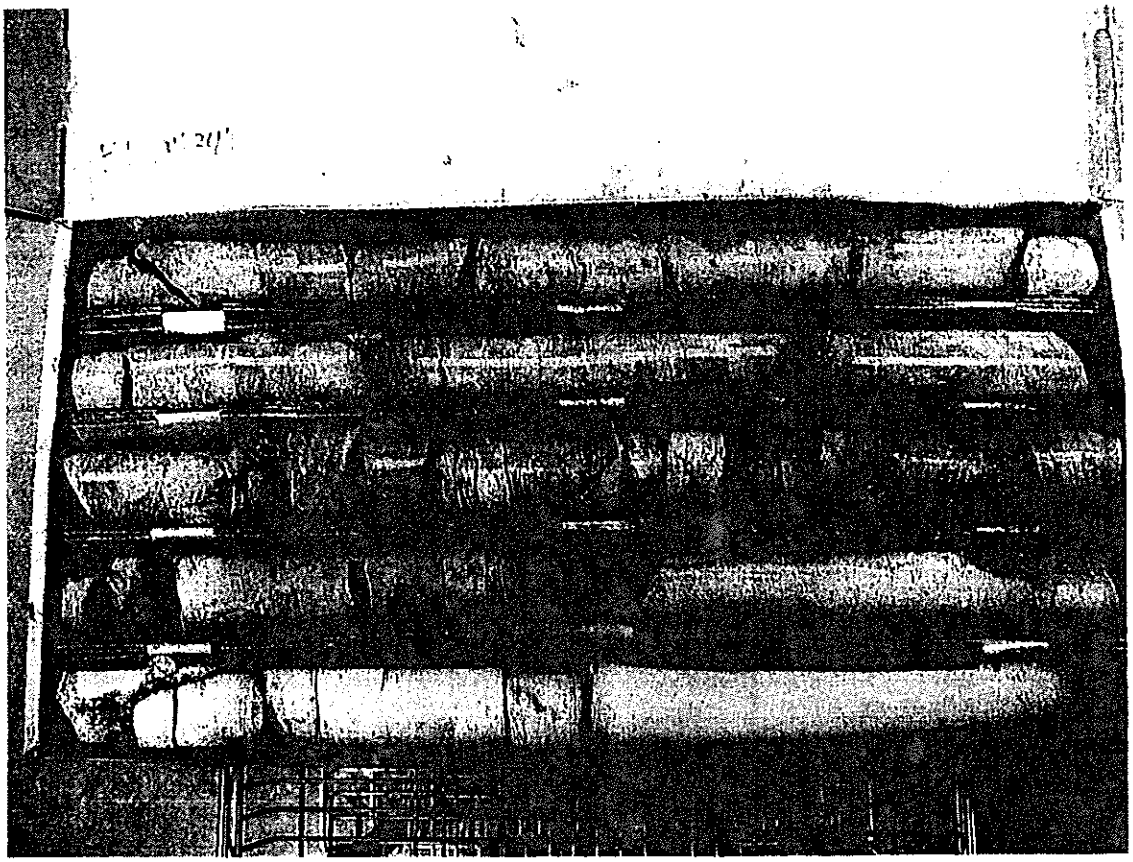
Ground Water Data

Project: Pond Creek #1 Mine
Williamson County, Illinois

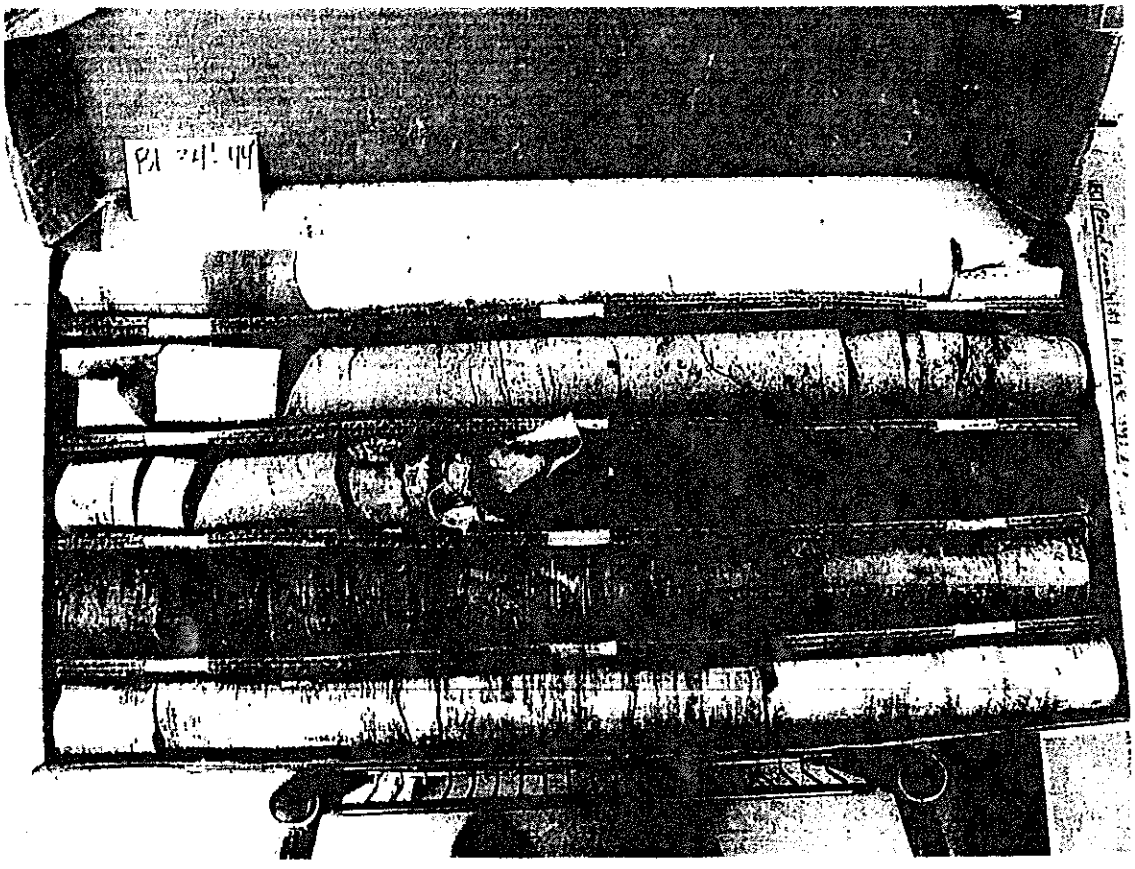
Date of Boring
July 27, 2014

Client: Williamson Energy
Johnston City, Illinois

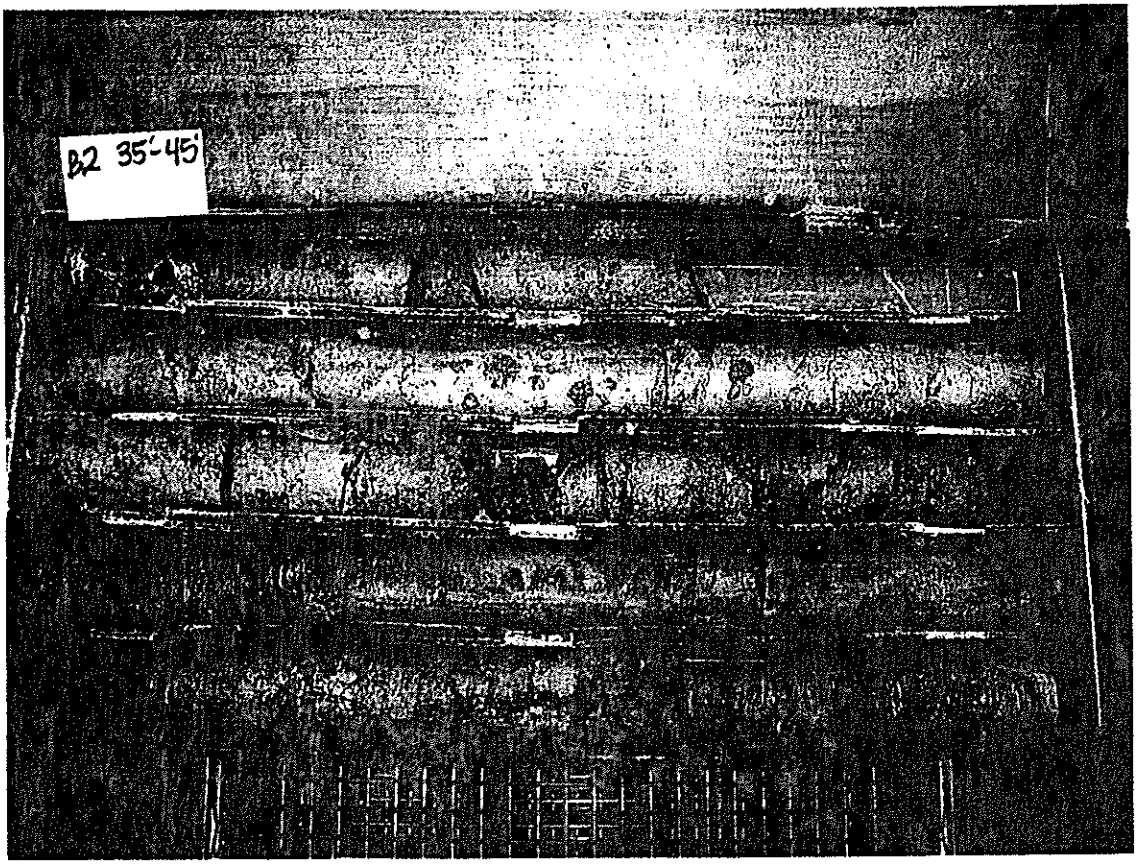
Project No.
H-14179



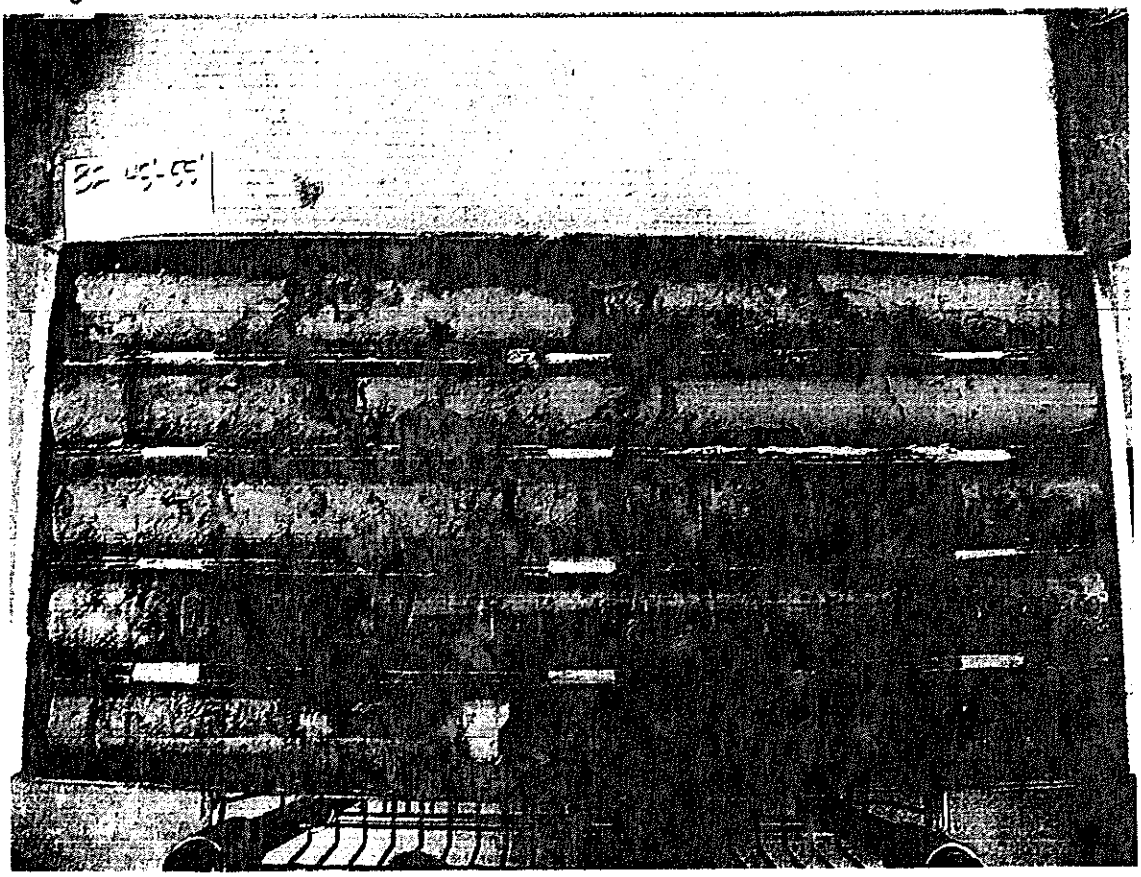
Boring 1 24' to 34'



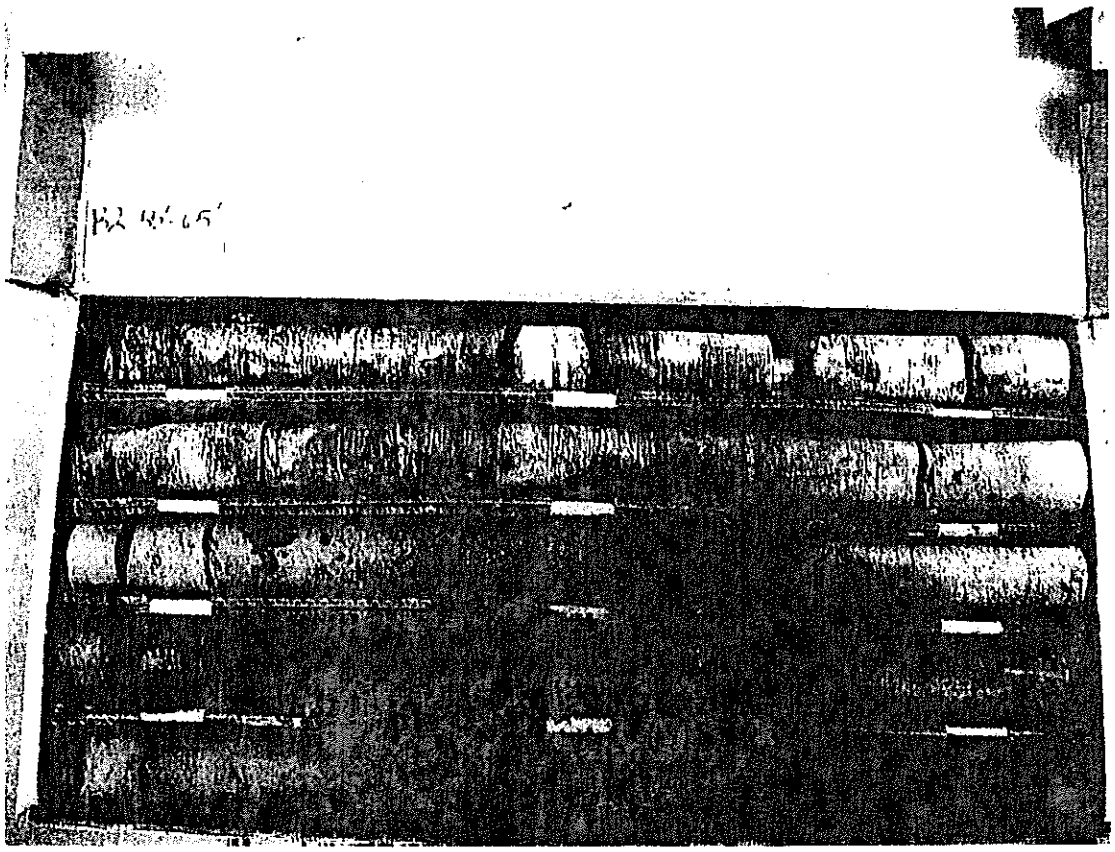
Boring 1 34' to 44'



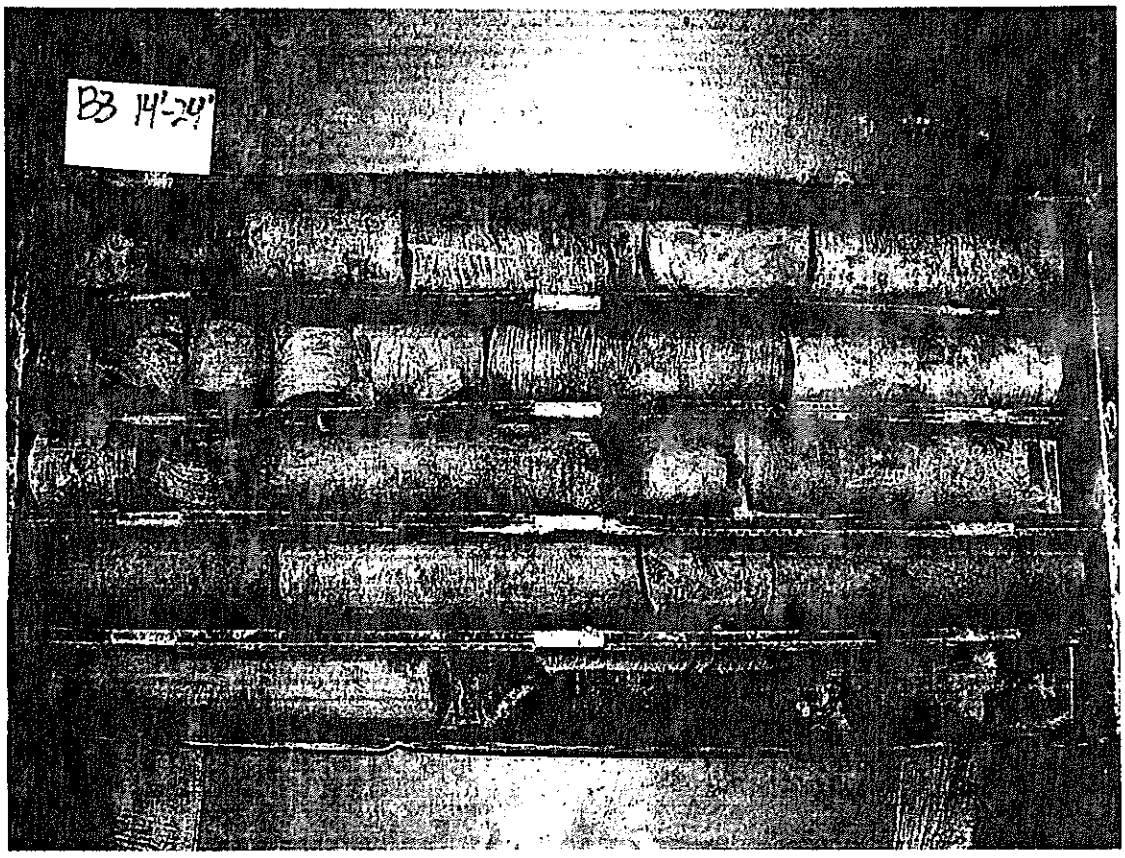
Boring 2 35' to 45'



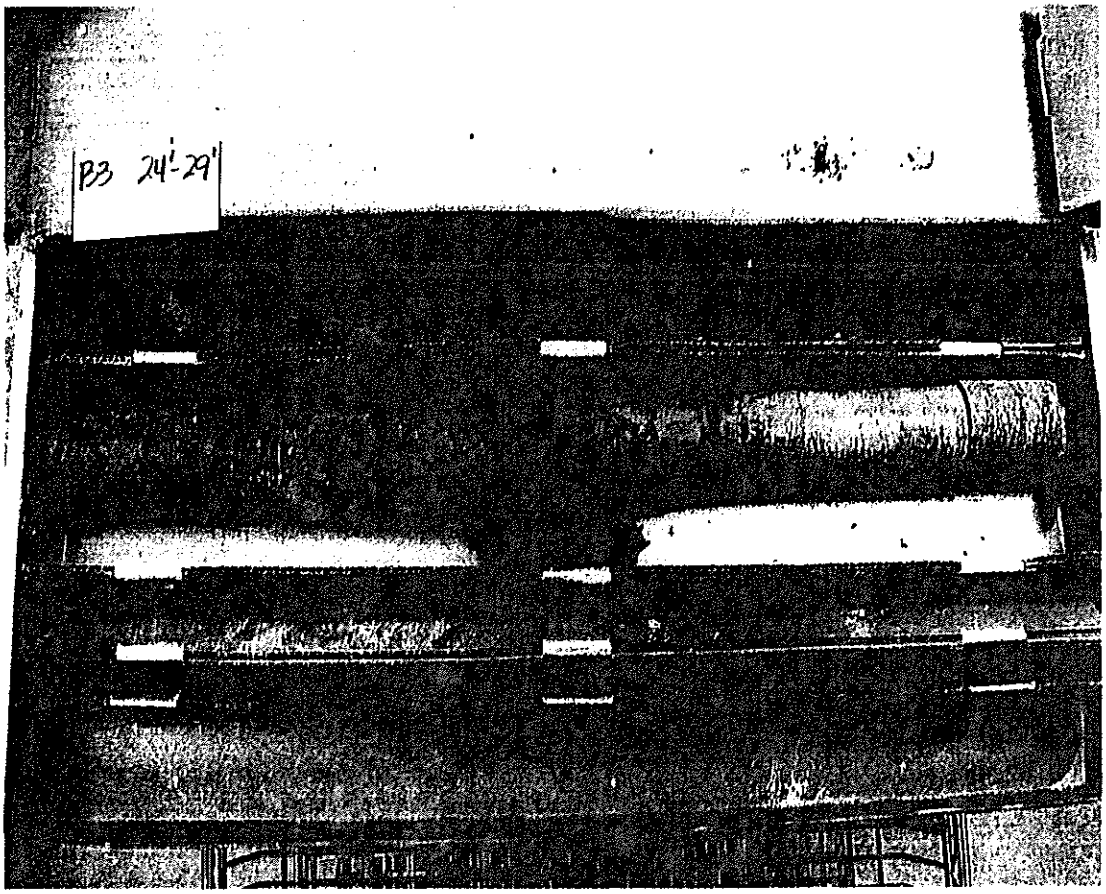
Boring 2 45' to 55'



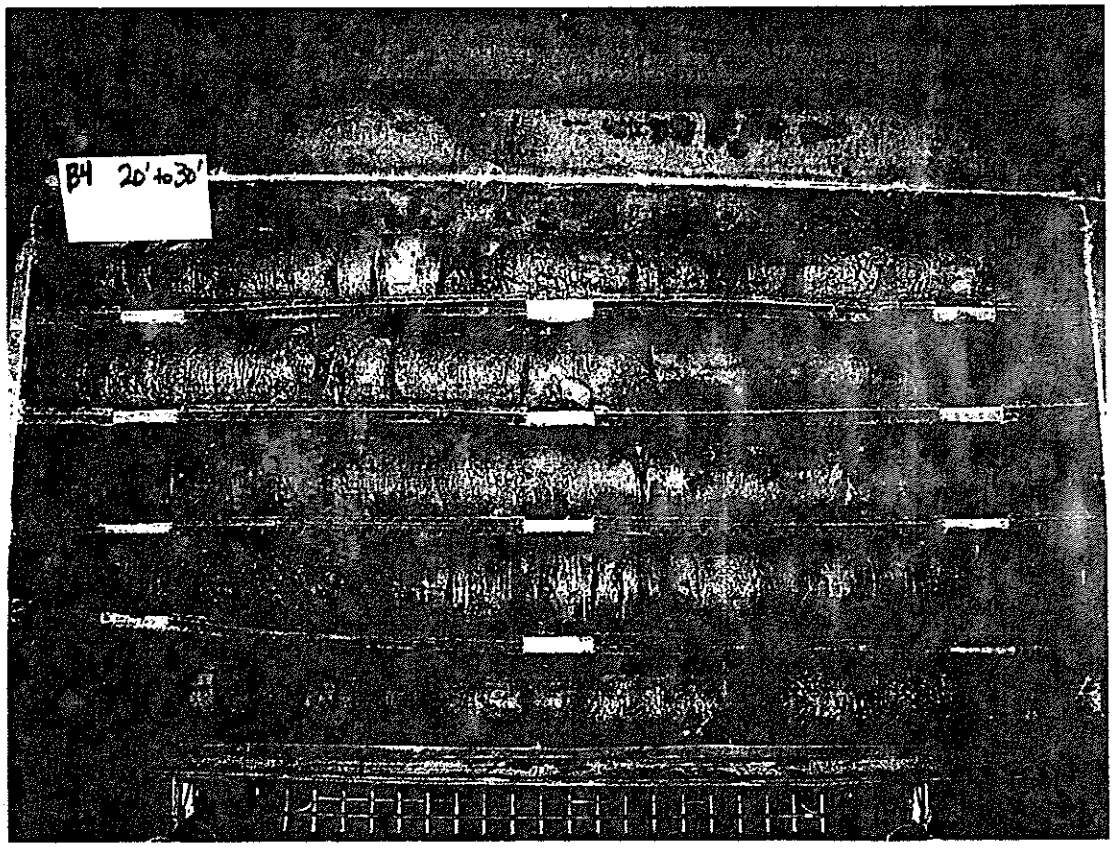
Boring 2 55' to 65'



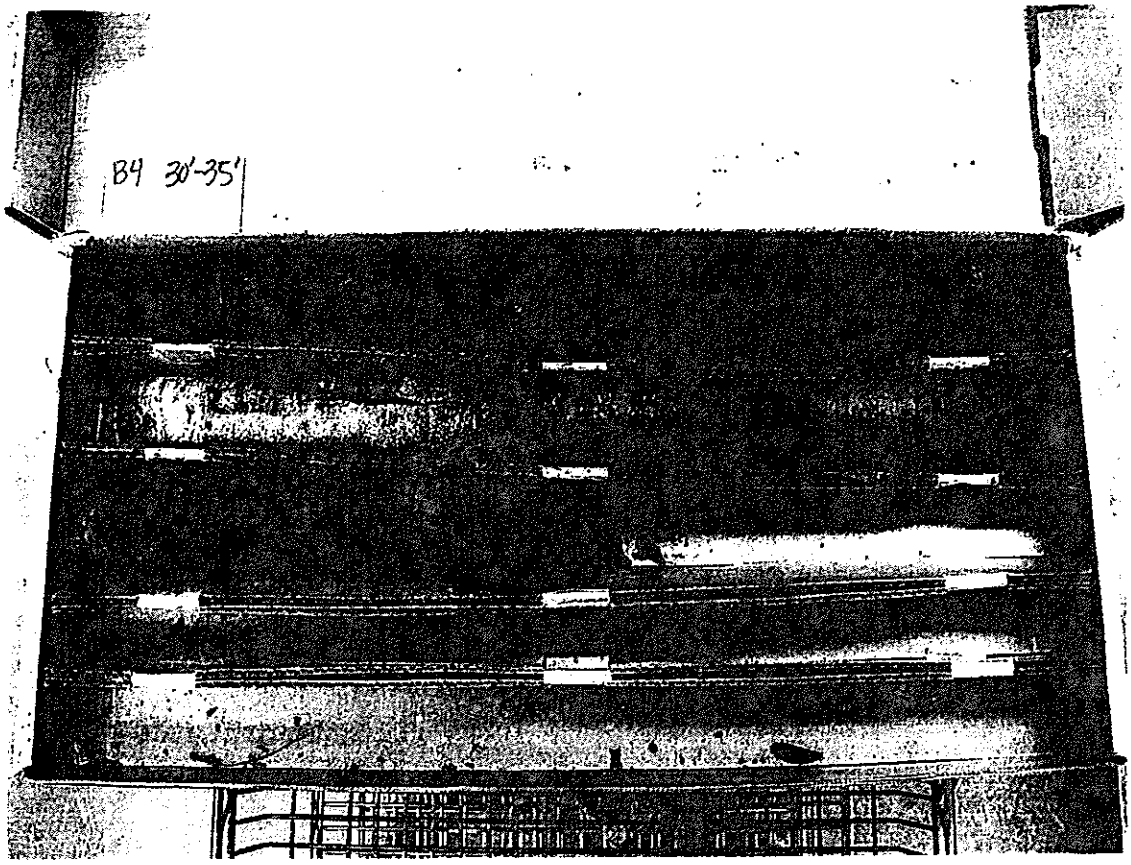
Boring 3 14' to 24'



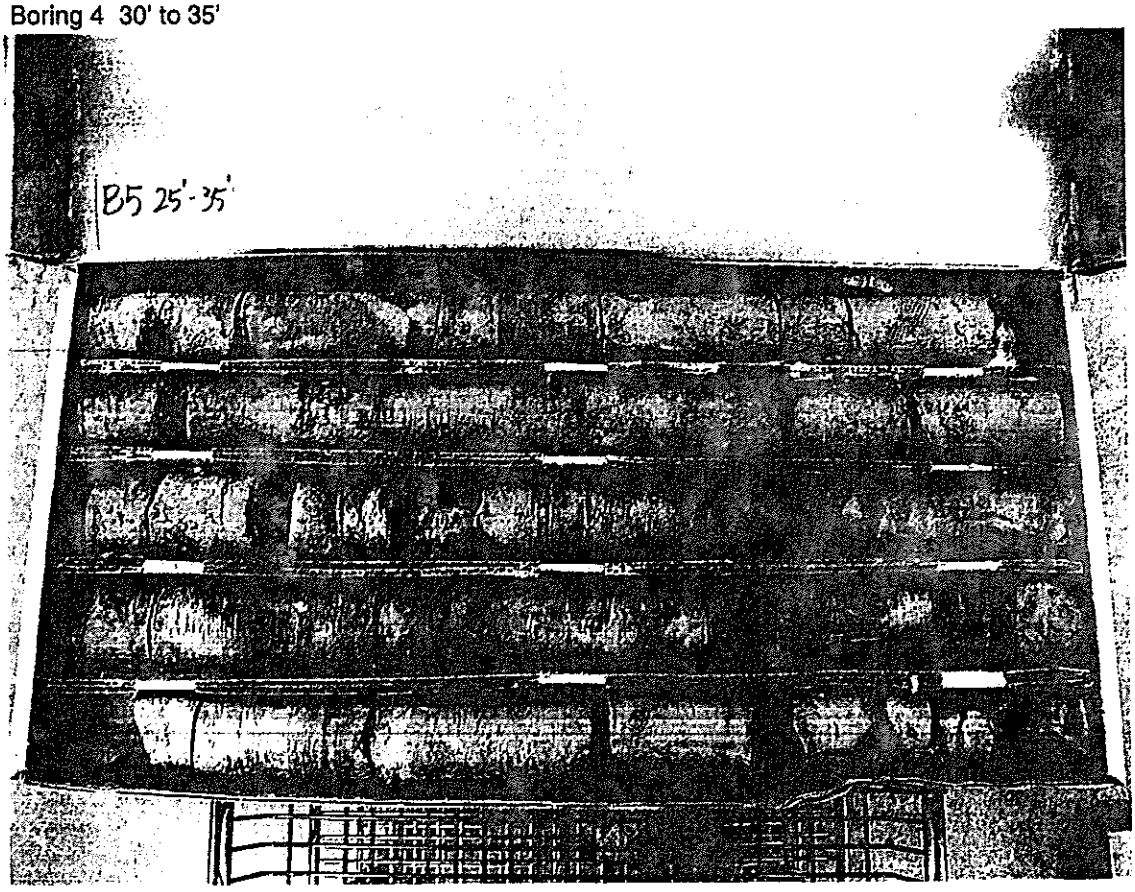
Boring 3 24' to 29'



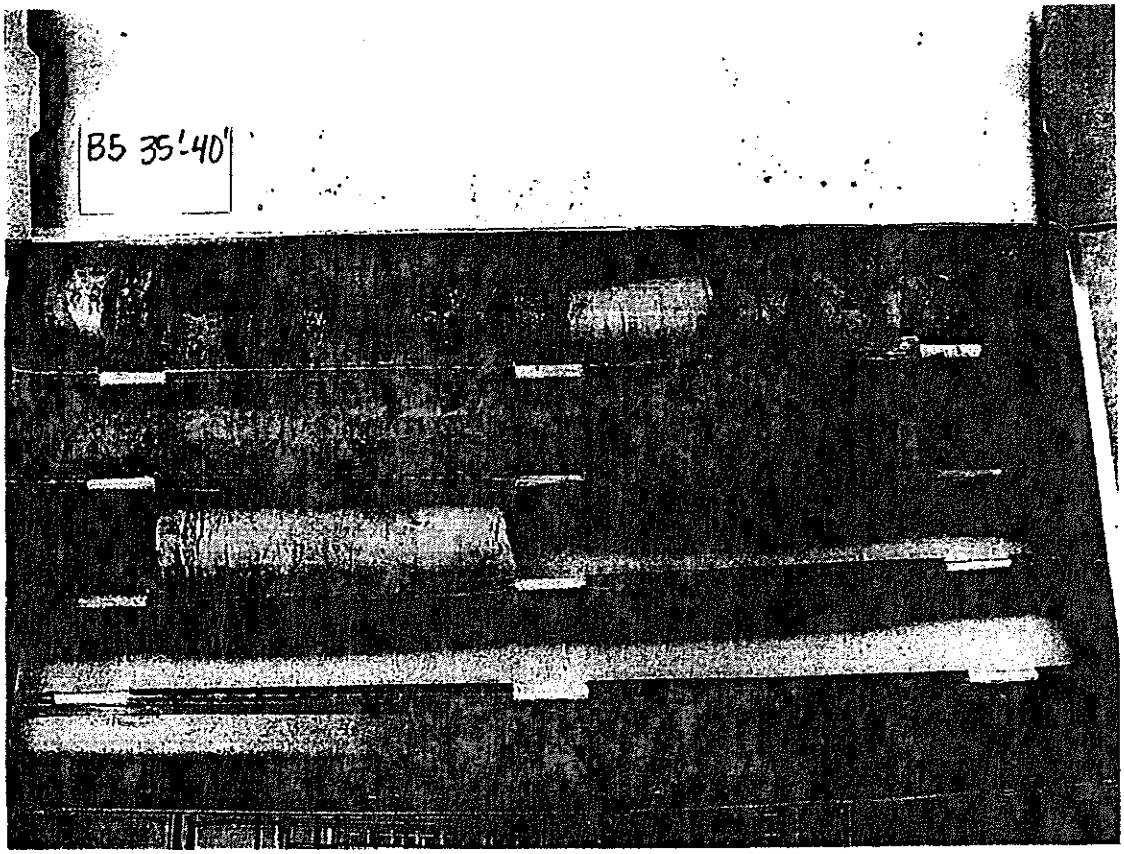
Boring 4 20' to 30'



Boring 4 30' to 35'



Boring 5 25' to 35'



Boring 5 35' to 40'

R10742

Holcomb Foundation Engineering Company

Monitoring Well Report

Site # H-14179 Location Williamson County Well # MW1

Site Name Pond Creek #1 Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 7/26/2014

Driller Jeff Carter Geologist _____ Date Completed: 7/26/2014

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of Bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of Bentonite: # of bags 1 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

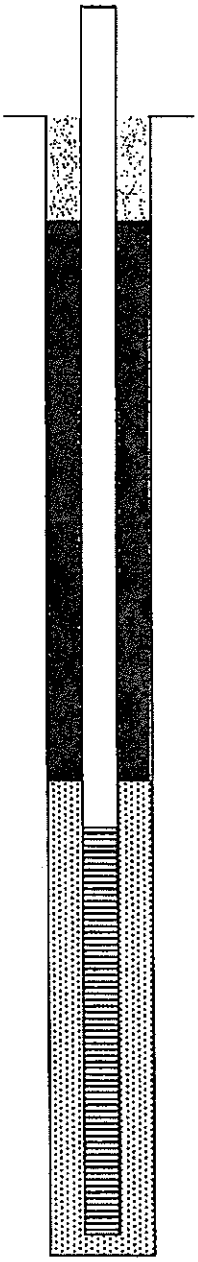
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				Steel

Measurements to .1 ft. (where applicable)

Riser pipe length			8'	
Protective cover length			5'	
Screen length			10'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			1.0"	



+3.0 MSL Top of Riser Pipe

0.0 MSL Ground Surface

2 ft. Concrete Seal

-2.0 ft. Top of Bentonite

1 ft. Bentonite

-3.0 ft. Top of Sand

-5.0 ft. Top of Screen

10.0 ft. Total Screen Interval

-15.0 ft. Bottom of Screen

-15.0 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

Holcomb Foundation Engineering Company

Monitoring Well Report

Site # H-14179 Location Williamson County Well # MW3

Site Name Pond Creek #1 Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 7/26/2014

Driller Jeff Carter Geologist _____ Date Completed: 7/26/2014

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of Bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of Bentonite: # of bags 1 lbs. per bag 50

Type of Sand Pack: FilterSil #1 10-20

Source of Sand: FilterSil Junction City, GA

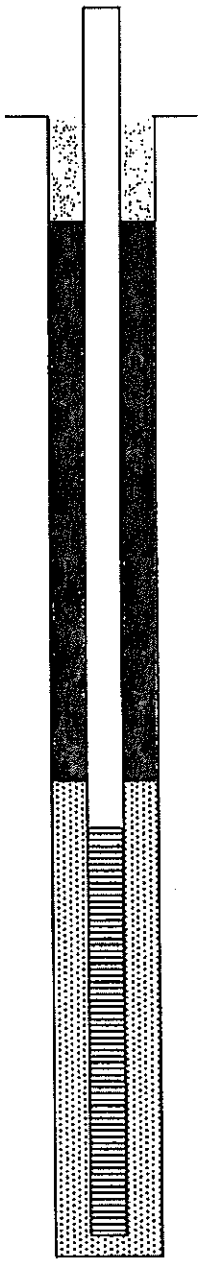
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				Steel

Measurements to .1 ft. (where applicable)

Riser pipe length			8'	
Protective cover length			5'	
Screen length			10'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			---	
Screen slot size			0.010"	
% of openings in screen			---	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			1.0"	



+3.0 MSL Top of Riser Pipe

0.0 MSL Ground Surface

2 ft. Concrete Seal

-2.0 ft. Top of Bentonite

1 ft. Bentonite

-3.0 ft. Top of Sand

-5.0 ft. Top of Screen

10.0 ft. Total Screen Interval

-15.0 ft. Bottom of Screen

-15.0 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

Pond Creek #1 Mine
Johnston City, Illinois

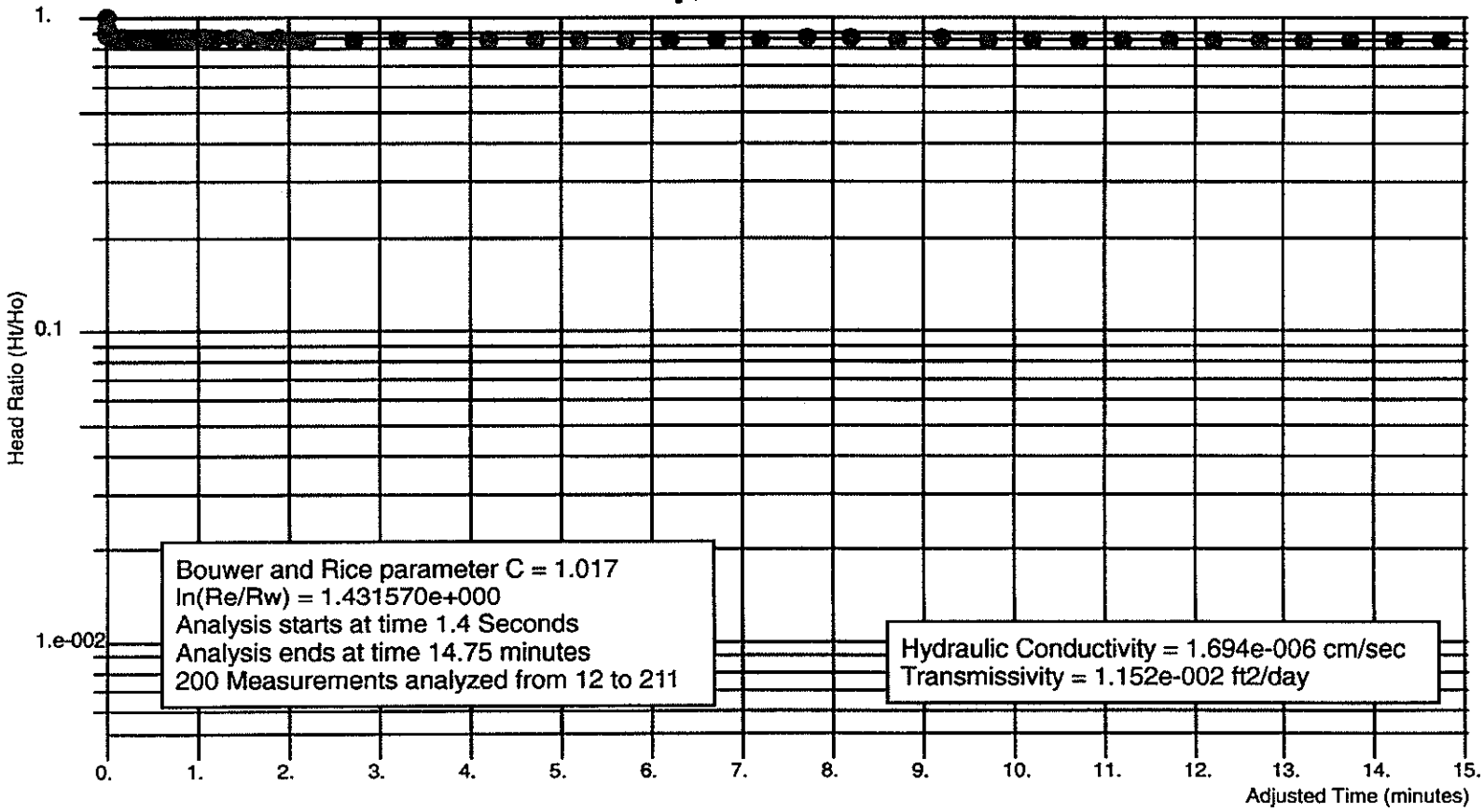
Slug Test Results
MW-1

Slug Test Analysis 7-31-2014

Bouwer and Rice Graph

Pond Creek No. 1 Mine Williamson County, Illinois

MW1



Project Number: H-14179 for WIlliamson Energy

Analysis by Starpoint Software

Ho is 12.11 feet at 1.4 Seconds

R10745

Bouwer and Rice Automatic Parameter Estimation

Slug Test Analysis

Site Name:	Pond Creek No. 1 Mine
Location:	Williamson County, Illinois
Test Date:	7-31-2014
Client:	Williamson Energy
Project Number:	H-14179

Well Label:	MW1
Aquifer Thickness:	2.4 feet
Screen Length:	10. feet
Casing Radius:	1. Inches
Effective Radius:	4. Inches
Bouwer and Rice Parameter C	1.017
Radius of Influence of Test	1.395 feet

Trial	Adjusted Time (Seconds)	Head (feet)	Head Ratio	Hyd. Con. (cm/sec)	Flow to Well (Gallons/Day)
12	0.	12.11	1.	--	
13	1.e-001	11.23	0.9273	4.765e-002	4.977e+005
14	0.2	10.94	0.9037	3.197e-002	3.255e+005
15	0.3	10.92	0.9022	2.166e-002	2.201e+005
16	0.5	10.94	0.9039	1.275e-002	1.299e+005
17	0.6	10.92	0.9022	1.083e-002	1.101e+005
18	0.7	10.9	0.9002	9.481e-003	9.615e+004
19	0.8	10.88	0.899	8.397e-003	8.505e+004
20	1.	10.87	0.8981	6.788e-003	6.867e+004
21	1.1	10.86	0.8969	6.245e-003	6.31e+004
22	1.2	10.86	0.8967	5.734e-003	5.793e+004
23	1.4	10.84	0.8956	4.973e-003	5.017e+004
24	1.5	10.83	0.8948	4.676e-003	4.714e+004
25	1.6	10.82	0.8938	4.428e-003	4.459e+004
26	1.7	10.8	0.8924	4.226e-003	4.249e+004
27	1.8	10.81	0.893	3.968e-003	3.992e+004
28	2.	10.79	0.8913	3.633e-003	3.648e+004
29	2.1	10.77	0.89	3.504e-003	3.514e+004
30	2.2	10.77	0.8894	3.364e-003	3.37e+004
31	2.3	10.75	0.8882	3.253e-003	3.255e+004
32	2.5	10.75	0.8884	2.988e-003	2.991e+004
33	2.6	10.74	0.8874	2.9e-003	2.9e+004
34	2.7	10.74	0.8872	2.797e-003	2.796e+004
35	2.8	10.72	0.8855	2.742e-003	2.735e+004
36	3.	10.7	0.8839	2.596e-003	2.585e+004
37	3.1	10.7	0.8839	2.512e-003	2.502e+004
38	3.2	10.69	0.8829	2.456e-003	2.443e+004
39	3.3	10.68	0.8824	2.394e-003	2.38e+004
40	3.5	10.67	0.8816	2.273e-003	2.257e+004
41	3.6	10.66	0.8809	2.224e-003	2.207e+004
42	3.7	10.67	0.8812	2.158e-003	2.142e+004
43	3.8	10.66	0.8803	2.118e-003	2.101e+004
44	4.	10.64	0.8791	2.033e-003	2.013e+004
45	4.1	10.63	0.8781	2.001e-003	1.979e+004
46	4.2	10.63	0.8777	1.96e-003	1.938e+004
47	4.3	10.62	0.8773	1.921e-003	1.899e+004
48	4.5	10.61	0.8767	1.845e-003	1.823e+004
49	4.6	10.61	0.8762	1.814e-003	1.791e+004

50	4.72	10.6	0.8756	1.777e-003	1.753e+004
51	4.84	10.6	0.8753	1.738e-003	1.714e+004
52	4.97	10.59	0.8744	1.704e-003	1.679e+004
53	5.09	10.58	0.8741	1.669e-003	1.643e+004
54	5.22	10.58	0.8737	1.633e-003	1.607e+004
55	5.35	10.57	0.8731	1.601e-003	1.575e+004
56	5.47	10.57	0.8729	1.568e-003	1.542e+004
57	5.6	10.56	0.8723	1.54e-003	1.514e+004
58	5.72	10.56	0.8723	1.508e-003	1.482e+004
59	5.85	10.55	0.8717	1.482e-003	1.455e+004
60	5.97	10.55	0.8714	1.456e-003	1.429e+004
61	6.1	10.55	0.8711	1.428e-003	1.401e+004
62	6.22	10.54	0.8708	1.404e-003	1.377e+004
63	6.35	10.54	0.8704	1.38e-003	1.353e+004
64	6.47	10.53	0.8702	1.356e-003	1.33e+004
65	6.6	10.53	0.8698	1.334e-003	1.307e+004
66	6.72	10.53	0.8696	1.312e-003	1.286e+004
67	6.85	10.52	0.8692	1.292e-003	1.265e+004
68	6.97	10.52	0.8691	1.271e-003	1.244e+004
69	7.1	10.52	0.8688	1.25e-003	1.224e+004
70	7.22	10.52	0.8686	1.231e-003	1.205e+004
71	7.35	10.51	0.8682	1.214e-003	1.187e+004
72	7.47	10.51	0.8681	1.196e-003	1.169e+004
73	7.6	10.51	0.8679	1.177e-003	1.151e+004
74	7.73	10.5	0.8677	1.159e-003	1.133e+004
75	7.85	10.5	0.8675	1.143e-003	1.117e+004
76	7.98	10.5	0.8673	1.126e-003	1.1e+004
77	8.1	10.5	0.8673	1.109e-003	1.084e+004
78	8.23	10.5	0.8671	1.094e-003	1.069e+004
79	8.35	10.49	0.8667	1.082e-003	1.056e+004
80	8.48	10.49	0.8667	1.065e-003	1.04e+004
81	8.6	10.49	0.8665	1.052e-003	1.027e+004
82	8.73	10.49	0.8663	1.038e-003	1.013e+004
83	8.85	10.49	0.8663	1.023e-003	9989
84	8.98	10.48	0.8659	1.012e-003	9873
85	9.1	10.48	0.8659	9.987e-004	9742
86	9.23	10.48	0.8658	9.859e-004	9616
87	9.35	10.48	0.8655	9.752e-004	9509
88	9.48	10.48	0.8655	9.618e-004	9378
89	9.6	10.48	0.8655	9.498e-004	9261
90	9.73	10.48	0.8653	9.384e-004	9148
91	9.85	10.47	0.8652	9.281e-004	9046
92	9.98	10.47	0.8652	9.161e-004	8929
93	10.11	10.47	0.8649	9.061e-004	8829
94	10.23	10.47	0.8649	8.954e-004	8725
95	10.36	10.47	0.8648	8.854e-004	8625
96	10.48	10.47	0.8646	8.764e-004	8536
97	10.61	10.47	0.8646	8.656e-004	8432
98	10.73	10.47	0.8646	8.56e-004	8337
99	10.86	10.46	0.8644	8.474e-004	8251
100	10.98	10.46	0.8644	8.381e-004	8161
101	11.11	10.46	0.8642	8.294e-004	8075
102	11.23	10.46	0.8642	8.205e-004	7988
103	11.36	10.46	0.8642	8.111e-004	7897
104	11.48	10.46	0.864	8.037e-004	7823
105	11.61	10.46	0.864	7.947e-004	7736
106	11.73	10.46	0.864	7.866e-004	7656

Pond Creek No. 1 Mine

107	11.86	10.46	0.8638	7.795e-004	7585
108	11.98	10.46	0.864	7.702e-004	7497
109	12.11	10.46	0.8638	7.634e-004	7429
110	12.23	10.46	0.8638	7.559e-004	7356
111	12.36	10.45	0.8636	7.489e-004	7286
112	12.48	10.45	0.8636	7.417e-004	7216
113	12.61	10.45	0.8636	7.341e-004	7142
114	12.74	10.45	0.8634	7.275e-004	7077
115	12.86	10.45	0.8634	7.208e-004	7011
116	12.99	10.45	0.8634	7.135e-004	6941
117	13.11	10.45	0.8632	7.084e-004	6889
118	13.24	10.45	0.8634	7.001e-004	6810
119	13.36	10.45	0.8632	6.951e-004	6760
120	13.49	10.45	0.863	6.893e-004	6702
121	14.5	10.45	0.8629	6.422e-004	6242
122	15.5	10.44	0.8626	6.019e-004	5849
123	16.5	10.44	0.8625	5.661e-004	5501
124	17.5	10.44	0.8622	5.348e-004	5195
125	18.5	10.43	0.8619	5.072e-004	4925
126	19.5	10.43	0.8616	4.822e-004	4680
127	20.5	10.43	0.8616	4.586e-004	4452
128	21.5	10.43	0.8616	4.373e-004	4245
129	22.5	10.43	0.8615	4.184e-004	4061
130	23.5	10.43	0.8613	4.011e-004	3892
131	24.5	10.43	0.8613	3.847e-004	3733
132	25.5	10.42	0.861	3.704e-004	3593
133	26.5	10.42	0.8609	3.568e-004	3461
134	27.5	10.42	0.8609	3.439e-004	3335
135	28.5	10.42	0.8609	3.318e-004	3218
136	29.5	10.42	0.8607	3.21e-004	3112
137	30.5	10.42	0.8607	3.104e-004	3010
138	31.5	10.42	0.8607	3.006e-004	2915
139	32.5	10.42	0.8607	2.913e-004	2825
140	33.5	10.42	0.8607	2.826e-004	2741
141	34.5	10.42	0.8605	2.75e-004	2666
142	35.5	10.42	0.8605	2.672e-004	2590
143	36.5	10.41	0.8603	2.602e-004	2522
144	37.5	10.41	0.8603	2.533e-004	2455
145	38.5	10.41	0.8603	2.467e-004	2391
146	39.5	10.41	0.8603	2.405e-004	2331
147	40.5	10.41	0.8603	2.345e-004	2273
148	41.5	10.41	0.8603	2.289e-004	2218
149	42.5	10.41	0.8603	2.235e-004	2166
150	43.5	10.41	0.8601	2.186e-004	2119
151	44.5	10.41	0.8601	2.137e-004	2071
152	45.5	10.41	0.8601	2.09e-004	2026
153	46.5	10.41	0.8601	2.045e-004	1982
154	47.5	10.41	0.8601	2.002e-004	1940
155	48.5	10.41	0.8603	1.959e-004	1898
156	49.5	10.41	0.8603	1.919e-004	1860
157	50.5	10.41	0.8601	1.883e-004	1825
158	51.5	10.41	0.8601	1.847e-004	1790
159	52.5	10.41	0.8601	1.812e-004	1755
160	53.5	10.41	0.8601	1.778e-004	1723
161	54.5	10.41	0.8599	1.748e-004	1694
162	55.5	10.41	0.8599	1.717e-004	1663
163	56.5	10.41	0.8599	1.687e-004	1634

164	57.5	10.41	0.8601	1.654e-004	1603
165	58.5	10.41	0.8599	1.629e-004	1578
166	59.5	10.41	0.8601	1.598e-004	1549
167	60.5	10.41	0.8599	1.575e-004	1526
168	61.5	10.41	0.8601	1.547e-004	1499
169	62.5	10.41	0.8599	1.525e-004	1477
170	63.5	10.41	0.8599	1.501e-004	1454
171	64.5	10.41	0.8599	1.477e-004	1431
172	65.5	10.41	0.8599	1.455e-004	1409
173	66.5	10.41	0.8599	1.433e-004	1388
174	67.5	10.41	0.8599	1.412e-004	1368
175	68.5	10.41	0.8599	1.391e-004	1348
176	69.5	10.41	0.8599	1.371e-004	1328
177	70.5	10.41	0.8597	1.353e-004	1311
178	71.5	10.41	0.8597	1.334e-004	1292
179	72.5	10.41	0.8597	1.316e-004	1275
180	73.5	10.41	0.8597	1.298e-004	1257
181	83.5	10.4	0.8596	1.144e-004	1108
182	93.5	10.4	0.8596	1.022e-004	989.4
183	103.5	10.4	0.8593	9.248e-005	895.3
184	113.5	10.4	0.8596	8.417e-005	815.1
185	123.5	10.4	0.8593	7.75e-005	750.3
186	133.5	10.4	0.8591	7.179e-005	694.8
187	163.5	10.4	0.859	5.869e-005	568.
188	193.5	10.39	0.8586	4.975e-005	481.2
189	223.5	10.39	0.8584	4.313e-005	417.
190	253.5	10.39	0.8586	3.797e-005	367.3
191	283.5	10.39	0.8586	3.396e-005	328.4
192	313.5	10.4	0.8588	3.065e-005	296.5
193	343.5	10.4	0.8591	2.79e-005	270.
194	373.5	10.4	0.8594	2.561e-005	248.
195	403.5	10.4	0.8591	2.375e-005	229.9
196	433.5	10.4	0.8594	2.207e-005	213.6
197	463.5	10.41	0.8597	2.059e-005	199.4
198	493.5	10.4	0.8596	1.936e-005	187.5
199	523.5	10.4	0.8594	1.827e-005	176.9
200	553.5	10.4	0.8596	1.726e-005	167.1
201	583.5	10.4	0.8594	1.639e-005	158.7
202	613.5	10.4	0.8588	1.566e-005	151.5
203	643.5	10.4	0.8588	1.493e-005	144.5
204	673.5	10.4	0.859	1.425e-005	137.9
205	703.5	10.4	0.859	1.364e-005	132.
206	733.5	10.4	0.859	1.308e-005	126.6
207	763.5	10.4	0.8591	1.255e-005	121.5
208	793.5	10.4	0.8594	1.205e-005	116.7
209	823.5	10.4	0.8594	1.162e-005	112.5
210	853.5	10.4	0.8594	1.121e-005	108.5
211	883.5	10.4	0.8594	1.083e-005	104.8

Arithmetic Means:

Hydraulic Conductivity	1.67e-003 cm/sec
Transmissivity	11.36 ft2/day

Geometric Means:

Hydraulic Conductivity	4.857e-004 cm/sec
Transmissivity	3.304 ft2/day

Sensitivity Analysis:

Hydraulic Conductivity	2.189e-005 cm/sec
Transmissivity	0.1489 ft2/day

Pond Creek #1 Mine
Johnston City, Illinois

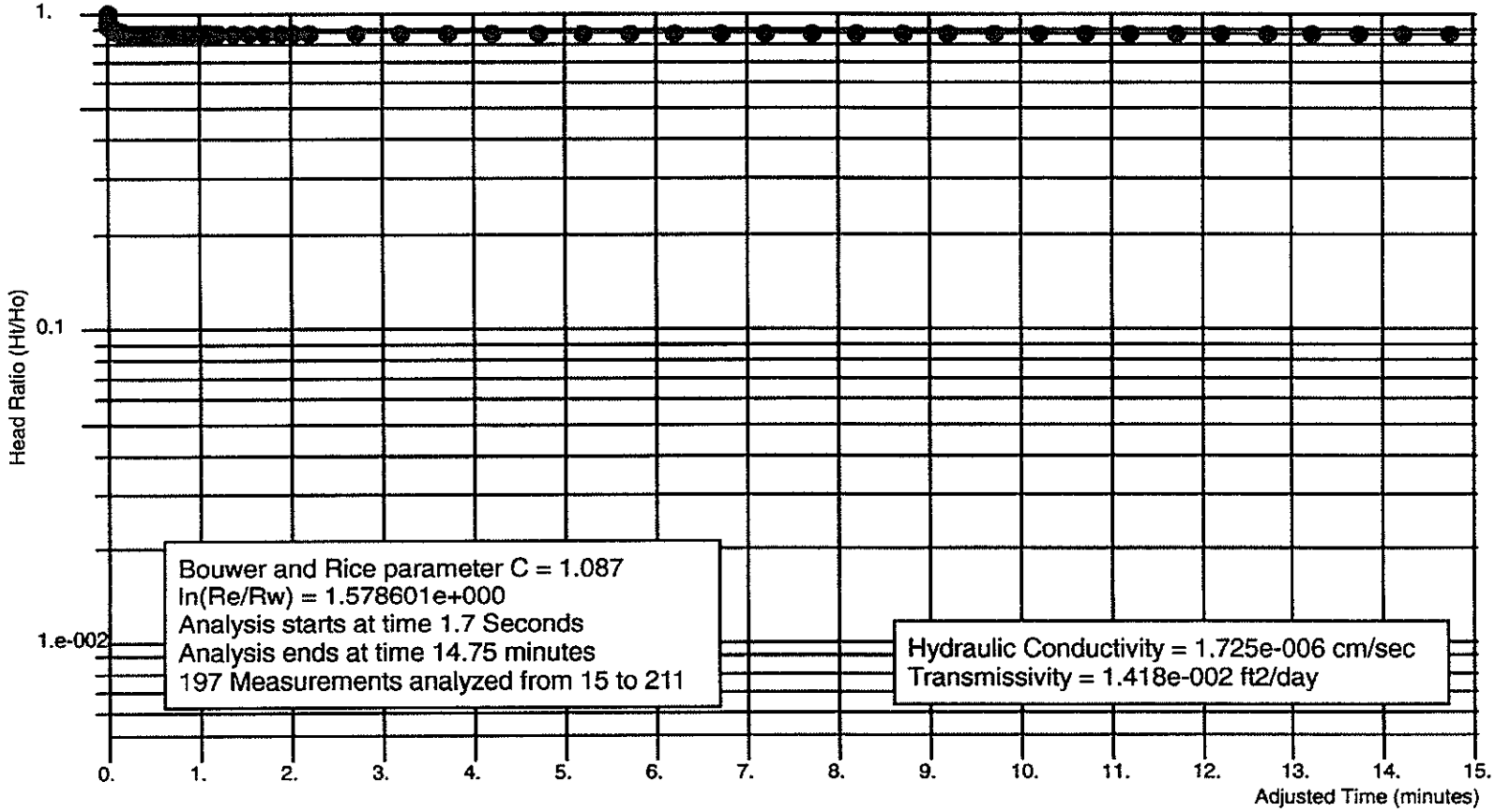
Slug Test Results
MW-3

Slug Test Analysis 7-31-2014

Bouwer and Rice Graph

Pond Creek No. 1 Mine Williamson County, Illinois

MW3



Project Number: H-14179 for WIlliamson Energy

Analysis by Starpoint Software

Ho is 11.37 feet at 1.7 Seconds

R10752

Bouwer and Rice Automatic Parameter Estimation

Slug Test Analysis

Site Name:	Pond Creek No. 1 Mine
Location:	Williamson County, Illinois
Test Date:	7-31-2014
Client:	Williamson Energy
Project Number:	H-14179

Well Label:	MW3
Aquifer Thickness:	2.9 feet
Screen Length:	10. feet
Casing Radius:	1. Inches
Effective Radius:	4. Inches
Bouwer and Rice Parameter C	1.087
Radius of Influence of Test	1.616 feet

Trial	Adjusted Time (Seconds)	Head (feet)	Head Ratio	Hyd. Con. (cm/sec)	Flow to Well (Gallons/Day)
15	0.	11.37	1.	--	
16	0.2	10.93	0.9612	1.14e-002	1.051e+005
17	0.3	10.73	0.9437	1.113e-002	1.008e+005
18	0.4	10.59	0.9316	1.021e-002	9.126e+004
19	0.5	10.57	0.9294	8.43e-003	7.517e+004
20	0.7	10.51	0.9245	6.459e-003	5.729e+004
21	0.8	10.5	0.9239	5.7e-003	5.052e+004
22	0.9	10.47	0.9213	5.25e-003	4.64e+004
23	1.1	10.45	0.9193	4.405e-003	3.885e+004
24	1.2	10.43	0.9175	4.135e-003	3.639e+004
25	1.3	10.42	0.9165	3.863e-003	3.397e+004
26	1.4	10.4	0.9148	3.663e-003	3.214e+004
27	1.5	10.37	0.9119	3.54e-003	3.097e+004
28	1.7	10.38	0.9127	3.095e-003	2.71e+004
29	1.8	10.34	0.9101	3.015e-003	2.633e+004
30	1.9	10.32	0.9076	2.939e-003	2.559e+004
31	2.	10.31	0.9074	2.8e-003	2.438e+004
32	2.2	10.28	0.9041	2.64e-003	2.29e+004
33	2.3	10.26	0.9026	2.566e-003	2.222e+004
34	2.4	10.24	0.9012	2.497e-003	2.159e+004
35	2.5	10.23	0.9001	2.424e-003	2.093e+004
36	2.7	10.22	0.8994	2.263e-003	1.953e+004
37	2.8	10.21	0.898	2.215e-003	1.908e+004
38	2.9	10.19	0.8963	2.175e-003	1.87e+004
39	3.	10.17	0.895	2.129e-003	1.828e+004
40	3.2	10.16	0.8938	2.021e-003	1.733e+004
41	3.3	10.16	0.8938	1.96e-003	1.68e+004
42	3.4	10.15	0.8932	1.914e-003	1.64e+004
43	3.5	10.14	0.8921	1.879e-003	1.608e+004
44	3.7	10.13	0.8909	1.799e-003	1.537e+004
45	3.8	10.12	0.89	1.766e-003	1.508e+004
46	3.9	10.11	0.8894	1.731e-003	1.477e+004
47	4.	10.1	0.8884	1.704e-003	1.452e+004
48	4.2	10.09	0.8876	1.636e-003	1.393e+004
49	4.3	10.08	0.8868	1.61e-003	1.37e+004
50	4.42	10.07	0.8862	1.575e-003	1.339e+004
51	4.54	10.07	0.886	1.536e-003	1.306e+004
52	4.67	10.06	0.8851	1.506e-003	1.278e+004

Pond Creek No. 1 Mine

53	4.79	10.05	0.8845	1.476e-003	1.253e+004
54	4.92	10.05	0.8839	1.445e-003	1.226e+004
55	5.05	10.04	0.8834	1.414e-003	1.198e+004
56	5.17	10.03	0.8828	1.389e-003	1.176e+004
57	5.3	10.03	0.8825	1.359e-003	1.151e+004
58	5.42	10.03	0.882	1.334e-003	1.129e+004
59	5.55	10.02	0.8819	1.305e-003	1.104e+004
60	5.67	10.02	0.8814	1.283e-003	1.085e+004
61	5.8	10.01	0.881	1.259e-003	1.064e+004
62	5.92	10.01	0.8806	1.237e-003	1.045e+004
63	6.05	10.	0.8802	1.215e-003	1.026e+004
64	6.17	10.	0.88	1.194e-003	1.008e+004
65	6.3	10.	0.8797	1.172e-003	9889
66	6.42	9.996	0.8794	1.153e-003	9730
67	6.55	9.996	0.8794	1.13e-003	9537
68	6.67	9.991	0.8789	1.114e-003	9397
69	6.8	9.991	0.8789	1.093e-003	9218
70	6.92	9.988	0.8787	1.077e-003	9076
71	7.05	9.986	0.8785	1.058e-003	8921
72	7.17	9.984	0.8783	1.042e-003	8783
73	7.3	9.981	0.8781	1.026e-003	8644
74	7.43	9.979	0.8779	1.01e-003	8504
75	7.55	9.979	0.8779	9.937e-004	8369
76	7.68	9.977	0.8777	9.784e-004	8239
77	7.8	9.974	0.8775	9.656e-004	8128
78	7.93	9.974	0.8775	9.498e-004	7995
79	8.05	9.972	0.8773	9.37e-004	7886
80	8.18	9.97	0.8771	9.236e-004	7771
81	8.3	9.97	0.8771	9.102e-004	7659
82	8.43	9.967	0.8768	8.982e-004	7556
83	8.55	9.965	0.8767	8.87e-004	7460
84	8.68	9.965	0.8767	8.737e-004	7348
85	8.8	9.965	0.8767	8.618e-004	7248
86	8.93	9.963	0.8765	8.505e-004	7152
87	9.05	9.963	0.8765	8.392e-004	7057
88	9.18	9.963	0.8765	8.274e-004	6957
89	9.3	9.963	0.8765	8.167e-004	6867
90	9.43	9.96	0.8762	8.073e-004	6786
91	9.55	9.958	0.876	7.983e-004	6709
92	9.68	9.958	0.876	7.876e-004	6619
93	9.81	9.956	0.8759	7.784e-004	6540
94	9.93	9.956	0.8759	7.689e-004	6461
95	10.06	9.956	0.8759	7.59e-004	6378
96	10.18	9.956	0.8759	7.501e-004	6303
97	10.31	9.953	0.8756	7.423e-004	6235
98	10.43	9.953	0.8756	7.337e-004	6164
99	10.56	9.953	0.8756	7.247e-004	6088
100	10.68	9.951	0.8754	7.177e-004	6027
101	10.81	9.953	0.8756	7.08e-004	5947
102	10.93	9.951	0.8754	7.012e-004	5889
103	11.06	9.951	0.8754	6.93e-004	5820
104	11.18	9.949	0.8753	6.866e-004	5765
105	11.31	9.949	0.8753	6.787e-004	5699
106	11.43	9.949	0.8753	6.716e-004	5639
107	11.56	9.946	0.875	6.655e-004	5587
108	11.68	9.946	0.875	6.587e-004	5529
109	11.81	9.949	0.8753	6.5e-004	5458

Pond Creek No. 1 Mine

110	11.93	9.946	0.875	6.449e-004	5413
111	12.06	9.946	0.875	6.379e-004	5355
112	12.18	9.946	0.875	6.317e-004	5302
113	12.31	9.946	0.875	6.25e-004	5246
114	12.44	9.946	0.875	6.185e-004	5191
115	12.56	9.944	0.8748	6.135e-004	5149
116	12.69	9.944	0.8748	6.072e-004	5096
117	12.81	9.944	0.8748	6.015e-004	5048
118	12.94	9.944	0.8748	5.955e-004	4997
119	13.06	9.942	0.8746	5.909e-004	4958
120	13.19	9.942	0.8746	5.85e-004	4909
121	14.2	9.937	0.8742	5.455e-004	4575
122	15.2	9.937	0.8742	5.096e-004	4274
123	16.2	9.934	0.8739	4.792e-004	4018
124	17.2	9.932	0.8738	4.52e-004	3789
125	18.2	9.932	0.8738	4.272e-004	3581
126	19.2	9.93	0.8736	4.055e-004	3399
127	20.2	9.927	0.8733	3.863e-004	3237
128	21.2	9.927	0.8733	3.681e-004	3084
129	22.2	9.925	0.8731	3.52e-004	2949
130	23.2	9.925	0.8731	3.369e-004	2822
131	24.2	9.923	0.873	3.234e-004	2709
132	25.2	9.923	0.873	3.106e-004	2601
133	26.2	9.92	0.8727	2.994e-004	2507
134	27.2	9.92	0.8727	2.884e-004	2415
135	28.2	9.92	0.8727	2.782e-004	2329
136	29.2	9.918	0.8725	2.69e-004	2252
137	30.2	9.92	0.8727	2.597e-004	2175
138	31.2	9.918	0.8725	2.518e-004	2108
139	32.2	9.918	0.8725	2.44e-004	2042
140	33.2	9.916	0.8723	2.37e-004	1983
141	34.2	9.916	0.8723	2.3e-004	1925
142	35.2	9.916	0.8723	2.235e-004	1871
143	36.2	9.916	0.8723	2.173e-004	1819
144	37.2	9.913	0.8721	2.12e-004	1773
145	38.2	9.913	0.8721	2.064e-004	1727
146	39.2	9.911	0.8719	2.014e-004	1685
147	40.2	9.911	0.8719	1.964e-004	1643
148	41.2	9.911	0.8719	1.917e-004	1603
149	42.2	9.911	0.8719	1.871e-004	1565
150	43.2	9.911	0.8719	1.828e-004	1529
151	44.2	9.909	0.8717	1.789e-004	1496
152	45.2	9.909	0.8717	1.75e-004	1463
153	46.2	9.909	0.8717	1.712e-004	1432
154	47.2	9.909	0.8717	1.675e-004	1401
155	48.2	9.909	0.8717	1.641e-004	1372
156	49.2	9.906	0.8715	1.611e-004	1347
157	50.2	9.906	0.8715	1.579e-004	1320
158	51.2	9.906	0.8715	1.548e-004	1294
159	52.2	9.909	0.8717	1.515e-004	1267
160	53.2	9.906	0.8715	1.49e-004	1246
161	54.2	9.906	0.8715	1.462e-004	1223
162	55.2	9.906	0.8715	1.436e-004	1200
163	56.2	9.906	0.8715	1.41e-004	1179
164	57.2	9.906	0.8715	1.386e-004	1158
165	58.2	9.904	0.8713	1.364e-004	1140
166	59.2	9.904	0.8713	1.341e-004	1121

167	60.2	9.906	0.8715	1.317e-004	1101
168	61.2	9.904	0.8713	1.297e-004	1084
169	62.2	9.904	0.8713	1.276e-004	1067
170	63.2	9.904	0.8713	1.256e-004	1050
171	64.2	9.904	0.8713	1.236e-004	1033
172	65.2	9.904	0.8713	1.217e-004	1018
173	66.2	9.904	0.8713	1.199e-004	1002
174	67.2	9.904	0.8713	1.181e-004	987.3
175	68.2	9.904	0.8713	1.164e-004	972.8
176	69.2	9.904	0.8713	1.147e-004	958.8
177	70.2	9.904	0.8713	1.131e-004	945.1
178	71.2	9.904	0.8713	1.115e-004	931.8
179	72.2	9.902	0.8711	1.101e-004	920.1
180	73.2	9.904	0.8713	1.084e-004	906.4
181	83.2	9.897	0.8707	9.589e-005	801.
182	93.2	9.895	0.8705	8.573e-005	715.9
183	103.2	9.897	0.8707	7.731e-005	645.7
184	113.2	9.895	0.8705	7.058e-005	589.4
185	123.2	9.897	0.8707	6.476e-005	540.9
186	133.2	9.894	0.8704	6.003e-005	501.2
187	163.2	9.894	0.8704	4.899e-005	409.1
188	193.2	9.892	0.8702	4.145e-005	346.
189	223.2	9.892	0.8702	3.587e-005	299.5
190	253.2	9.892	0.8702	3.162e-005	264.
191	283.2	9.892	0.8702	2.827e-005	236.
192	313.2	9.89	0.8701	2.56e-005	213.7
193	343.2	9.888	0.8699	2.34e-005	195.3
194	373.2	9.885	0.8696	2.156e-005	179.9
195	403.2	9.885	0.8696	1.996e-005	166.5
196	433.2	9.885	0.8696	1.858e-005	155.
197	463.2	9.885	0.8696	1.737e-005	145.
198	493.2	9.883	0.8694	1.634e-005	136.3
199	523.2	9.885	0.8696	1.538e-005	128.3
200	553.2	9.881	0.8693	1.459e-005	121.7
201	583.2	9.878	0.869	1.387e-005	115.6
202	613.2	9.878	0.869	1.319e-005	110.
203	643.2	9.883	0.8694	1.253e-005	104.5
204	673.2	9.885	0.8696	1.195e-005	99.74
205	703.2	9.885	0.8696	1.144e-005	95.48
206	733.2	9.883	0.8694	1.099e-005	91.69
207	763.2	9.885	0.8696	1.055e-005	87.97
208	793.2	9.883	0.8694	1.016e-005	84.75
209	823.2	9.88	0.8692	9.812e-006	81.82
210	853.2	9.883	0.8694	9.446e-006	78.79
211	883.2	9.876	0.8688	9.172e-006	76.45

Arithmetic Means:

Hydraulic Conductivity	1.057e-003 cm/sec
Transmissivity	8.693 ft2/day

Geometric Means:

Hydraulic Conductivity	3.91e-004 cm/sec
Transmissivity	3.214 ft2/day

Sensitivity Analysis:

Hydraulic Conductivity	1.813e-005 cm/sec
Transmissivity	0.149 ft2/day

DOCUMENT

55

4275-114-C
Due date: 11-7-14/10/14

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

Date: September 26, 2014

To: Larry Crislip

From: Bill Buscher BB

Subject: Review and Comment on the Pond Creek Mine Permit #375 Geotextile Tube IPR groundwater monitoring and protection plan, Williamson County

At the request of the Mine Pollution Control Program (MPCP) the Groundwater Section has reviewed the data for the Pond Creek Mine, permit no. 375, Geotextile Tube IPR dated July 2014 and Supplemental Information dated August 2014. The purpose of the review is to evaluate groundwater protection and monitoring system design for the proposed use of geotextile tubes for fine coal refuse disposal.

1. A low permeability liner is required to be installed under the proposed refuse placement area. The low permeability liner may consist of a four foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s or a synthetic liner capable of providing an equivalent level of groundwater protection.

2. A low permeability cap is required to be installed over the proposed refuse at reclamation. The low permeability cap may consist of a four foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s or a synthetic liner capable of providing an equivalent level of protection.

3. Four monitoring wells are required, one on each corner of the proposed placement area.

4. The monitoring wells are required to be sampled a minimum of six times for the inorganic parameters listed in Table A prior to placement of refuse and also six times post-reclamation. An adequate number of samples must be collected to calculate a statistical representation of existing groundwater quality ("background") in the area, prior to disposal of slurry in the proposed disposal area. Sampling frequency must be monthly until an adequate data set exists to calculate statistically based background concentrations.

5. A statistical representation of existing water quality must be established using the method outlined in Attachment 1, or another Agency-approved method, for the monitoring wells. The statistical procedures

described may not be appropriate under existing and proposed site conditions. Alternative statistical methods may need to be used. This method should be used to determine the 95 percent confidence limit for each parameter.

6. The post mining statistical method used may depend upon the initial background statistics method.

ATTACHMENT 1

A. A statistically valid representation of background (existing) and/or post-mining groundwater quality shall be submitted to the Agency utilizing the following method. This method should be used to predict the confidence limit when single groundwater samples are taken from each monitoring (test) well.

Should the Permittee determine that an alternate statistical method would be more appropriate based on the data being evaluated, the Permittee may request utilization of such alternate methodology. Upon approval from the Agency, the alternate methodology may be utilized to determine a statistically valid representation of background and/or post-mining groundwater quality.

1. Determine the arithmetic mean $(\overline{X}_b)$ of each indicator parameter for the sampling period. If more than one well is used, an equal number of samples must be taken from each well.

$$\overline{X}_b = \frac{X_1 + X_2 + \ldots X_n}{n}$$

Where:

$\overline{X}_b$ = Average value for a given chemical parameter

X_n = Values for each sample

n = the number of samples taken

2. Calculate the variance (S_b^2) and standard deviation (S_b) for each parameter using the values (X_n) from each sample of the well(s) as follows:

$$S_b^2 = \frac{(X_1 - \overline{X}_b)^2 + (X_2 - \overline{X}_b)^2 + \ldots + (X_n - \overline{X}_b)^2}{n-1}$$

$$S_b = \sqrt{S_b^2}$$

3. Calculate the upper confidence limit using the following formula:

$$CL = \overline{X}_b \pm t\sqrt{1 + 1/n}\ \ (S_b)$$

Where:

CL = upper confidence limit prediction
(upper and lower limits should be calculated for pH)

t = one-tailed t value at the required significance level and at n-1 degrees of freedom from Table 1
(a two-tailed t value should be used for pH)

4. If the values of any routine parameter for any monitoring well exceed the upper confidence limit for that parameter, the permittee shall conclude that a statistically significant change has occurred at that well.

5. When some of the values are less than the Method Detection Limit (MDL), a value of one-half (1/2) the MDL shall be substituted for each value that is reported as less than the MDL. All other computations shall be calculated as given above.

B. If all values are less than the MDL for a given parameter, the Practical Quantitation Limit (PQL), for the analytical method utilized, shall be used to evaluate data from monitoring wells. If the analytical results from any monitoring well exceed two (2) times the PQL for any single parameter, or if they exceed the PQLs for two or more parameters, the permittee shall conclude that a statistically significant change has occurred.

Table 1
Standard t-Tables Level of Significance

Degrees of freedom	t-values (one-tail)		t-values (two-tail)*		
		99%	95%	99%	95%
4	3.747	2.132	4.604	2.776	
5	3.365	2.015	4.032	2.571	
6	3.143	1.943	3.707	2.447	
7	2.998	1.895	3.499	2.365	
8	2.896	1.860	3.355	2.306	
9	2.821	1.833	3.250	2.262	
10	2.764	1.812	3.169	2.228	
11	2.718	1.796	3.106	2.201	
12	2.681	1.782	3.055	2.179	
13	2.650	1.771	3.012	2.160	
14	2.624	1.761	2.977	2.145	
15	2.602	1.753	2.947	2.131	
16	2.583	1.746	2.921	2.120	
17	2.567	1.740	2.898	2.110	
18	2.552	1.734	2.878	2.101	
19	2.539	1.729	2.861	2.093	
20	2.528	1.725	2.845	2.086	
21	2.518	1.721	2.831	2.080	
22	2.508	1.717	2.819	2.074	
23	2.500	1.714	2.807	2.069	
24	2.492	1.711	2.797	2.064	
25	2.485	1.708	2.787	2.060	
30	2.457	1.697	2.750	2.042	
40	2.423	1.684	2.704	2.021	

Adopted from Table III of "Statistical Tables for Biological Agricultural and Medical Research" (1947, R.A. Fisher and F. Yates).
* For pH only when required.

Table A

Aluminum	Fluoride	Sulfate
Antimony	Iron (dissolved)	Thallium
Arsenic	Iron (total)	Total Dissolved Solids
Barium	Lead	Vanadium
Beryllium	Manganese (dissolved)	Zinc
Boron	Manganese (total)	pH
Cadmium	Mercury	Acidity
Chloride	Molybdenum	Alkalinity
Chromium	Nickel	Hardness
Cobalt	Phenols	Static Water Elevation
Copper	Selenium	
Cyanide	Silver	

DOCUMENT

56

4275-/14-A
Due date: 9-24-14
R10765

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

State of Illinois
Department of Natural Resources
Office of Mines and Minerals; Land Reclamation Division
One Natural Way
Springfield, IL 62702

SUPPLEMENTAL INFORMATION
PERMIT # 375
GEOTEXTILE TUBE IPR

POND CREEK MINE NO. 1
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-364-1413
AUGUST 2014

Summersville, WV

848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV

Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA

3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

September 26, 2014 618/993-7200

Mr. Mark Allaman
Williamson Energy, L.L.C.
16824 Liberty School Road
Marion, IL 62959

Re: Williamson Energy, L.L.C. – Pond Creek Mine
NPDES Permit No. IL0077666
Geotextile Tube Refuse Disposal
IEPA Log Nos. 4275-14 and 4275-14-A

Dear Mr. Allaman:

We received the information concerning the above referenced project, dated July 17 and August 11, 2014, on July 25 and August 15, 2014, respectively. This information has been reviewed, and based upon that review, the following items are offered for your consideration and appropriate action:

1. A low permeability liner should be installed under the proposed geotextile tube refuse disposal area. This low permeability liner should consist of four (4) foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s, or less. A synthetic liner capable of providing an equivalent level of groundwater protection may be utilized in lieu of the four (4) foot compacted clay.

2. At such time that fine coal refuse disposal utilizing the geotextile tubes is completed and reclamation of the area is initiated, a low permeability cap should be included and installed as part of the final cover plan. The low permeability cap should consist of four (4) foot compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/s, or less. A synthetic liner capable of providing an equivalent level of protection may be utilized in lieu of the four (4) foot compacted clay.

3. The initial submittal of this project assigned IEPA Log No. 4275-14 proposed a monitoring well at the two (2) eastern corners of the geotextile tube placement area. The supplemental information assigned IEPA Log No. 4275-14-A relocated these two (2) proposed wells to the western corners of the geotextile tube placement area. These plans should be revised to propose a monitoring well at each of the four (4) corners of the geotextile tube placement area.

4. As discussed in a meeting held at the IEPA headquarters on September 17, 2014, the proposed hydrology and water handling system for the geotextile tube refuse disposal area should be revised to justify and demonstrate the ability to manage the disposal facility as a "no-discharge" system. As a State Construction and Operating Permit (Subtitle D Permit) is being requested to cover this facility and activity, no offsite discharge either directly or through an approved NPDES outfall, shall be allowed. Revised hydrology and water handling designs shall be provided to demonstrate that all runoff from a worse-case scenario can be contained and directed to the coal preparation closed circuit water handling system.

Should you have any questions or comments regarding the above, or need any additional information concerning Agency requirements, please contact me at the above telephone number or the Marion address listed below.

Sincerely,

Larry D. Crislip, P.E.
Manager, Permit Section
Mine Pollution Control Program
Bureau of Water

LDC:cs/6819c/9-25-14

cc: IDNR/Office of Mines and Minerals
BOW/MPCP/FOS/Marion

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

August 11, 2014

Project No. B14-364-1413

Mr. Larry Crislip
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Mine Pollution Control Program
2309 West Main Street, Suite 116
Marion, IL 62959

Supplemental Information
Response to Engineering Review
Permit 375; IPR for Geotextile Tubes
Williamson Energy, LLC
Pond Creek No. 1 Mine
Williamson County, Illinois

Dear Mr. Crislip:

Please find enclosed two copies of the Supplemental Information for the above referenced application. This letter describes our response to the request for additional information contained in the Illinois Department of Natural Resources (IDNR); Office of Mines and Minerals, Land Reclamation Division memorandum dated July 29, 2014 (copy attached). The memo was written by Mr. James Bowling in reference to the document described above.

The responses to the IDNR's request for additional information are as follows:

Response to Comment No. 1 – Profile and cross-section of each proposed sediment ditch is provided on Drawing No. B14-364-E5.

Response to Comment No. 2 – Profile and cross-section of the secondary spillway is provided on Drawing No. B14-364-E5.

Response to Comment No. 3 – The cells associated with the sediment ditches are shown on Drawing Nos. B14-364-E2 and B14-364-E3.

Response to Comment No. 4 – An Engineering Certification has been provided.

RECEIVED
AUG 15 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

We trust this letter and the supplemental information are acceptable to the agency. If there are any questions, or if further clarification is required, please contact us. An original and two copies of the Supplemental Information have been sent to Mr. Scott Fowler, IDNR and one copy has been sent to Mr. Robert Schoeppel, IDNR.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:kjs

File: \\Aci-zeus\projects\Projects\Williamson Energy (1413)\2014\B14-364-1413\14364-12.doc

MEMORANDUM
LAND RECLAMATION DIVISION

TO: BOB SCHOEPPEL

FROM: JIM BOWLING

RE: POND CREEK MINE
PERMIT 375: IPR DATED 7/17/2014 FOR THE GEOTEXTILE TUBE FIELD ENGINEERING REVIEW

DATE: JULY 29, 2014

Upon review of the above referenced Insignificant Permit Revision (IPR), the following items shall be addressed. The Applicant shall address each item associated with the engineering review prior to this IPR being approved.

1. The Applicant shall provide a profile and cross-section of each proposed sediment ditch in accordance with 62 Ill. Adm. Code 1784.23.

2. The Applicant shall provide a profile and cross-section of the secondary spillway in accordance with 62 Ill. Adm. Code 1784.23.

3. On the structure proportioning sheet for each proposed sediment ditch, the Applicant indicates 3 cells and 2 barriers for each ditch. Upon review of Drawings B14-364-E2 and B14-364-E3, the plan views do not show any cells associated with the sediment ditches. Please clarify.

4. The Applicant did not provide an Engineering Certification. In accordance with 62 Ill. Adm. Code 1784.23(c), the plan shall be certified by a Registered Professional Engineer under the Illinois Professional Engineering Act.

If you have any questions regarding the engineering review, please do not hesitate to contact me.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

August 11, 2014

Project No. B14-364-1413

Mr. Scott Fowler
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

Supplemental Information
Response to Engineering Review
Permit 375; IPR for Geotextile Tubes
Williamson Energy, LLC
Pond Creek No. 1 Mine
Williamson County, Illinois

Dear Mr. Fowler:

Please find enclosed one original and two copies of the Supplemental Information for the above referenced application. This letter describes our response to the request for additional information contained in the Illinois Department of Natural Resources (IDNR), Office of Mines and Minerals, Land Reclamation Division memorandum dated July 29, 2014 (copy attached). The memo was written by Mr. James Bowling in reference to the document described above.

The responses to the IDNR's request for additional information are as follows:

Response to Comment No. 1 – Profile and cross-section of each proposed sediment ditch is provided on Drawing No. B14-364-E5.

Response to Comment No. 2 – Profile and cross-section of the secondary spillway is provided on Drawing No. B14-364-E5.

Response to Comment No. 3 – The cells associated with the sediment ditches are shown on Drawing Nos. B14-364-E2 and B14-364-E3.

Response to Comment No. 4 – An Engineering Certification has been provided.

We trust this letter and the supplemental information are acceptable to the IDNR. If there are any questions, or if further clarification is required, please contact us. A copy of the Supplemental Information has been sent to Mr. Robert Schoeppel in Benton and two copies have been sent to Mr. Larry Crislip, IEPA.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:kjs

File: \\Aci-zeus\projects\Projects\Williamson Energy (1413)\2014\B14-364-1413\14364-11.doc

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

August 11, 2014

Project No. B14-364-1413

Mr. Robert Schoeppel
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Office of Mines and Minerals
Land Reclamation Division
503 East Main St.
Benton, IL 62812-2522

Supplemental Information
Response to Engineering Review
Permit 375; IPR for Geotextile Tubes
Williamson Energy, LLC
Pond Creek No. 1 Mine
Williamson County, Illinois

Dear Mr. Schoeppel:

Please find enclosed one copy of the Supplemental Information for the above referenced application. This letter describes our response to the request for additional information contained in the Illinois Department of Natural Resources (IDNR), Office of Mines and Minerals, Land Reclamation Division memorandum dated July 29, 2014 (copy attached). The memo was written by Mr. James Bowling in reference to the document described above.

The responses to the IDNR's request for additional information are as follows:

Response to Comment No. 1 – Profile and cross-section of each proposed sediment ditch is provided on Drawing No. B14-364-E5.

Response to Comment No. 2 – Profile and cross-section of the secondary spillway is provided on Drawing No. B14-364-E5.

Response to Comment No. 3 – The cells associated with the sediment ditches are shown on Drawing Nos. B14-364-E2 and B14-364-E3.

Response to Comment No. 4 – An Engineering Certification has been provided.

We trust this letter and the supplemental information are acceptable to the IDNR. If there are any questions, or if further clarification is required, please contact us. An original and two copies of the Supplemental Information have been sent to Mr. Scott Fowler and two copies have been sent to Mr. Larry Crislip, IEPA.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P.E.
Senior Project Manager

CEY:kjs

File: \\Aci-zeus\projects\Projects\Williamson Energy (1413)\2014\B14-364-1413\14364-13.doc

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" on the line below if that item is relevant.

(1) ☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

(2) ☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

(3) Certification of the Illinois Environmental Protection Agency-35 Ill. Adm. Code 405.104(a) Permit.

☐ In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

INDIVIDUAL P.E. CERTIFICATION

Claudio E. Yon
Name

062-050632
Illinois Registration Number (Seal)

CLAUDIO ELI YON
062-050632
LICENSED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

Alliance Consulting, Inc.
Firm

124 Philpott Lane, Beaver, WV 25813
Address

304-255-0491
Phone Number

Signature

8/7/14
Date

PROFESSIONAL DESIGN FIRM CERTIFICATION

Complete if applicable. If not, respond _____

☒ As an employee of a "professional design firm" as defined by the Illinois Department of Financial and Professional Regulation, I certify that the professional design firm is registered and in good standing with the Illinois Department of Financial and Professional Regulation.

Alliance Consulting of West Virginia, Inc.
Professional Design Firm Name

184.006236
Professional Design Firm Number

SPILLWAY DISCHARGE CAPACITY

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

SPILLWAY DISCHARGE CAPACITY

PROJECT NUMBER: B14-236-1413 *CALCS BY:* BWM

PROJECT NAME: MACH MINING *CHECKED BY:* _____
STOCKPILE REFUSE AREA
SEDIMENT DITCHES 1 AND 2 SPILLWAY

Q=CLH^1.5 OR
Q=CH^1.5(L+0.4(Z1+Z2)H)

WHERE:

COEFFICIENT C=	2.8
BOTTOM WIDTH L=	30
SIDE SLOPE Z1=	2
SIDE SLOPE Z2=	2
SPILLWAY INVERT EL. =	486.5

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

ELEVATION (FEET)	HEAD (FEET)	Q CFS	
486.5	0	0.0	
487	0.5	30.5	
487.5	1	88.5	
488	1.5	166.7	>145.7 (1 & 2 Peak Q)
488.5	2	262.9	
489	2.5	376.3	
489.5	3	506.3	
490	3.5	652.7	

Therefore, a 30-foot wide, 3.5-foot deep emergency spillway channel will be capable of routing the runoff from the 100-year, 6-hour storm event while mainaining 2-feet of freeboard.

DOCUMENT

57

4275 • / 14
Due date: 9/5/14
R10779

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Pat Quinn, Governor
Marc Miller, Director

October 3, 2014

Mr. Anthony Webb
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

Re: Permit No. 375
Insignificant Revision No. 47

Dear Mr. Webb:

The appropriate Department technical staff has reviewed the proposed change dated July 17, 2014 and supplemental dated August 11 and September 25, 2014, submitted by the permittee for the Pond Creek Mine. The permittee has requested approval to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes. Since this operation is not currently approved, it will constitute a change to the approved plan. Insignificant permit revisions are allowed under 62 Ill. Adm. Code 1774.13(b)(2).

Section 1774.13: The Department has determined the proposed alteration will have no significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area, is in compliance with 62 Ill. Adm. Code 1700 – 1850 and is insignificant, and hereby exempts the permittee from submitting a significant permit revision application in accordance with Section 1774.13(b)(2). The Department grants permission to place fine coal refuse into geotextile tubes as described, subject to the permit conditions at the end of this approval.

> Sections 1784.14(e)(4) and 1784.14(f)(2), respectively: The Department has determined that neither a new or updated probable hydrologic consequences determination nor a new or updated assessment of the probable cumulative hydrologic impacts is required.

Section 1800.15(d): The bond for the area will be $ 368,992. Copies of bond form SCML-2 have been enclosed for your use. For additional bonding and other forms, please contact this office or download a copy from the web at: www.dnr.state.il.us/mines/lrd/forms.htm. Please note many forms have been modified. **Only** the most current versions will be accepted.

Permit Conditions: The Department grants permission to place fine coal refuse into geotextile tubes as described, subject to the following permit conditions:

RECEIVED
OCT 08 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

1) The Department is not approving the placement of any coarse coal refuse in this area.

2) A low permeability liner with a hydraulic conductivity of $1x10^{-7}$ cm/sec or less shall be installed in the proposed disposal area. This liner shall be either a four-foot compacted clay liner or a synthetic liner capable of achieving the required hydraulic conductivity value.

3) Groundwater monitoring wells GW-29, GW-30, GW-31 and GW32 shall be installed at the locations depicted on Drawing No. B14-364-M1, dated 9/15/14. These wells shall be installed to the uppermost water-bearing unit at a depth sufficient to monitor potential groundwater impacts related to the refuse disposal area.

4) Background groundwater quality data shall be established via the collection of six monthly samples beginning immediately after the wells are installed. Once background has been established for these wells, groundwater monitoring shall occur quarterly.

   The wells shall be sampled for the following parameters: Aluminum (Al) Antimony (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Boron (B), Cadmium (Cd), Chloride (Cl), Chromium (Cr), Cobalt (Co), Copper (Cu), Cyanide (Cn), Fluoride (F), Iron (Fe) – total and dissolved, Lead (Pb), Manganese (Mn) – total and dissolved, Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Sulfate (SO_4), Thallium (Tl), Total Dissolved Solids (TDS), Vanadium (V), Zinc (Zn), ph, Alkalinity, Acidity, Hardness and Water Elevation (reported as true elevation, not depth to water).

5) Within thirty (30) days of completion of well installation activities, a boring log and well construction/well completion diagram for each newly installed well shall be submitted to the Department. Top of casing and ground elevation must be surveyed and the surveyed elevations shall be included on the boring logs/well construction diagrams. Additionally, a revised/updated map shall be submitted showing the location of the newly installed well as well as all other groundwater monitoring wells at this facility.

6) Proof of plugging and abandonment of the temporary groundwater monitoring wells installed by Holcomb Engineering (known as MW1 and MW3) shall be submitted to the Department by November 3, 2014.

All other conditions and provisions contained in the approved permit also apply to this revision. Approval from this agency does not relieve the permittee from obtaining approval from other agencies requiring such.

Please submit two additional copies of your request letter and maps to Larry Crislip, Illinois Environmental Protection Agency, 2309 West Main Street, Marion, Illinois 62959.

Should you have any questions, please contact Robert W. Schoeppel at our Benton Office.

Sincerely,

James Hafliger, Acting Director
Office of Mines & Minerals

by: Scott K. Fowler, Supervisor
Land Reclamation Division

SKF:RS:gr
Enclosure
cc: R. Schoeppel
L. Crislip

10010903.doc

4275-14

R10783

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

July 24, 2014

Mr. Scott K. Fowler, Supervisor
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
One Natural Resources Way
Springfield, IL 62702-1271

Re: Williamson Energy, LLC - Permit No. 375, IPR for Geotextile Tubes

Dear Mr. Fowler:

This letter authorizes Alliance Consulting, Inc. (Alliance), and its representatives, permission to perform work on, receive comments and submit corrections on the above application. Please send copies of any comments to Alliance Consulting, Inc. at 124 Philpott Lane, Beaver, WV 25813, as well as Williamson Energy, LLC at the above address.

Thank you for your cooperation.

Sincerely,

WILLIAMSON ENERGY, LLC

Dwayne Francisco
Authorized Agent

RECEIVED
JUL 25 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 17, 2014

Project No. B14-364-1413

Mr. Larry Crislip
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Mine Pollution Control Program
2309 West Main Street, Suite 116
Marion, IL 62959

Transmittal Letter
Insignificant Permit Revision
Permit No. No. 375
Williamson Energy LLC
Williamson County, Illinois

Dear Mr. Crislip:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting two copies of an Incidental Permit Revision (IPR) for Permit 375. The purpose of the revision is to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes or place coarse coal refuse.

An original and one copy of this application have been sent to Mr. Scott Fowler in the IDNR Springfield office and two copies have been sent to the IDNR Benton office to Messers Brad Murphy and Jim Bowling.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:wmb
Enclosure

cc: Scott Fowler
Brad Murphy
Jim Bowling

FILE: 14364-06

RECEIVED
JUL 25 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 17, 2014

Project No. B14-364-1413

Mr. Scott K. Fowler, Supervisor
Land Reclamation Division
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
One Natural Resources Way
Springfield, ILL 62702-1271

Transmittal
Insignificant Permit Revision
Permit No. No. 375
Williamson Energy LLC
Williamson County, Illinois

Dear Mr. Fowler:

Please find enclosed the original and two copies of an Insignificant Revision for the Williamson Energy, LLC Permit No. 375.

The purpose of the revision is to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes or place coarse coal refuse. The tubes are fabricated from high strength, woven polypropylene geotextile material. The geotextile material is resistant to ultraviolet degradation and stable in chemical and biological environments naturally occurring in soil. They are specifically designed for dredged material disposal, dewatering material and coastal erosion control. Fine coal refuse from the Pond Creek Facility will be pumped into the geotube for dewatering. As the geotubes dewater, additional bags are offset on top of bags which have dewatered. This offsetting, created by the vertical rising, forms a pyramid shape. When completed, the bags will be covered with a minimum of 3 feet of subsoil, 1-foot of topsoil and seeded. A plan view of the proposed refuse placement area is shown on Drawing No. B14-364-E3 entitled "Proposed Geotextile Tube Disposal Area Plan", cross sections are contained on Drawing No. B14-364-E4 and Drawing No. B14-364-E2 entitled "Surface Facilities Map".

Water draining from the bags and surface water runoff will be maintained by a ditchline around the perimeter of the refuse area. This water will flow by gravity through Pond No. 5 or may be pumped into the sediment control structure which encompasses the existing refuse disposal facility.

RECEIVED
JUL 25 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

124 Philpott Lane • Raleigh County Airport Industrial Park • Beaver, WV 25813-9502 • TELE: (304) 255-0491 • FAX: (304) 255-4232

Two copies have been sent to the Benton office to the attention of Messers Brad Murphy and Jim Bowling and two copies have been sent to Mr. Larry Crislip of IEPA.

If you have any questions or require additional information, please contact us.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:wmb
Enclosures

cc: Larry Crislip
Brad Murphy
Jim Bowling

FILE: 14364-04

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 17, 2014

Project No. B14-364-1413

Mr. Jim Bowling
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Land Reclamation Division
503 E. Main, FL 001
Benton, IL 62812

Transmittal Letter
Insignificant Permit Revision
Permit No. No. 375
Williamson Energy LLC
Williamson County, Illinois

Dear Mr. Bowling:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting one copy of an Incidental Permit Revision (IPR) for Permit 375. The purpose of the revision is to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes or place coarse coal refuse.

An original and one copy of this application have been sent to Mr. Scott Fowler in the Springfield office, one copy has been sent to Mr. Brad Murphy in the Benton Office and two copies have been sent to Mr. Larry Crislip of IEPA. If you have any questions, or require additional information, please contact us.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:wmb
Enclosure

cc: Scott Fowler
Larry Crislip
Brad Murphy

FILE: 14364-07

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 17, 2014

Project No. B14-364-1413

Mr. Brad Murphy
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Land Reclamation Division
503 E. Main, FL 001
Benton, IL 62812

Transmittal Letter
Insignificant Permit Revision
Permit No. No. 375
Williamson Energy LLC
Williamson County, Illinois

Dear Mr. Murphy:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting one copy of an Incidental Permit Revision (IPR) for Permit 375. The purpose of the revision is to place refuse in an area currently permitted for soil storage. This area will be used to place fine coal refuse into geotextile tubes or place coarse coal refuse.

An original and one copy of this application have been sent to Mr. Scott Fowler in the Springfield office, one copy has been sent to Mr. Jim Bowling in the Benton Office and two copies have been sent to Mr. Larry Crislip of IEPA. If you have any questions, or require additional information, please contact us.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:wmb
Enclosure

cc: Scott Fowler
Larry Crislip
Jim Bowling

FILE: 14364-05

State of Illinois
Department of Natural Resources
Office of Mines and Minerals; Land Reclamation Division
One Natural Way
Springfield, IL 62702

PERMIT # 375
GEOTEXTILE TUBE IPR

POND CREEK MINE NO. 1
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-364-1413
JULY 2014

GEOSTRUX™

GEOTEXTILE TUBES

FIELD PROVEN IN A WIDE VARIETY OF APPLICATIONS

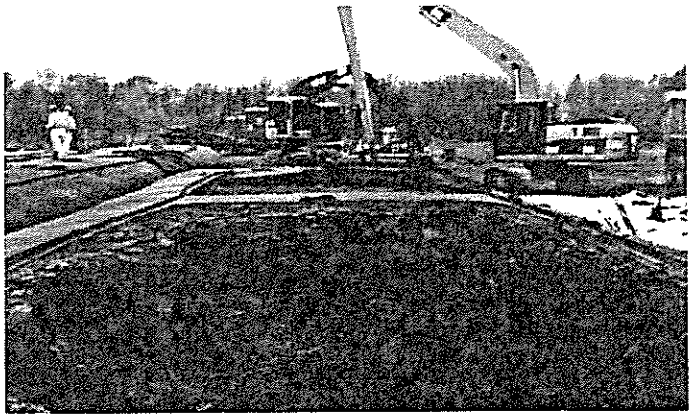
APPLICATIONS

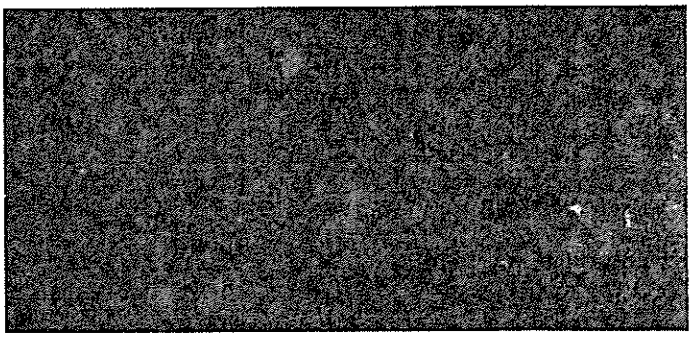
- Habitat Creation
- Coastal Protection
- Breakwaters, Groins & Jetties
- Dewatering Liquid Waste and Sludge
- Dewatering Lake and River Sediments

ADVANTAGES

- Cost Effective
- Passive Dewatering
- Improved Effluent Clarity







GEOSTRUX™ Geotextile Tube

Dimensions and Capacities

Circumference	Capacity*
22.5'**	1.3 CY/LF
30'	2.3 CY/LF
45'	4.1 CY/LF
60'	6.2 CY/LF
75'	8.3 CY/LF
90'	10.1 CY/LF

**Calculated volume – Actual capacity may vary*

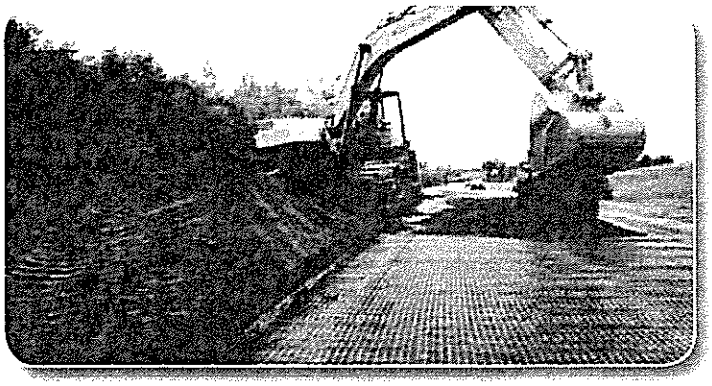
***Container Tubes*

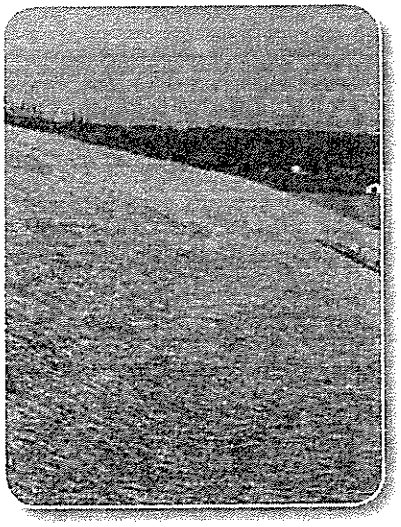
Available in either black or tan fabric

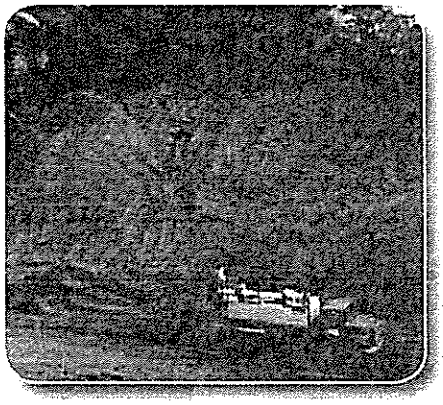
Note: Dimensions and capacities are represented as typical values. They should not be used for design purposes. GSI makes no warranties and assumes no liability in connection with the use of this information.

GSI GEO-SYNTHETICS, LLC.

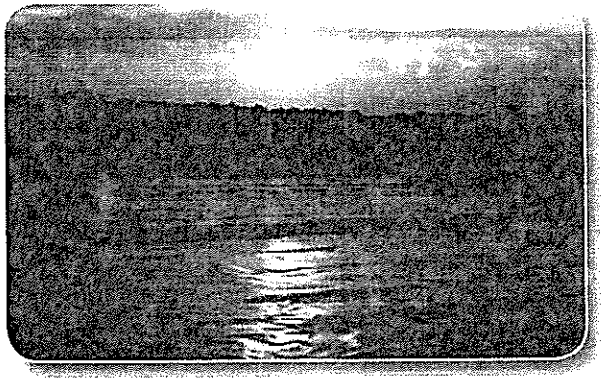
WWW.GEO-SYNTHETICS.COM PHONE: 800.444.5523 GEOSTRUX@GEO-SYNTHETICS.COM







GSI
GEO-SYNTHETICS, INC.





Solutions at GROUND LEVEL

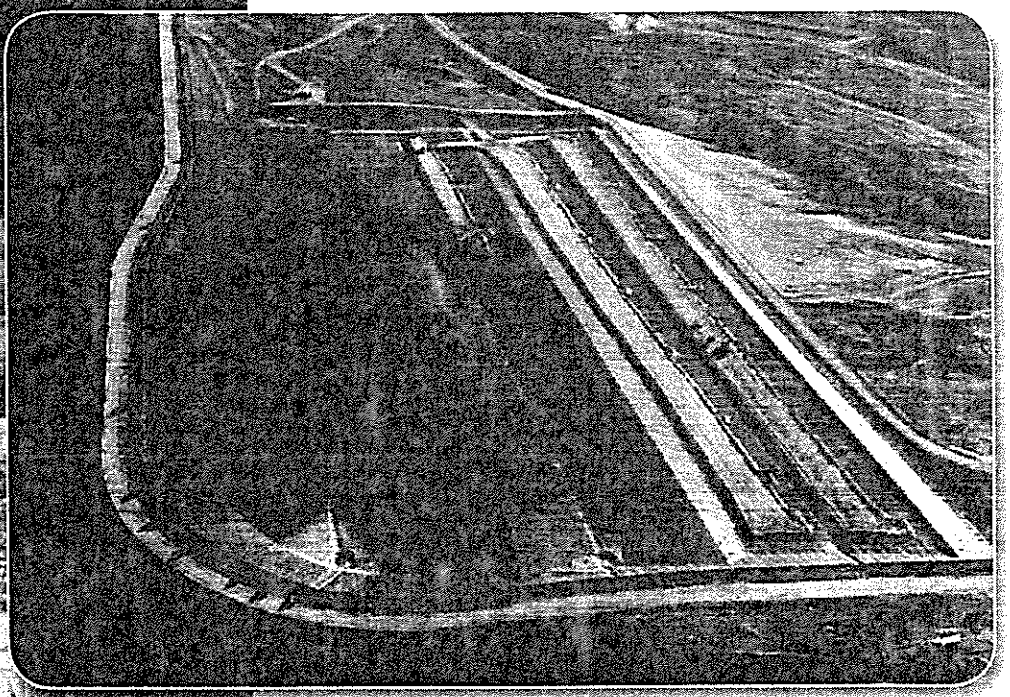
A NOTABLE SOURCE FOR Preserving THE Environment

Geo-Synthetics, Inc. has offered quality geo-solutions since 1971. We have worked hard to excel as a leader in the environmental industry and have stood the test of time, surpassed by no one in experience, service and product offerings.

GSI is recognized and respected as a full-service company, offering distribution, fabrication and installation services nationally. Our high level of expertise and capabilities sets us apart in the industry. Behind every GSI product and service is a promise to deliver you the best our industry has to offer.

PROVEN GEO-SOLUTIONS





One Company – One Vision

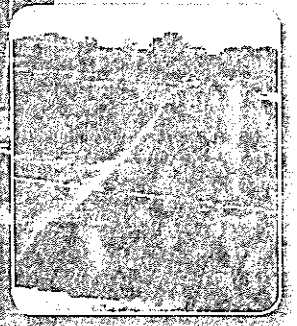
Installation Services

Our experience lies in the more than 350 million square feet of geosynthetic solutions we have installed from coast to coast. You can rely on our experience to assist in project planning, accurate estimating, project management, and the best geosynthetic installation reputation in the industry. If job site safety, timeliness, and high quality work are of importance to you, then GSI is your choice.

Geosynthetics are ideal for contaminant, waste management and seepage control. GSI offers a wide range of materials that have been extensively researched, tested and proven for long-term use in many primary or secondary applications including:

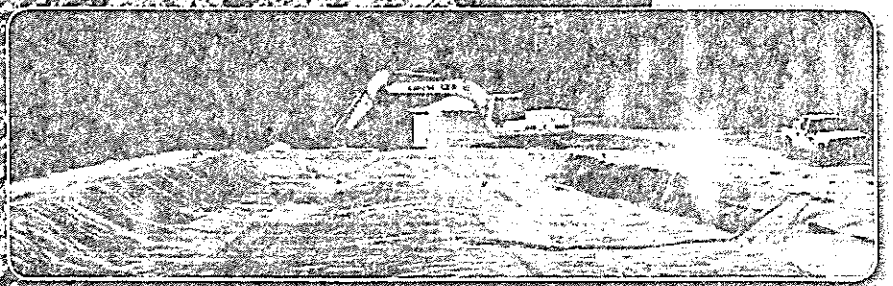
- Solid Waste Landfills
- Sewage Lagoons
- Evaporation and Brine Ponds
- Decorative Ponds
- Vapor Barriers
- Mine Tailing Ponds
- Agriculture
- Ash Monofill
- Hazardous Waste Landfills



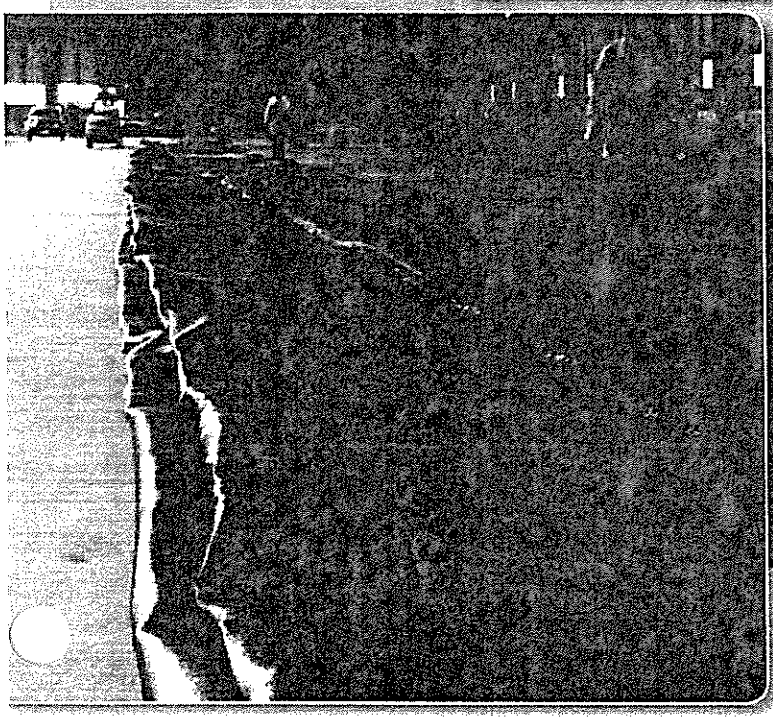


P R O V E N G E S O L U T I O N S



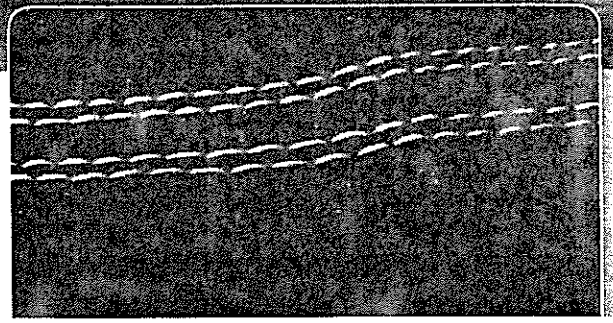


UNMATCHED CAPABILITIES UNMATCHED Benefits



Our slitting, seaming and re-rolling capabilities enable us to tailor products to fit exact needs and specifications while our large, centrally located facility allows guaranteed quick shipments to any destination.

At GSI, we pride ourselves on our service. In addition to our well-trained Midwest-based customer service professionals, you may rely upon our products specialists located throughout the United States. Whatever your needs or wherever your site is located, GSI is positioned to serve you.



PRODUCTS AND SERVICES OFFERED

- Erosion/Sediment Control
- Geotextiles
- Geotextile Tubes
- Drainage Products
- Geogrids
- Fencing
- Geomembrane Products
- Fabrication
- Construction Services

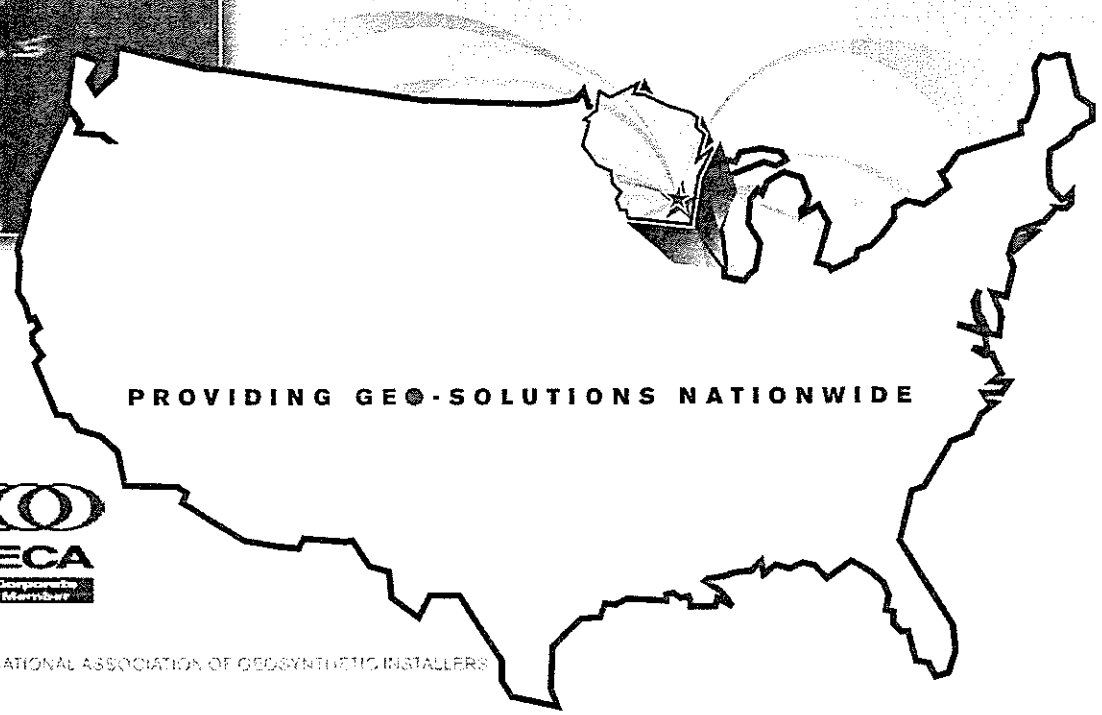




GSI
GEO-SYNTHETICS, INC.

2401 Pewaukee Road
Waukesha, Wisconsin 53188-6904
800-444-5523 • 262-524-7979
FAX 262-524-7961

www.geo-synthetics.com



ECTC

IECA
Corporate Member

IAGI INTERNATIONAL ASSOCIATION OF GEOSYNTHETIC INSTALLERS

GEOSTRUX

GEOTEXTILE TUBES

GEOSTRUX™ Geotextile Tubes are fabricated from high strength woven polypropylene geotextile material. The geotextile material is resistant to ultraviolet degradation and stable in chemical and biological environments naturally occurring in soil. **GEOSTRUX™ Geotextile Tubes** are specifically designed for dredged material disposal, dewatering of contaminated materials, and coastal erosion control.

GEOSTRUX™ Geotextile Tubes conform to the properties listed below. These properties have been derived from quality control testing performed by GAI-LAP accredited laboratories. All properties are Minimum Average Roll Value (**MARV**) unless otherwise noted.

PROPERTY	TEST METHOD	ENGLISH		SI Units	
		MD	CD	MD	CD
Wide With Tensile Ultimate	ASTM D4959	450 lbs/in	625 lbs/in	79k N/m	109 kN/m
Wide Width Elongation	ASTM D4595	17%	13%	17%	13%
Trapezoidal Tear	ASTM D4533	280 lbs	300 lbs	1246 N	1355 N
CBR Puncture – **Typical**	ASTM D6241	2950 lbs		13.1 kN	
Puncture	ASTM D4833	250 lbs		1113N	
Factory Seam Strength	ASTM D4884	400 lbs/in		70 kNm	
Permittivity	ASTM D4491	.260 sec-1		.260 sec-1	
Apparent Opening Size (AOS)	ASTM D4571	40 U.S Sieve		.425 mm	
Water Flow Rate	ASTM D4491	20 gpm/ft^2		810 l/min/m^2	
UV Resistance @ 1200 hrs **Typical Value**	ASTM D4355	85%		85 %	
UV Resistance @ 1200 hrs	ASTM D4355	70%		70%	
Pore Size Distribution (O50) **Typical Value**	ASTM D6767	~175 US Std. Sieve		85 micron	
Pore Size Distribution (O95) **Typical Value**	ASTM D6767	~50 US Std. Sieve		307 micron	

*GSI will provide geotextile manufacturer certification documents that validates the test data shown

The information listed above is believed to be an accurate representation of information compiled from testing sources. Test values, statistical data and other information presented may be based solely on results of unverified tests made on random samples, information presented may relate only to tested sample and because the conditions in which such information may be used are beyond the control of Geo-Synthetics LLC. Geo-Synthetics LLC does not guarantee either the accuracy or reliability of the information or the suggestions and recommendations contained herein. Geo-Synthetics LLC assumes no responsibility for the use of this information and disclaims all liabilities which may arise in connection with the use of the above information. All the information referenced above are provided as information only, without charge or obligation to the recipient or user, and in no way makes or creates a warranty with respect to any product. Final determination of the suitability, reliability, and accuracy of the information and suggested uses is solely the responsibility of the user. The property values are effective 1/2014 and supersede any values previously published and are subject to change.

Geo-Synthetics LLC 2401 Pewaukee Road Waukesha, WI 53188 (800) 444-5523
www.geo-synthetics.com geostrux @geo-synthetics.com

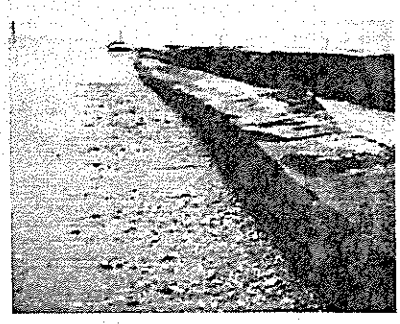
GEOSTRUX™
GEOTEXTILE TUBES

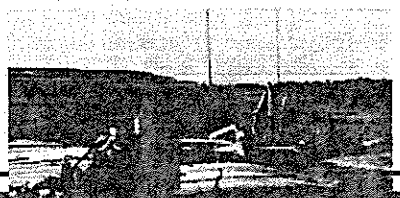
ENVIRONMENTALLY PROVEN SOLUTIONS FOR DEWATERING AND COASTAL APPLICATIONS



GEOSTRUX™ Tubes are produced using high strength woven fabrics which are manufactured to exacting standards by our in-house fabrication group.

Once on site, GEOSTRUX™ Tubes are hydraulically filled with heavily saturated sediment, sand or waste materials. When fully dewatered, the sediment has reduced weight and volume, allowing for more cost-effective material handling. In coastal applications the structure is strategically placed before filling to provide cost effective shoreline protection or habitat creation.





WWW.GEO-SYNTHETICS.COM
PHONE: 800.444.5523
GEOSTRUX@GEO-SYNTHETICS.COM

GEOSTRUX™
GEOTEXTILE TUBES

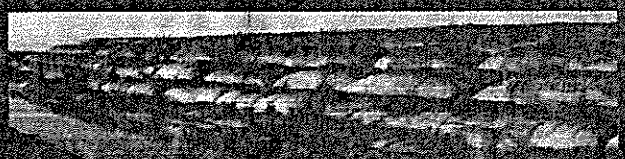
FIELD PROVEN IN A WIDE VARIETY OF APPLICATIONS

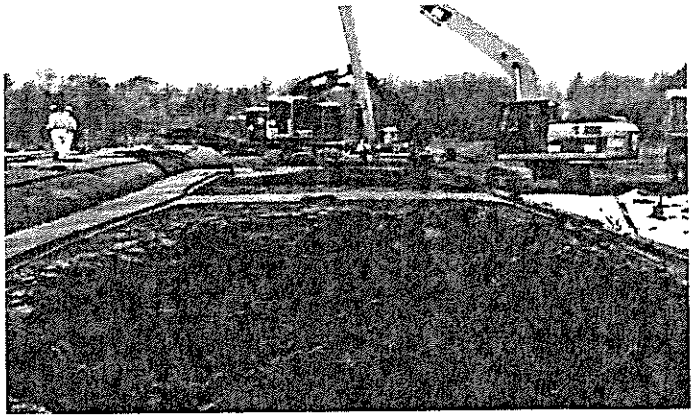
APPLICATIONS

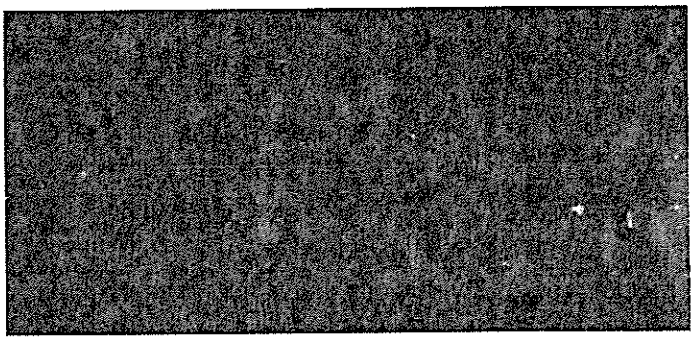
- Habitat Creation
- Coastal Protection
- Breakwaters, Groins & Jetties
- Dewatering Liquid Waste and Sludge
- Dewatering Lake and River Sediments

BENEFITS

- Cost Effective
- Passive Dewatering
- Improved Effluent Clarity







GEOSTRUX™ Geotextile Tube

Dimensions and Capacities

Circumference	Capacity*
22.5'**	1.3 CY/LF
30'	2.3 CY/LF
45'	4.1 CY/LF
60'	6.2 CY/LF
75'	8.3 CY/LF
90'	10.1 CY/LF

**Calculated volume – Actual capacity may vary*

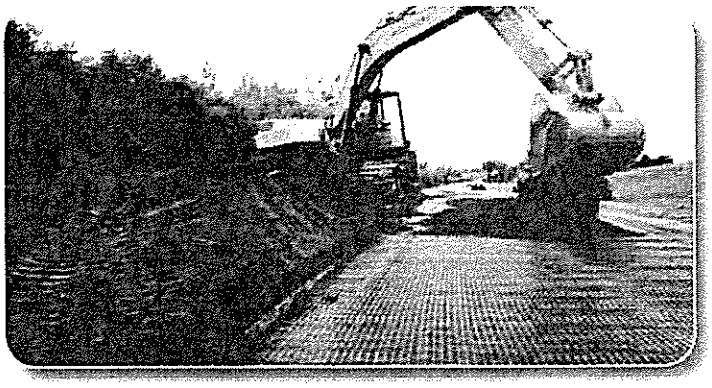
***Container Tubes*

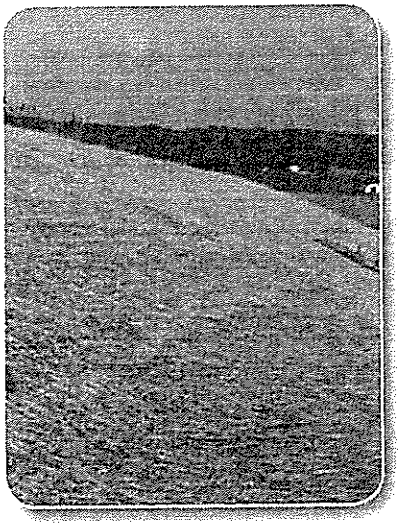
Available in either black or tan fabric

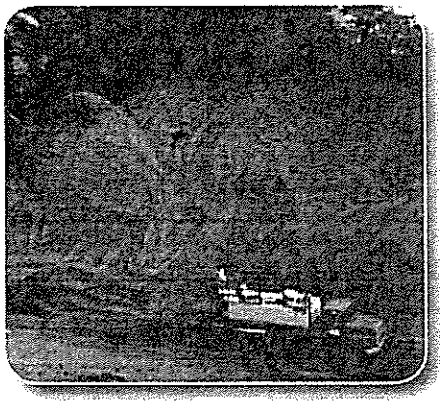
Note: Dimensions and capacities are represented as typical values. They should not be used for design purposes. GSI makes no warranties and assumes no liability in connection with the use of this information.

GSI GEO-SYNTHETICS, LLC.

WWW.GEO-SYNTHETICS.COM PHONE: 800.444.5523 GEOSTRUX@GEO-SYNTHETICS.COM







GEO-SYNTHETICS, INC.





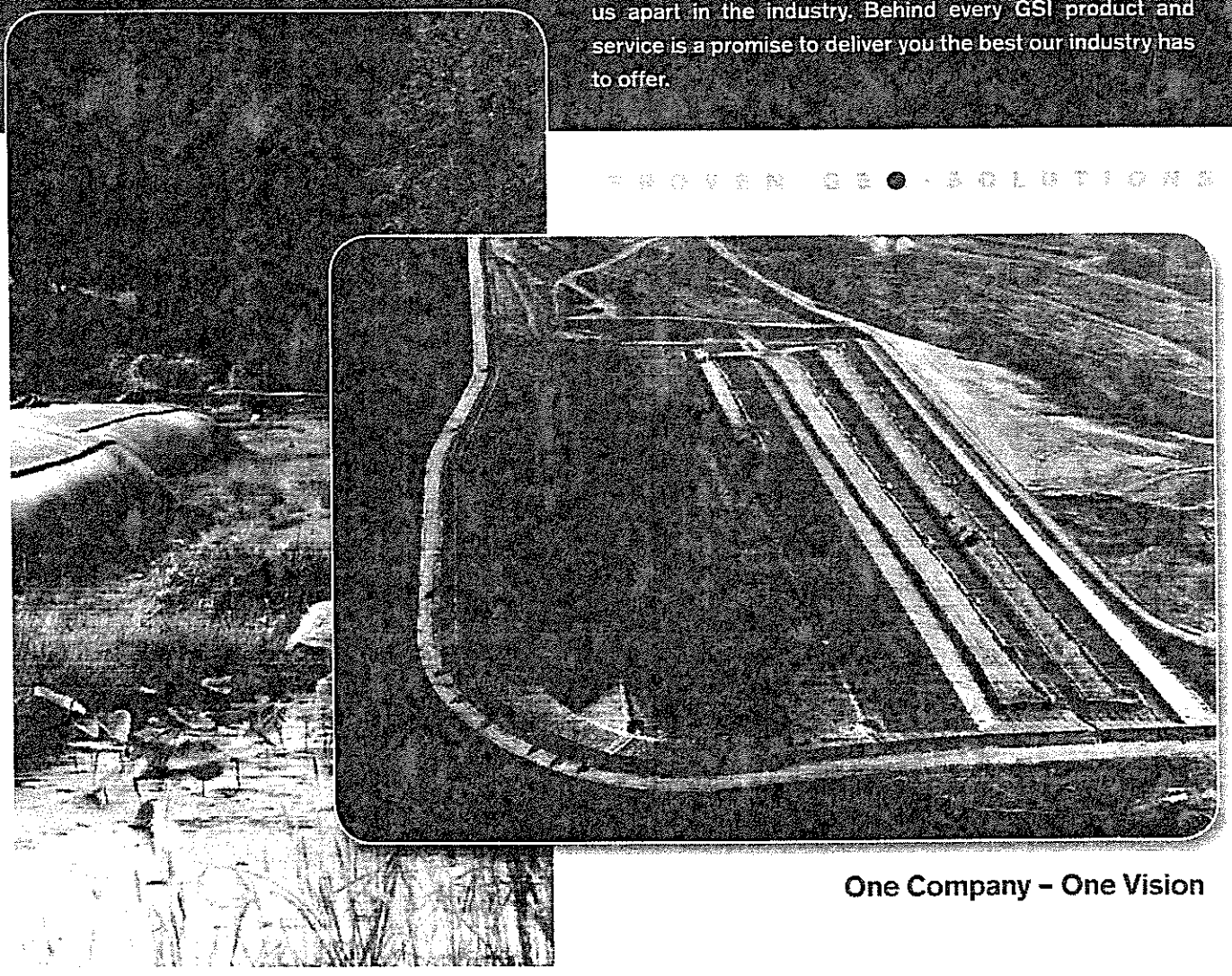
Solutions at GROUND LEVEL

A NOTABLE SOURCE FOR Preserving THE Environment

Geo-Synthetics, Inc. has offered quality geo-solutions since 1971. We have worked hard to excel as a leader in the environmental industry and have stood the test of time, surpassed by no one in experience, service and product offerings.

GSI is recognized and respected as a full-service company, offering distribution, fabrication and installation services nationally. Our high level of expertise and capabilities sets us apart in the industry. Behind every GSI product and service is a promise to deliver you the best our industry has to offer.

PROVEN GEO-SOLUTIONS



One Company – One Vision

R10801

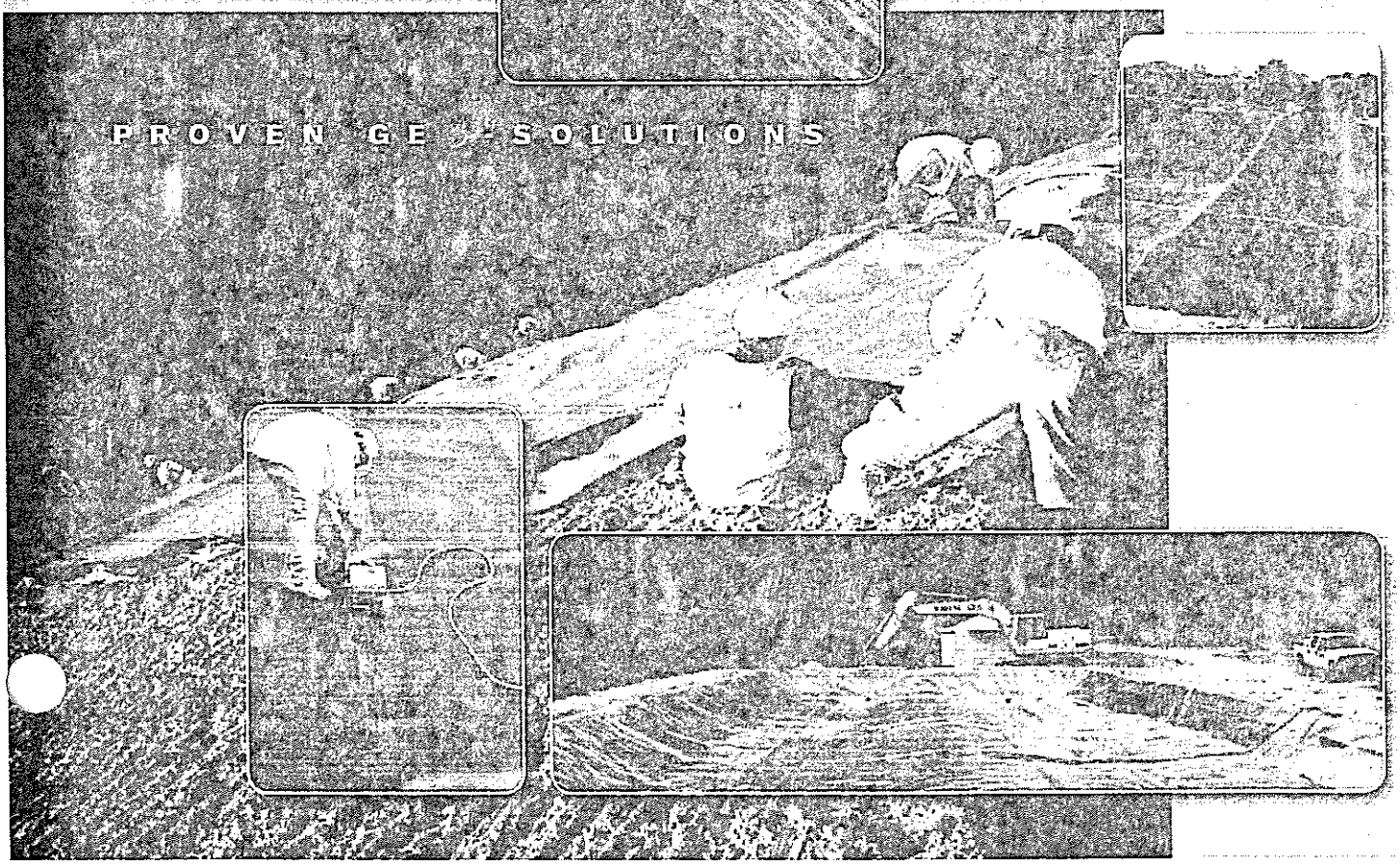
Installation Services

Our experience lies in the more than 350 million square feet of geosynthetic solutions we have installed from coast to coast. You can rely on our experience to assist in project planning, accurate estimating, project management and the best geosynthetic installation reputation in the industry. If job site safety, timeliness, and high quality work are of importance to you, then GSI is your choice.

Geosynthetics are ideal for contaminant, waste management and seepage control. GSI offers a wide range of materials that have been extensively researched, tested and proven for long-term use in many primary or secondary applications including:

- Solid Waste Landfills
- Sewage Lagoons
- Evaporation and Brine Ponds
- Decorative Ponds
- Vapor Barriers
- Mine Tailing Ponds
- Agriculture
- Ash Monofill
- Hazardous Waste Landfills



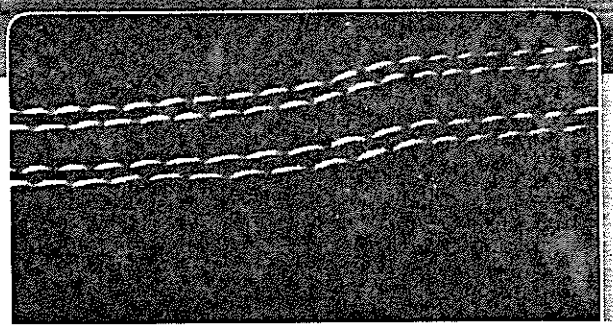


UNMATCHED CAPABILITIES UNMATCHED Benefits



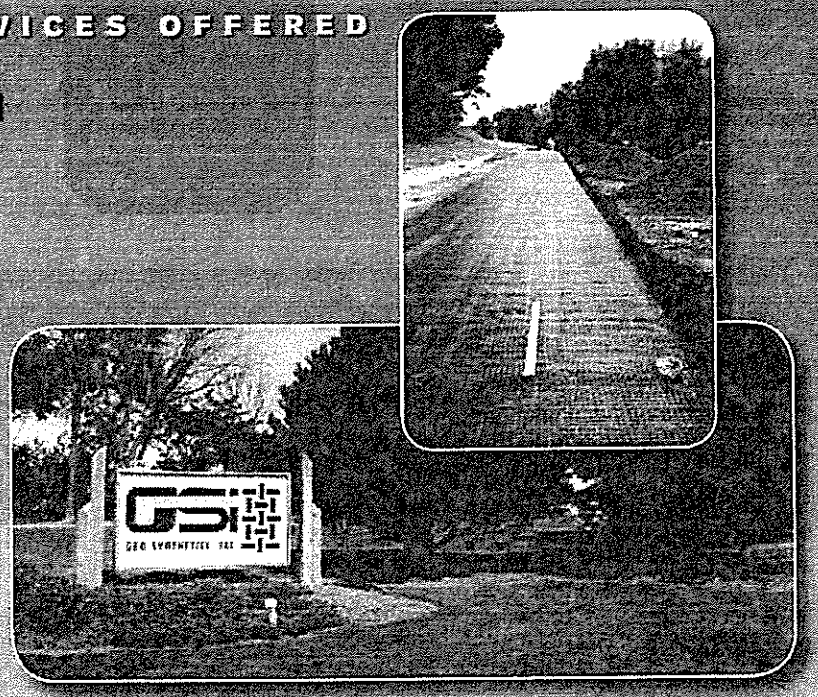
Our slitting, seaming and re-rolling capabilities enable us to tailor products to fit exact needs and specifications while our large, centrally located facility allows guaranteed quick shipments to any destination.

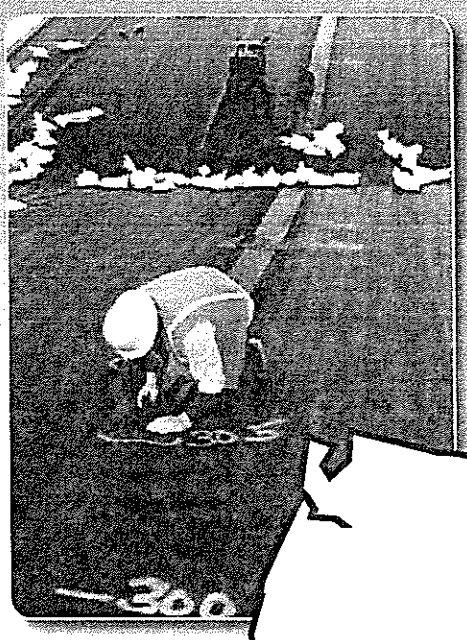
At GSI, we pride ourselves on our service. In addition to our well-trained Midwest-based customer service professionals, you may rely upon our products specialists located throughout the United States. Whatever your needs or wherever your site is located, GSI is positioned to serve you.



PRODUCTS AND SERVICES OFFERED

- Erosion/Sediment Control
- Geotextiles
- Geotextile Tubes
- Drainage Products
- Geogrids
- Fencing
- Geomembrane Products
- Fabrication
- Construction Services

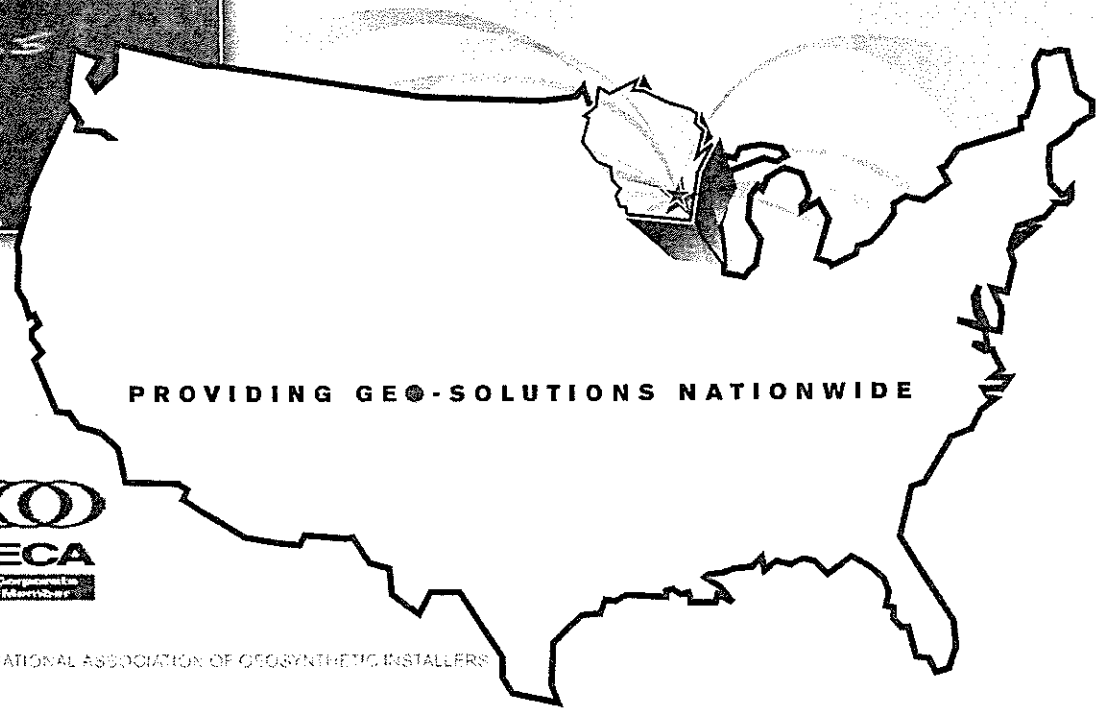




GEO-SYNTHETICS, INC.

2401 Pewaukee Road
Waukesha, Wisconsin 53188-6904
800-444-5523 • 262-524-7979
FAX 262-524-7961

www.geo-synthetics.com



PROVIDING GEO-SOLUTIONS NATIONWIDE

IECA

IAGI INTERNATIONAL ASSOCIATION OF GEOSYNTHETIC INSTALLERS

GEOTEXTILE TUBES

GEOSTRUX™ Geotextile Tubes are fabricated from high strength woven polypropylene geotextile material. The geotextile material is resistant to ultraviolet degradation and stable in chemical and biological environments naturally occurring in soil. **GEOSTRUX™ Geotextile Tubes** are specifically designed for dredged material disposal, dewatering of contaminated materials, and coastal erosion control.

GEOSTRUX™ Geotextile Tubes conform to the properties listed below. These properties have been derived from quality control testing performed by GAI-LAP accredited laboratories. All properties are Minimum Average Roll Value **(MARV)** unless otherwise noted.

PROPERTY	TEST METHOD	ENGLISH		SI Units	
		MD	CD	MD	CD
Wide With Tensile Ultimate	ASTM D4959	450 lbs/in	625 lbs/in	79k N/m	109 kN/m
Wide Width Elongation	ASTM D4595	17%	13%	17%	13%
Trapezoidal Tear	ASTM D4533	280 lbs	300 lbs	1246 N	1355 N
CBR Puncture – **Typical**	ASTM D6241	2950 lbs		13.1 kN	
Puncture	ASTM D4833	250 lbs		1113N	
Factory Seam Strength	ASTM D4884	400 lbs/in		70 kNm	
Permittivity	ASTM D4491	.260 sec-1		.260 sec-1	
Apparent Opening Size (AOS)	ASTM D4571	40 U.S Sieve		.425 mm	
Water Flow Rate	ASTM D4491	20 gpm/ft^2		810 l/min/m^2	
UV Resistance @ 1200 hrs **Typical Value**	ASTM D4355	85%		85 %	
UV Resistance @ 1200 hrs	ASTM D4355	70%		70%	
Pore Size Distribution (O50) **Typical Value**	ASTM D6767	~175 US Std. Sieve		85 micron	
Pore Size Distribution (O95) **Typical Value**	ASTM D6767	~50 US Std. Sieve		307 micron	

*GSI will provide geotextile manufacturer certification documents that validates the test data shown

The information listed above is believed to be an accurate representation of information compiled from testing sources. Test values, statistical data and other information presented may be based solely on results of unverified tests made on random samples, information presented may relate only to tested sample and because the conditions in which such information may be used are beyond the control of Geo-Synthetics LLC. Geo-Synthetics LLC does not guarantee either the accuracy or reliability of the information or the suggestions and recommendations contained herein. Geo-Synthetics LLC assumes no responsibility for the use of this information and disclaims all liabilities which may arise in connection with the use of the above information. All the information referenced above are provided as information only, without charge or obligation to the recipient or user, and in no way makes or creates a warranty with respect to any product. Final determination of the suitability, reliability, and accuracy of the information and suggested uses is solely the responsibility of the user. The property values are effective 1/2014 and supersede any values previously published and are subject to change.

Geo-Synthetics LLC 2401 Pewaukee Road Waukesha, WI 53188 (800) 444-5523
www.geo-synthetics.com geostrux @geo-synthetics.com

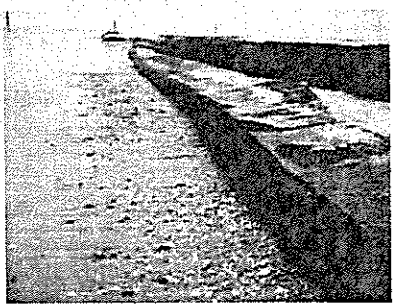
GEOSTRUX™
GEOTEXTILE TUBES

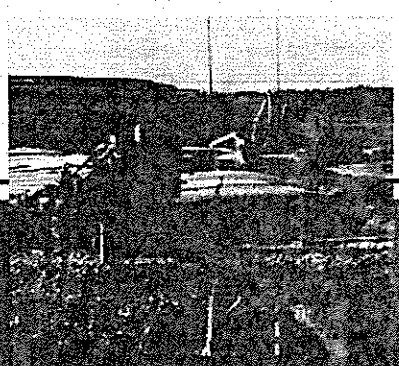
ENVIRONMENTALLY PROVEN SOLUTIONS FOR DEWATERING AND COASTAL APPLICATIONS



GEOSTRUX™ Tubes are produced using high strength woven fabrics which are manufactured to exacting standards by our in-house fabrication group.

Once on site, GEOSTRUX™ Tubes are hydraulically filled with heavily saturated sediment, sand or waste materials. When fully dewatered, the sediment has reduced weight and volume, allowing for more cost-effective material handling. In coastal applications the structure is strategically placed before filling to provide cost effective shoreline protection or habitat creation.





WWW.GEO-SYNTHETICS.COM
PHONE: 800.444.5523
GEOSTRUX@GEO-SYNTHETICS.COM

RECLAMATION COST ESTIMATE

Reclamation Item	Units	Price	COST
Refuse Area Soil Cover	25.6 ac./165,205 yd^3	$2/$yd^3$	$330,410
Lime	25.6 ac.	$28/ton	$717
Revegetation	25.6 ac.	$500/ac.	$12,800
Total			$343,927

GENERAL INFORMATION

Permit No. 375

Structure ID: **Stockpile Disposal Area Sediment Ditch No. 1**

Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in
B.	Estimated Runoff Area:	**12.74**	acres
C.	Estimated Distrubed Area:	**6.67**	acres
D.	Runoff Coefficient:	**52.35**	percent
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr storn	**1.35**	ac/ft
F.	Sediment Volume (Dist. Area X 0.1):	**0.67**	ac/ft
G.	Pit Pumpage:	**500.00**	gpm
H.	Pit Pumpage Treatment:	**None**	
I.	Basin Volume (Required at Normal Pool*):	**3.13**	ac/ft
	Basin Volume (Provided at Normal Pool):	**4.74**	ac/ft
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet (Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (25yr/6hr):	-	acres
L.	Diversion Ditching:	**None**	
M.	Inlet Elevation**:	**N/A**	feet
	Outlet Elevation	**N/A**	feet
	Outfall Elevation	**N/A**	feet
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**	

Notes:

* Basin Volume Required = (0.42 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Mach Mining - Stockpile Refuse Area
PROJECT NUMBER: B14-326-1413
DESCRIPTION: *Sediment Ditch No. 1*

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :

TOTAL AREA =	12.74	ACRES	DISTURBED AREA =	6.67	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	0.67	AC. FT.
10 YR - 24 HR RUNOFF VOL =	1.35	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	0.56	AC. FT.
PUMPAGE =	500	GPM	PUMPAGE VOLUME =	1.11	AC. FT.
LINEAR FEET OF DITCHLINE =	1951	FEET	SEDIMENT CAPACITY REQD =	2.33	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	8.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	3		BARRIER SPACING =	650.33	FEET
NUMBER OF BARRIERS =	2		TOP WIDTH (TOTAL) =	41.88	FEET
POOL AREA=	1.17	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	4.78	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.04	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	4.74	ACRE FEET
60% CLEANOUT DEPTH = 1.65 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 72.28 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	30.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.87	FEET
AREA OF FLOW =	28.00	SQ.FT.
VELOCITY =	2.58	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	41.88	FEET

Q ACTUAL = 72.38 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.87 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.47 FEET

Copyright 1998 -2010 Pamela L Schwab

Mach Stockpile Refuse Disposal Area

Sediment Ditch No. 1

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc.
124 Philpott Ln.
Beaver, WV 25813

Phone: 304-255-0491

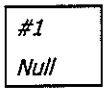
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.700	12.700	39.63	3.25

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.700	0.000	0.000	0.000	80.000	M	39.63	3.253
	Σ	**12.700**						**39.63**	**3.253**

Copyright 1998 -2010 Pamela L Schwab

Mach Mining Stockpile Refuse Disposal Area

Sediment Ditch No. 1

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc.
124 Philpott Ln.
Beaver, WV 25813

Phone: 304-255-0491

Copyright 1998 -2010 Pamela L Schwab

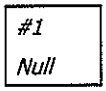
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.700	12.700	72.28	4.19

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.700	0.000	0.000	0.000	80.000	M	72.28	4.189
	Σ	**12.700**						**72.28**	**4.189**

GENERAL INFORMATION
Permit No. **375**
Structure ID: **Stockpile Disposal Area Sediment Ditch No. 2**
Type: **Combination** (Dam, Incised, or Combination)

DESIGN DETAILS

A.	Design Storm: 100yr/6hr	**6.21**	in	
B.	Estimated Runoff Area:	**12.87**	acres	
C.	Estimated Distrubed Area:	**6.67**	acres	
D.	Runoff Coefficient:	**51.83**	percent	
E.	Quanitity of Runoff (10 hrs of a 10yr/24hr storn	**1.38**	ac/ft	
F.	Sediment Volume (Dist. Area X 0.1):	**0.67**	ac/ft	
G.	Pit Pumpage:	**500.00**	gpm	
H.	Pit Pumpage Treatment:	**None**		
I.	Basin Volume (Required at Normal Pool*):	**3.15**	ac/ft	
	Basin Volume (Provided at Normal Pool):	**4.86**	ac/ft	
J.	Basin Freeboard (Designed Storm 100yr/6hr):	**2.00**	feet	(Reference SCS-IL, June, 1992)
K.	Surface Area at Design Storm (25yr/6hr):	-	acres	
L.	Diversion Ditching:	**None**		
M.	Inlet Elevation**:	**N/A**	feet	
	Outlet Elevation	**N/A**	feet	
	Outfall Elevation	**N/A**	feet	
N.	Emergency Spillway System**: (Design Storm 25yr/6hr)	**None**		

Notes:

* Basin Volume Required = (0.42 X Runoff Volume) + Sediment Volume + (pit Pumpage X 0.00442 X 0.5)

** Detailed drawings are submitted with the basin plan view and sections.

EXCAVATED SEDIMENT DITCH
STRUCTURE PROPORTIONING SHEET

PROJECT NAME: Mach Mining - Stockpile Refuse Area
PROJECT NUMBER: B14-326-1413
DESCRIPTION: ***Sediment Ditch No. 2***

SEDIMENT STORAGE REQUIREMENTS:

DRAINAGE AREA NO. :

TOTAL AREA =	12.87	ACRES	DISTURBED AREA =	6.67	ACRES
SED STORAGE FACTOR =	0.1	AC.FT./AC	REQUIRED SED VOL =	0.67	AC. FT.
10 YR - 24 HR RUNOFF VOL =	1.38	AC.FT	REQUIRED RUNOFF VOL. (8 HR) =	0.58	AC. FT.
PUMPAGE =	500	GPM	PUMPAGE VOLUME =	1.11	AC. FT.
LINEAR FEET OF DITCHLINE =	1999	FEET	SEDIMENT CAPACITY REQD =	2.35	AC. FT.

PROPOSED DITCH DIMENSIONS:

SIDE SLOPE (L) =	2.00:1		SIDE SLOPE (R) =	2.00:1	
BOTTOM WIDTH =	8.0	FEET	BARRIER DAM HEIGHT (MIN) =	5.60	FEET
NUMBER OF CELLS =	3		BARRIER SPACING =	666.33	FEET
NUMBER OF BARRIERS =	2		TOP WIDTH (TOTAL) =	41.92	FEET
POOL AREA=	1.17	AC.			

SEDIMENT DITCH CAPACITY:

TOTAL VOLUME OF DITCH (NO BARRIERS) =	4.90	ACRE FEET
TOTAL VOLUME OF BARRIERS =	0.04	ACRE FEET
TOTAL AVAILABLE STORAGE VOLUME =	4.86	ACRE FEET
60% CLEANOUT DEPTH = 1.62 FEET		

BARRIER/SPILLWAY DIMENSIONS:

SPILLWAY LENGTH = 5.0 FEET

REQD SPILLWAY FLOW = 73.42 CFS
(100 yr. 6 hr. peak flow)

SPILLWAY CHECK BASED ON WEIR EQUATION

Q = CLH^1.5 OR
Q = CH^1.5(L+0.4(Z1+Z2)H)
REF. (MESA MANUAL, Pg. 6.136)

REF. (OPEN CHANNEL HYDRAULICS, CHOW, Pg. 53)

WHERE:

COEFFICIENT C =	2.8	
BOTTOM WIDTH L =	30.4	FEET
SIDE SLOPE Z1 =	2	
SIDE SLOPE Z2 =	2	

SPILLWAY FLOW DEPTH =	0.88	FEET
AREA OF FLOW =	28.30	SQ.FT.
VELOCITY =	2.60	FPS
FREEBOARD =	2.00	FEET
TOP WIDTH =	41.92	FEET

Q ACTUAL = 73.51 CFS

TOTAL SPILLWAY DEPTH (DEPTH ABOVE BARRIER DAM) = 2.88 FEET
TOTAL (MINIMUM) DITCH DEPTH = 8.48 FEET

Mach Stockpile Refuse Disposal Area

Sediment Ditch No. 2

10 Yr - 24 Hr Event

RPC

Alliance Consulting, Inc.
124 Philpott Ln.
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	40.26	3.30

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.000	0.000	0.000	80.000	M	40.26	3.305
	Σ	**12.900**						**40.26**	**3.305**

Mach Mining Stockpile Refuse Disposal Area

Sediment Ditch No. 2

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc.
124 Philpott Ln.
Beaver, WV 25813

Phone: 304-255-0491

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	6.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	REF AREA



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	73.42	4.26

Structure Detail:

Structure #1 (Null)

REF AREA

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.000	0.000	0.000	80.000	M	73.42	4.255
	Σ	**12.900**						**73.42**	**4.255**

DOCUMENT

58

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

Subject: Williamson Energy, LLC – Pond Creek Mine

Data: Log No. 4237-14

Reviewed by: D. Maschhoff **Date:** 2/18/15

Log No. 4237-14 ⇒ IBR No. 60 to OMM Permit No. 375

Log No. 4237-14

- IBR consisting of 9.89 acres located in Section 13, Township 8 South, Range 3 East, Williamson County.
- Activities in this IBR area will include developing the site for topsoil and subsoil storage areas and constructing associated drainage ditches.
- This is area is adjacent to the permit area for the purpose of relocating the existing topsoil and subsoil storage areas.
- Two (2) drainage ditches to direct runoff from the IBR site to the existing Ditch D-5c and Pond 005.
- Upon completion of relocating the topsoil and subsoil stockpiles will be vegetated with the approved seed mixture to protect from wind and water erosion.
- Ditch D-5D-1 and Ditch-5E-1 will be constructed to direct runoff from the IBR area to the existing Ditch D-5C, which drains into existing Sediment Pond 005.

* Action: Reference IEPA Log No. 4237-14 in renewed and modified NPDES permit for additional 9.89 acres for new soil storage area.

4237-/14
Due date: 8/31/14 R10887 1C

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Pat Quinn, Governor
Marc Miller, Director

September 3, 2014

Mr. Anthony Webb
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

Re: Permit No. 375
Incidental Boundary Revision No. 60

Dear Mr. Webb:

The appropriate Department technical staff have reviewed the proposed incidental boundary revision dated July 8, 2014 and supplemental information dated July 30, 2014, submitted by Williamson Energy for the Pond Creek mine. The request would add 9.89 acres to conduct Surface coal mining activities. The additional acres would be used for new soil storage area.

The Department finds the permittee has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

Archeo/Historic finding - 1773.15(c)(12): The effect of the proposed permitting action on properties listed on or eligible for listing on the National Register of Historic Places has been taken into account by the Department.

Sections 1784.14(e)(4) and 1784.14(f)(2), respectively: The Department has determined that neither a new or updated probable hydrologic consequences determination nor a new or updated assessment of the probable cumulative hydrologic impacts is required.

Section 1777.17(c): The fee for the area will be $247.25. The fee is comprised of $247.25 for non-surface mining area ($5/acres x 9.89 acres x 5 years the bond is in force).

Section 1800.11(a): The bond for the area will be $37,537.00. Copies of bond form SCML-2 have been enclosed for your use. For additional bonding and other forms, please contact this office or download a copy from the web at: www.dnr.state.il.us/mines/lrd/forms.htm. Please note many forms have been modified. **Only** the most current versions will be accepted.

RECEIVED
SEP 12 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

4237-/14
Due date: 8-21-14
R10838

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

State of Illinois
Department of Natural Resources
Office of Mines and Minerals; Land Reclamation Division
One Natural Way
Springfield, IL 62702

PERMIT # 375
IBR FOR 9.89 ACRES

POND CREEK MINE NO. 1
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-364-1413
JUNE 2014

Summersville, WV

848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV

Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA

151 East Pike Street
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 8, 2014

Project No. B14-364-1413

Mr. Larry Crislip
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Mine Pollution Control Program
2309 West Main Street
Suite 116
Marion, IL 62959

Transmittal Letter
Incidental Boundary Revision for 9.89 Acres
Williamson Energy, LLC; Permit 375
Williamson County, Illinois

Dear Mr. Crislip:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting two copies of an Incidental Boundary Revision (IBR) for Permit 375. This IBR addresses the addition of 9.89 acres for a new soil storage area.

Copies of this IBR application have been sent to Mr. Scott Fowler and Mr. Brad Murphy of IDNR Office of Mines and Minerals.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Project Manager

SMS:sms
Enclosures

cc: Scott Fowler
Brad Murphy

FILE: 14344-03

RECEIVED
JUL 09 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 8, 2014

Project No. B14-364-1413

Mr. Scott K. Fowler, Supervisor
Land Reclamation Division
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
One Natural Resources Way
Springfield, IL 62702-1271

Transmittal Letter
Incidental Boundary Revision for 9.89 Acres
Williamson Energy, LLC; Permit 375
Williamson County, Illinois

Dear Mr. Fowler:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting an original and one copy of an Incidental Boundary Revision (IBR) for Permit 375. This IBR addresses the addition of 9.89 acres for a new soil storage area.

One copy of this IBR application has been sent to Mr. Brad Murphy in the Benton and two copies have been sent to Mr. Larry Crislip of IEPA.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Project Manager

SMS:sms
Enclosures

cc: Brad Murphy
Larry Crislip

FILE: 14344-01

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

July 8, 2014

Project No. B14-364-1413

Mr. Brad Murphy
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Land Reclamation Division
503 E. Main, FL 001
Benton, IL 62812

Transmittal Letter
Incidental Boundary Revision for 9.89 Acres
Williamson Energy, LLC; Permit 375
Williamson County, Illinois

Dear Mr. Murphy:

On behalf of our client, Williamson Energy LLC, Alliance Consulting, Inc. is submitting one copy of an Incidental Boundary Revision (IBR) for Permit 375. This IBR addresses the addition of 9.89 acres for a new soil storage area.

An original and one copy of this IBR application has been sent to Mr. Scott Fowler in the Springfield office and two copies have been sent to Mr. Larry Crislip of IEPA. If you have any questions, or require additional information, please contact us.

If you have any questions, or require additional information, please contact us.

Sincerely,

ALLIANCE CONSULTING, INC.

Stephen M. Sutphin
Project Manager

SMS:sms
Enclosures

cc: Scott Fowler
Larry Crislip

FILE: 14364-02

State of Illinois
Department of Natural Resources
Office of Mines and Minerals; Land Reclamation Division
One Natural Way
Springfield, IL 62702

PERMIT # 375
IBR FOR 9.89 ACRES

POND CREEK MINE NO. 1
WILLIAMSON COUNTY, IL

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, IL

ALLIANCE PROJECT NO. B14-364-1413
JUNE 2014

PART I

updated 02/25/2011

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS
INCIDENTAL BOUNDARY REVISION IBR-1

PART I

DATE: July 3, 2014

NOTICE : This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill. Rev. Stat. 1987 Ch. 96 1/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(I)(~~We~~)(The) Williamson Energy LLC
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 99, Johnston City, IL 62951 (618) 983-3020
(Address) (Telephone Number)

hereby submit application for an Incidental Boundary Revision to Permit 375

Name of Mine Pond Creek No. 1.

MSHA No. 11-03141

I, Dwayne Francisco under penalty
(vice president or his duly authorized representative under the existing permit)

of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Authorized Agent
Title

Surface Area:

ADDITIONAL ACRES REQUESTED 9.89 EXISTING PERMIT ACREAGE 669.60

B) Indicate the type of disturbance and associated acreage.

Type of Disturbance	Existing Permit	IBR	Total
Area Stripping	20.10	0.00	20.10
Mine Waste Areas	277.40	0.00	277.40
Processing Areas & Support Facilities	168.80	0.00	168.80
Access, Haul Roads & Transport Facilities	23.70	0.00	23.70
Soil Storage Areas	76.00	9.89	85.89
Diversions	32.80	0.00	32.80
Coal Recovery (Gob & Slurry)	0.00	0.00	0.00
Other	31.60	0.00	31.60
Not to be Disturbed	37.20	0.00	37.20
Total	669.60	9.89	679.49

2) A) Provide name and address of every legal or equitable owner of record of the IBR area.

RESPONSE: Parcel No. A080313-103 is owned by:
New River Royality, LLC, 208 Public Square – 4th Floor, Benton, IL 62812

B) Provide name and address of the owner of record for all surface and subsurface areas contiguous to any part of the proposed IBR area.

RESPONSE: Parcel No. A080313-103 is owned by:
New River Royality, LLC, 208 Public Square – 4th Floor, Benton, IL 62812

C) Show location of owners of record of those lands, both surface and subsurface, included in or contiguous to the IBR area on premining land use map or another map, if necessary.

RESPONSE: Refer to the Supplemental Map 6 S.F. (Drawing No. B14-165-E2).

3) Provide name and address of any holder of record of leasehold interest for the IBR area.

RESPONSE: Williamson Energy LLC. P. O. Box 99, Johnston City, IL 62951

4) Affidavits, Certifications

A) Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.

RESPONSE: See Attachment I.4.A.

B) Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit requirements. In most cases, an Illinois registered engineer will be required to certify IEPA permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land survey or licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: See Attachment I.4.B.

5) Areas Designated Unsuitable for Mining

A) Does proposed IBR area include --

(1) Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?

Yes _____ No ___X___

(2) National forest land?

Yes _____ No ___X___

(3) Any land which will adversely affect any publicly-owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per 62 Ill. Adm. Code 1761.11(a)(3) or Section 10, (B)(C) of the SCM-1?

Yes _____ No ___X___

If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1 Application.

(4) Any public roads which are to be removed, relocated or temporarily closed?

Yes _____ No ___X___

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

B) Will proposed IBR area be located --

(1) Within 100 feet of the right-of-way line of any public road?

Yes _____ No ___X___

If yes, explain proposed procedure for complying with regulation section 1761.11(d), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

(2) Within 300 feet measured horizontally from any occupied dwelling?

Yes _____ No ___X___

If so, is waiver provided meeting requirements of Section 1761.15?

(3) Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?

Yes _____ No ___X___

(4) Within 100 feet measured horizontally of a cemetery?

Yes _____ No ___X___

C) Are valid existing rights (per 1761.11) claimed for any part of the IBR area?

Yes _____ No ___X___

If yes, provide documentation to substantiate claim.

D) Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.

RESPONSE: Refer to Attachment Part I.5.D. for the draft copy of the newspaper notice. The notice will be published in The Daily American newspaper.

PART I ATTACHMENTS

ATTACHMENT PART I.4.A

Attachment I.4.A

(I) (~~We~~) Dwayne Francisco
(Individual or Individuals)

under penalty of perjury declare on behalf of the applicant, Williamson Energy LLC, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area, and such legal right is not in any way the subject of pending court litigation.

Dated this 3rd day of July, 2014.

Dwayne Francisco Authorized Agent
Signature / Title

State of Illinois

County of Macoupin

Signed by and subscribed to before me on 7.3.14 by Monica S. Reiher.
(date) (name of person)

(Seal)

Monica S. Reiher
(Signature of Notary Public)

OFFICIAL SEAL
Monica S. Reiher
Notary Public, State of Illinois
COMMISSION #759127
My Commission Expires 12/07/2015

ATTACHMENT PART I.4.B

Attachment I.4.B.

Revised 1/25/12

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" on the line below if that item is relevant.

(1) ☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

(2) ☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

(3) Certification of the Illinois Environmental Protection Agency-35 Ill. Adm. Code 405.104(a) Permit.

☐ In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

INDIVIDUAL P.E. CERTIFICATION

Claudio E. Yon
Name

062-050632
Illinois Registration Number (Seal)

CLAUDIO ELI YON
062-050632
LICENSED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

Alliance Consulting, Inc.
Firm

124 Philpott Lane, Beaver, WV 25813
Address

304-255-0491
Phone Number

Signature

7/7/14
Date

PROFESSIONAL DESIGN FIRM CERTIFICATION

Complete if applicable. If not, respond _____

☒ As an employee of a "professional design firm" as defined by the Illinois Department of Financial and Professional Regulation, I certify that the professional design firm is registered and in good standing with the Illinois Department of Financial and Professional Regulation.

Alliance Consulting of West Virginia, Inc.
Professional Design Firm Name

184.006236
Professional Design Firm Number

ATTACHMENT PART I.5.D

Attachment I.5.D.

PUBLIC NOTICE

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy LLC, P. O. Box 99, Johnston City, IL 62951 hereby gives notice that on _____ 2014, a 9.89 acre contiguous incidental boundary revision (IBR) has been submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division, One Natural Resources Way, Springfield, IL 62702-1271. The IBR application is for 9.89 acres located in Williamson County, Township 8 South, Range 3 East, northwest quadrant of Section 13, east of Liberty School Road.

Activities will include developing the site for topsoil and subsoil storage areas and constructing associated drainage ditches.

Copies of the application are on file with the Illinois Department of Natural Resources, Office of Mines and Mineral, 503 East Main St., Benton, Illinois 62812, and the Springfield, Illinois Office.

Written comments concerning the operations should be addressed to the Office of Mines and Minerals, Land Reclamation Division at the Springfield office, no later than 7 days from the date of this notice.

PART II

PART II

PREMINING INFORMATION

Premining information is to be displayed on premining land use map unless otherwise indicated.

1) Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different then the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.

RESPONSE: The IBR boundary will be delineated by using PVC and/or metal post and will be located within eye sight of one another. The permit reference point can be located at the intersection of Permit 375 and Liberty School Road, approximately 5,392 feet due north of the intersection of Liberty School Road and Corinth Road. The reference point is noted on Map 6 S.F. (Drawing No. B14-364-M1).

2) Explain and locate areas where the IBR is contiguous to an existing permit.

RESPONSE: The proposed IBR area is contiguous to the current permitted boundary on the east and north sides. Refer to the Supplemental Map 6 S.F. additional details.

3) Give the acreages of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on premining land use map existing land uses in the proposed permit area and adjacent to it. Include on the premining land use map the location of all buildings and identify the current use of these buildings.

Pre-Mine Land Use	Existing Permit	IBR	Total
Cropland	524.70	0.00	524.70
Pasture land	6.60	9.89*	16.49
Grazing land	0.00	0.00	0.00
Forestry	107.9	0.00	107.9
Residential	5.80	0.00	5.80
Industrial/Commercial	3.50	0.00	3.50
Recreation	0.00	0.00	0.00
Fish and Wildlife Habitat	19.70	0.00	19.70
Developed Water Resources	1.40	0.00	1.40
Undeveloped land	0.00	0.00	0.00
Total	669.60	9.89	679.49

RESPONSE: Refer to Map 5 – Soils Resource Map for additional information. *Note: Acreage has not been planted in crops in the last 10 years. Site is occasionally mowed.

4) Soils Information Map

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes ___X___ No_____.

If no, explain.

RESPONSE: Refer to Attachment II.4. (NRCS Custom Soil Resource Report).

B) Delineate on the soils map(s) the area which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

RESPONSE: No removal of overburden or deposition of overburden for the extraction of coal will occur on the IBR area. Proposed site disturbance will be minimal and will include only topsoil removal, stockpiling of topsoil and subsoil and the construction of drainage ditches.

C) Are any of the identified map units correlated as prime farmland by NRCS criteria?

Yes ___X___ No_____.

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist, which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: Refer to Map 5 – Soils Resources Map. Additional information can be found in Attachment II.4. (NRCS Custom Soil Resource Report).

D) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: Refer to Map 5 – Soils Resources Map. Additional information can be found in Attachment II.4. (NRCS Custom Soil Resource Report).

E) Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.

RESPONSE: Refer to Map 5 – Soils Resources Map.

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes _____ No___X_____.

If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

PART II ATTACHMENTS

ATTACHMENT PART II.4.

United States Department of Agriculture

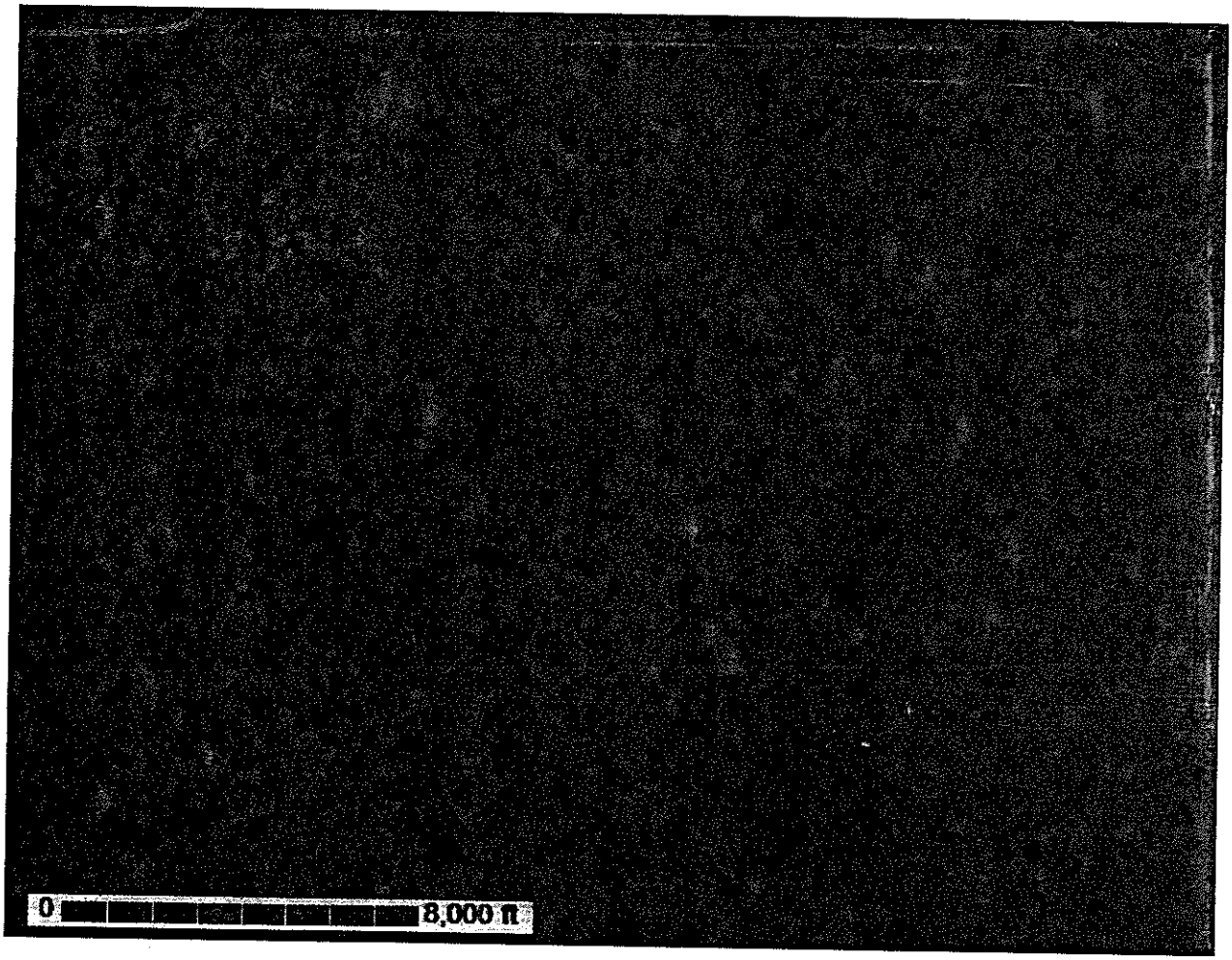
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Williamson County, Illinois

PERMIT 375; 9.89 Acre IBR



June 30, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map.....8
Legend.....9
Map Unit Legend.....10
Map Unit Descriptions.....10
Williamson County, Illinois.....12
12A—Wynoose silt loam, 0 to 2 percent slopes.....12
14B—Ava silt loam, 2 to 5 percent slopes.....13
14C2—Ava silt loam, 5 to 10 percent slopes, eroded.....14
14C3—Ava silty clay loam, 5 to 10 percent slopes, severely eroded.....15
3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded.....16
References.....17

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

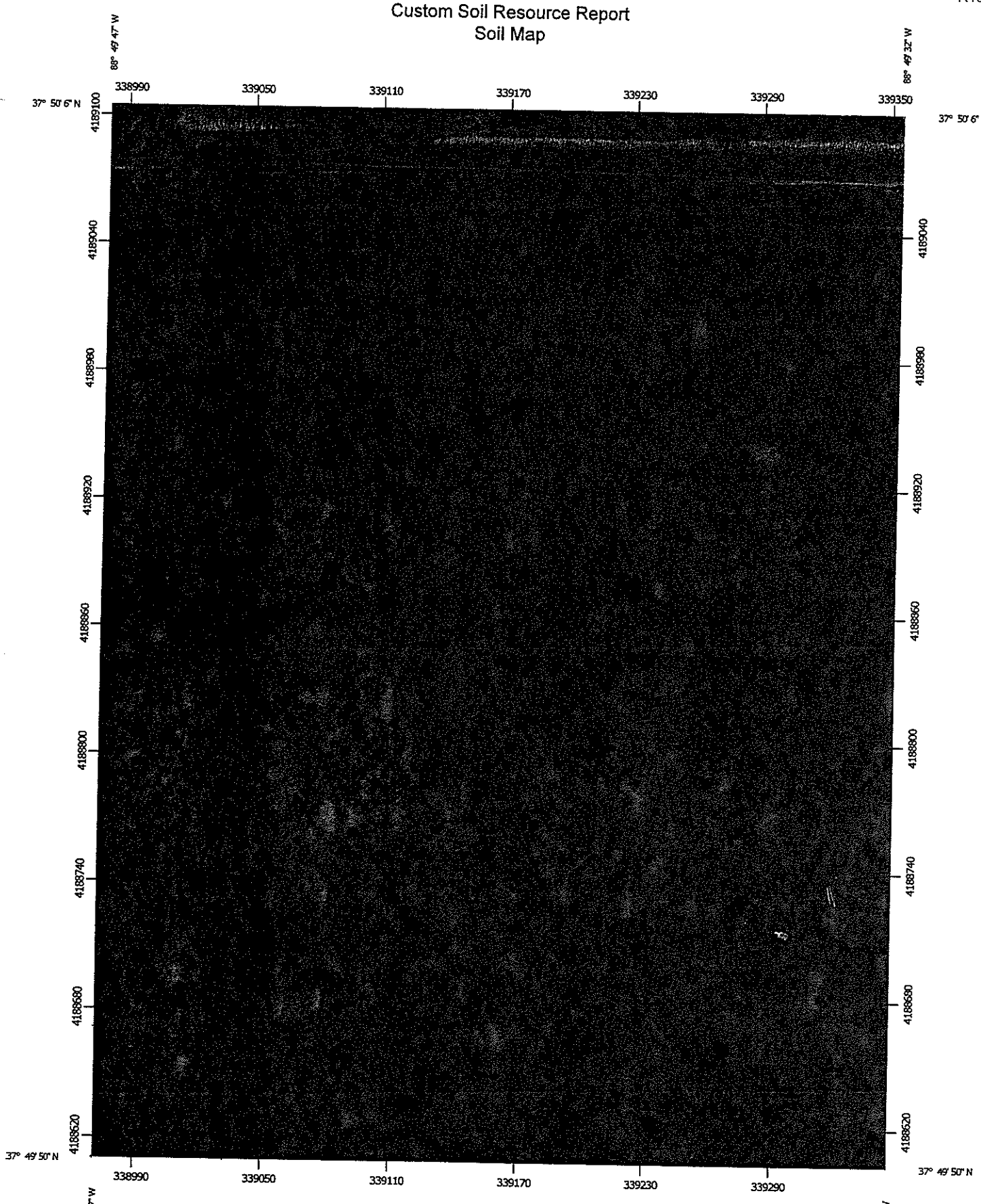
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,410 if printed on A portrait (8.5" x 11") sheet.

N

0 35 70 140 210 Meters

0 100 200 400 600 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2011—Oct 21, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R10868

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12A	Wynoose silt loam, 0 to 2 percent slopes	0.0	0.2%
14B	Ava silt loam, 2 to 5 percent slopes	5.8	48.1%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	3.9	32.6%
14C3	Ava silty clay loam, 5 to 10 percent slopes, severely eroded	1.7	14.1%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	0.6	4.9%
Totals for Area of Interest		**12.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially

where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Williamson County, Illinois

12A—Wynoose silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 42 inches
Mean annual air temperature: 53 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Wynoose and similar soils: 90 percent

Description of Wynoose

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over mixed loess and drift over sangamon age paleosol till

Typical profile

Ap - 0 to 7 inches: neutral, silt loam
Eg - 7 to 19 inches: very strongly acid, silt loam
Btg - 19 to 36 inches: very strongly acid, silty clay
2Btg - 36 to 66 inches: strongly acid, silty clay loam
3Btgb - 66 to 79 inches: moderately acid, silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 13 to 24 inches to abrupt textural change
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.02 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D

14B—Ava silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava and similar soils: 90 percent

Description of Ava

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over glacial drift

Typical profile

H1 - 0 to 8 inches: moderately acid, silt loam
H2 - 8 to 18 inches: moderately acid, silt loam
H3 - 18 to 36 inches: very strongly acid, silty clay loam
H4 - 36 to 53 inches: very strongly acid, silt loam
H5 - 53 to 80 inches: strongly acid, silt loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

14C2—Ava silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, eroded, and similar soils: 90 percent

Description of Ava, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Typical profile

H1 - 0 to 9 inches: moderately acid, silt loam
H2 - 9 to 28 inches: very strongly acid, silty clay loam
H3 - 28 to 64 inches: very strongly acid, silt loam
H4 - 64 to 78 inches: strongly acid, silt loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

14C3—Ava silty clay loam, 5 to 10 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, severely eroded, and similar soils: 90 percent

Description of Ava, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Typical profile

H1 - 0 to 9 inches: moderately acid, silty clay loam
H2 - 9 to 28 inches: very strongly acid, silty clay loam
H3 - 28 to 64 inches: very strongly acid, silt loam
H4 - 64 to 78 inches: strongly acid, silt loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Elevation: 340 to 490 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Belknap, frequently flooded, and similar soils: 90 percent

Description of Belknap, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

H1 - 0 to 7 inches: moderately acid, silt loam
H2 - 7 to 59 inches: strongly acid, silt loam
H3 - 59 to 80 inches: strongly acid, silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 12.7 inches)

Interpretive groups

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

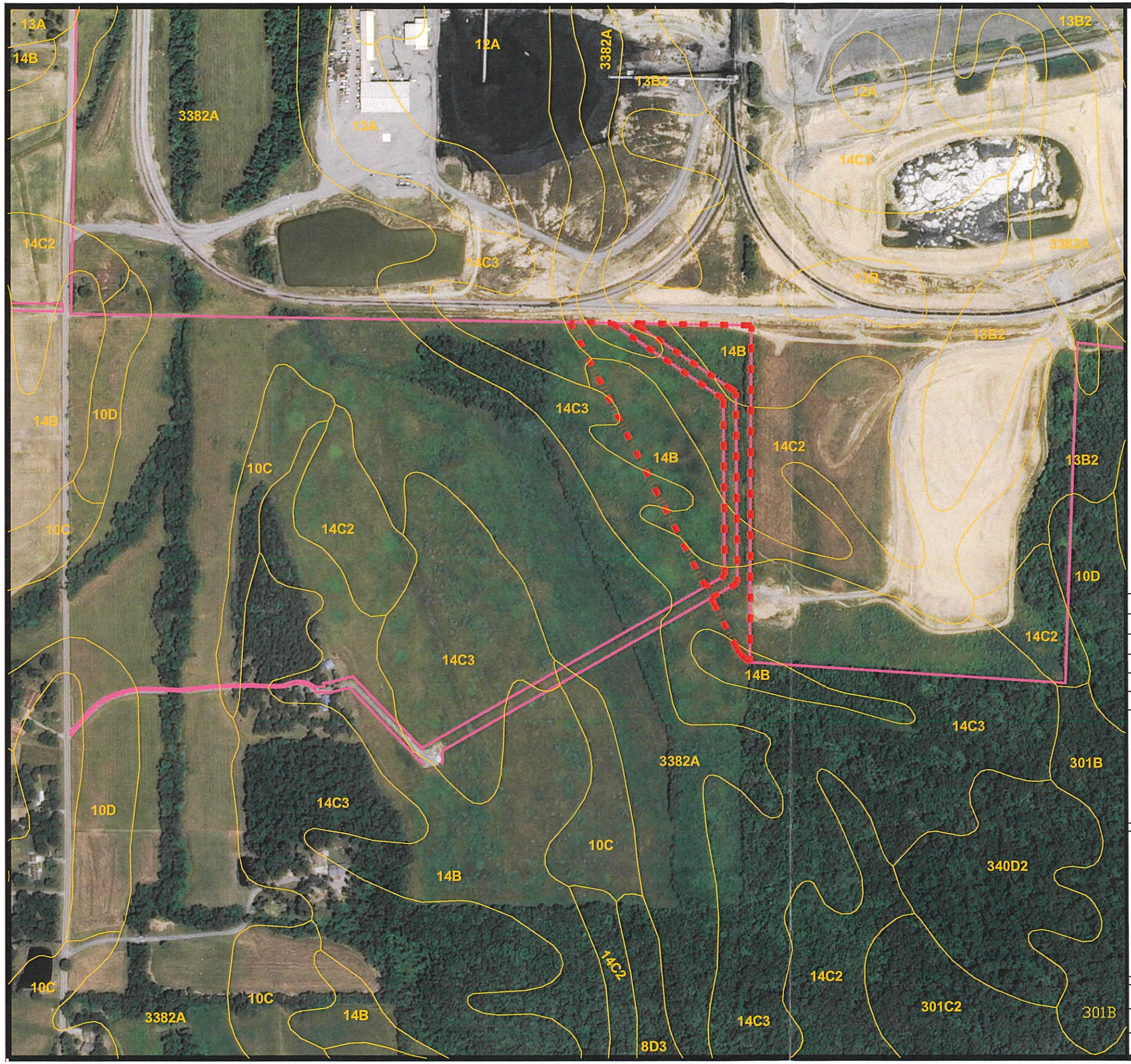
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

R10878



SOILS RESOURCES MAP

GENERAL INFORMATION

- PERMIT 375 PERMIT BOUNDARY
- PROPOSED IBR AREA (9.89 AC.)
- RAILROAD
- 14B SOIL SERIES BOUNDARY

SOIL INFORMATION

Acres	Soil ID	Soil Series	Slope (%)	Capability
5.22	14B	Ava	2 - 5	PF
3.04	14C2	Ava (eroded)	5 - 10	HC
1.27	14C3	Ava (severly eroded)	5 - 10	HC
0.36	3382A	Belknap	0 - 2	PF

PF = Prime Farmland
HC = High Capability
LC = Limited Capability

* REFER TO THE NRCS SOIL RESOURCE REPORT FOR ADDITIONAL INFORMATION ON SOIL CAPABILITIES.

400' 0 400' 800'

SCALE: 1"=400'

N

Mine Name: POND CREEK MINE #1	Permit No: 375
Quadrangle: PITTSBURG, ILLINOIS	Description: WILLIAMSON COUNTY, ILLINOIS
Date: 06/26/14	T8S R3E - SECTIONS 13

REV.	DATE	DESCRIPTION	P.M.

BECKLEY, WV
(304) 255-0491

Alliance Consulting, Inc.
Engineers Constructors Scientists

MAP 5

SOILS RESOURCES MAP

POND CREEK 1 MINE

Prepared For

WILLIAMSON ENERGY LLC.

JOHNSTON CITY, IL

CAD BY	SMS	06/26/14	PROJECT NO. B14-364-1413
CHECKED BY	SMS	06/26/14	
APPROVED BY	CEY	06/26/14	DRAWING NO. B14-364-B1

PART III

PART III

OPERATIONS PLAN

1) Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.

RESPONSE: The purpose of this IBR application is to add 9.89 adjacent acres to the permit for the purpose of relocating the existing topsoil and subsoil storage areas. Prior to relocating the soil stockpiles, two drainage ditches will be established to direct runoff from the IBR site to the existing Ditch D-5C and Pond 005. After the ditches have been constructed, soil material will be placed in area. Upon completion of relocating the topsoil and subsoil stockpiles, signs will be established identifying each stockpile and they will be vegetated with the approved seed mixture to protect them from wind and water erosion. Refer to the Supplemental Map 6 S.F. (Drawing No. B14-364-E2) for additional details.

2) Surface Drainage Control

A) 1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems. Show drainage patterns of all affected mining areas.

RESPONSE: Refer to the Supplemental Map 6 S.F. (Drawing No. B14-364-E2) for additional details.

2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?

Yes X No _____

If yes, delineate how and where surface drainage will be collected and treated, and list permit numbers and type of permit that the drainage control systems are operated under. If above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: Ditch D-5D-1 and Ditch D-5E-1 will be constructed to direct runoff from the IBR area to the existing Ditch D-5C, which drains into existing Sediment Pond 005. In addition to the proposed ditches, vegetation will be established as required by 62 Ill. Adm. Code 1817.22 c) 2) C). Refer to the Supplemental Map 6 S.F. (Drawing No. B14-364-E2) for ditch profiles.

B) Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes _____ No X

If no, please discuss.

RESPONSE: An existing drainage ditch, Ditch D-5E will prevent drainage from entering the site on the east side. Existing Ditch D-5C is located to the north of the site and directs drainage to Sediment Pond 005. On the northwest side of the IBR area, the natural drainage pattern is to drain towards an existing drainways permitted drainways

Refer to the Supplemental Map 6 S.F. (Drawing No. B14-364-E2.

C) Overland Flow Diversions and Sediment Ponds:

Are either overland flow diversions or sediment ponds to be constructed?

Yes _____ No __X__
If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (surface drainage control).

D) Does a perennial or intermittent stream occur within the proposed IBR area?

Yes _____ No __X__

If yes, is an exception to the 100 foot buffer zone being requested or is a stream diversion being proposed. For an exception to the 100 foot buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

3) Roads and other activities:

A) Are roads to be constructed in the IBR area?

Yes _____ No __X__

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: Access to the site will be from the existing permit area. No road construction will be required.

B) If the operations involve blasting, or any other activities not specifically addressed above, complete applicable parts of the SCM-1 or UCM-1.

RESPONSE: No other activities are proposed.

4) Are any existing structures proposed for utilization in the IBR?

Yes ____ No __X__

If yes, complete Part IV.4 of the SCM-1 or UCM-1.

RESPONSE: Not applicable.

PART III ATTACHMENTS

ATTACHMENT PART III.2.B

Topsoil/Subsiol Collection Ditch D-5E-1 and D-5D-1

10yr 24hr Storm event

BLA

Alliance Consulting, Inc
124 Philpott Lane
Beaver, WV 25813

Phone: 304-255-0491

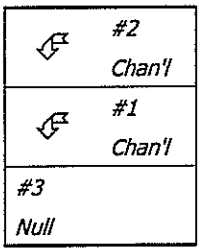
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.210 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.000	0.000	DITCH D-5E-1
Channel	#2	==>	#3	0.000	0.000	DITCH D-5D-1
Null	#3	==>	End	0.000	0.000	



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	2.620	2.620	9.47	0.84
#1	9.030	9.030	23.91	2.37
#3	0.000	11.650	32.62	3.21

Structure Detail:

Structure #2 (Vegetated Channel)

DITCH D-5D-1

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	2.5:1	2.5:1	1.0	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	9.47 cfs		9.47 cfs	
Depth:	0.92 ft	1.22 ft	1.58 ft	1.88 ft
Top Width:	7.60 ft	9.10 ft	10.91 ft	12.41 ft
Velocity:	1.94 fps		0.86 fps	
X-Section Area:	4.88 sq ft		10.99 sq ft	
Hydraulic Radius:	0.613 ft		0.955 ft	
Froude Number:	0.43		0.15	
Roughness Coefficient:	0.0553		0.1675	

Structure #1 (Vegetated Channel)

DITCH D-5E-1

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
5.00	2.5:1	2.5:1	1.0	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	23.91 cfs		23.91 cfs	
Depth:	1.11 ft	1.41 ft	1.79 ft	2.09 ft
Top Width:	10.56 ft	12.06 ft	13.96 ft	15.46 ft
Velocity:	2.76 fps		1.41 fps	
X-Section Area:	8.66 sq ft		16.99 sq ft	
Hydraulic Radius:	0.788 ft		1.160 ft	
Froude Number:	0.54		0.22	
Roughness Coefficient:	0.0460		0.1168	

Structure #3 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	2.620	0.000	0.000	0.000	88.000	M	9.47	0.844
	Σ	**2.620**						**9.47**	**0.844**
#1	1	9.030	0.125	0.000	0.000	88.000	M	23.91	2.366
	Σ	**9.030**						**23.91**	**2.366**
#3	Σ	**11.650**						**32.62**	**3.210**

PART IV

PART IV

RECLAMATION PLAN

1) Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.

RESPONSE: Refer to Map 7 S.F.; Reclamation Plan Map. The reclamation of the IBR area will comply with the approved reclamation plan.

2) Post Mining Land Use

A) Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the postmining land uses on the Post Mining Land Use Map. Acreage figures for postmining land use must differentiate between mined and surface disturbance areas based on the mining line used in the premining section of the application.

RESPONSE: Refer to Map 7 S.F.; Reclamation Plan Map

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCr	Prime	HCap	NonCr	Prime	HCap	NonCr
Cropland	9.50	3.50	2.50				9.50	3.50	2.50
Pasture Land		0.80	4.90					0.80	4.90
Grazing Land									
Forestry			14.29						14.29
Residential			1.51						1.51
Industrial / Commercial									
Recreation									
Fish & Wildlife Habitat (Herbaceous)		2.80	42.40	5.58	4.31		5.58	7.11	42.40
Fish & Wildlife Habitat (Woody)		0.80	567.30					0.80	567.30
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.30						19.30
Undeveloped Land									
Totals	**9.50**	**7.90**	**652.20**	**5.58**	**4.31**	**0.00**	**15.08**	**12.21**	**652.20**
	669.60			**9.89**			**679.49**		

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

3) Pursuant to Section 1784.21 the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.

RESPONSE: There are no forested areas within the proposed IBR consisting of 9.89 acres.

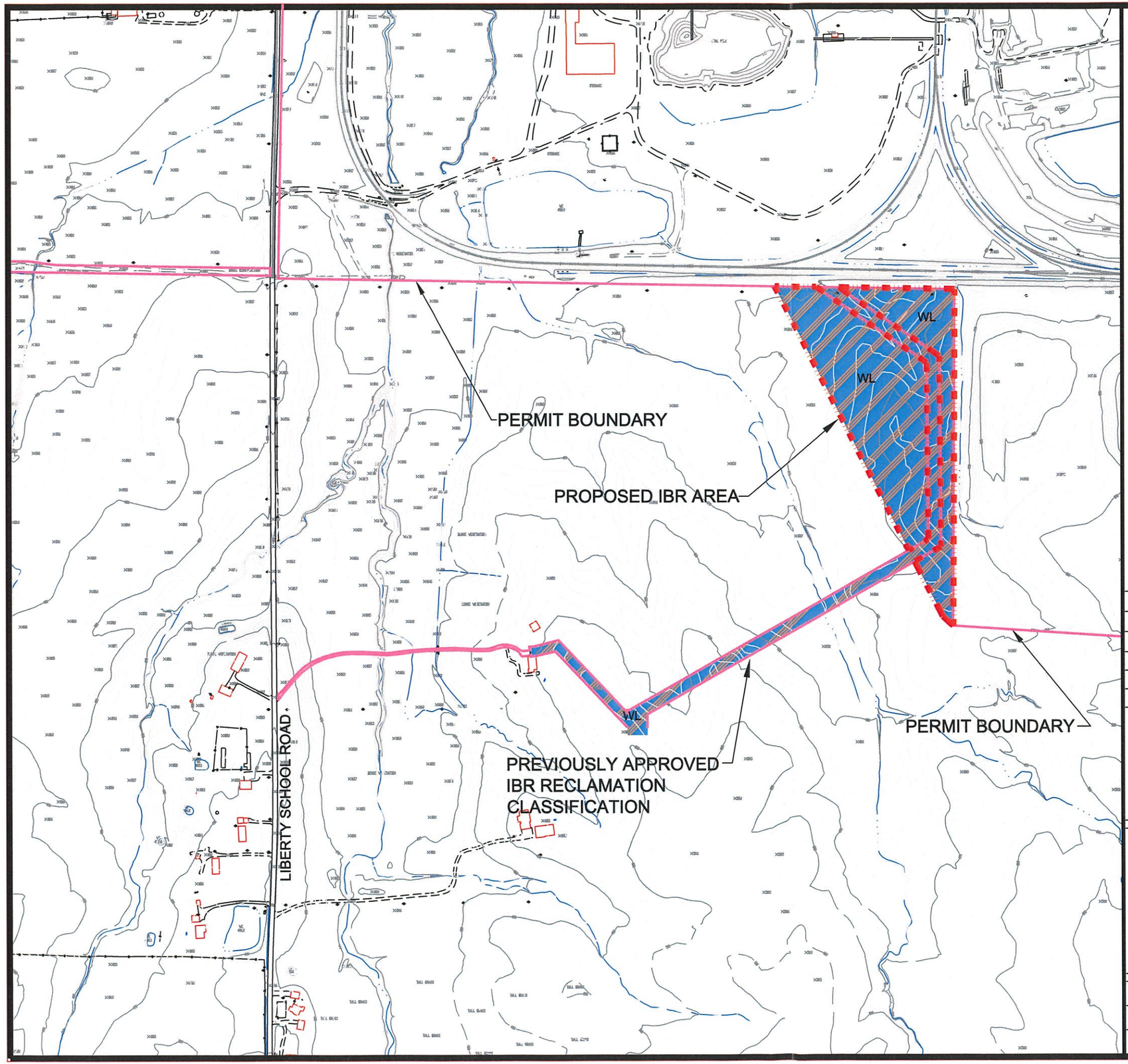
No protection and enhancement plan is required for the Indiana Bat or northern long-eared bat based on the specifications outlined in the July 2009 Range-Wide Indiana Bat Protection and Enhancement Plan Guidelines (revised February, 2013). Additionally, please note that current Northern Long-Eared Bat Interim Guidance recommends minimization action that the applicant has currently proposed in order to minimize any potential affect on the northern long-eared bat. The flow chart outlined in the Guidance was followed to conclude that no PEP is required and the steps have been provided below:

Is there suitable in bat habitat? ⟶ No ⟶ No additional summer habitat assessment/surveys required.

PART IV ATTACHMENTS

ATTACHMENT PART IV.1.

R10896



Map 7 S.F. - RECLAMATION PLAN MAP

GENERAL INFORMATION

MINING PERMIT #375 SURFACE FACILITIES

PROPOSED IBR AREA (9.89 AC.)

ROAD

SOIL INFORMATION

9.89 AC. WL WOODY WILDLIFE AREA/LOW CAPABILITY SOILS

LAND USE INFORMATION

C CROPLAND
F FORESTRY
WL WILDLIFE
W WATER
D DRIVEWAY

400' 0' 400' 800'

SCALE: 1"=400'

N

Mine Name: POND CREEK MINE #1	Permit No: 375
Quadrangle: PITTSBURG, ILLINOIS	Description: WILLIAMSON COUNTY, ILLINOIS
Date: 06/27/14	T8S R3E - SECTIONS 13

REV.	DATE	DESCRIPTION	P.M.

BECKLEY, WV
(304) 255-0491

Alliance Consulting, Inc.
Engineers Constructors Scientists

MAP 7

RECLAMATION PLAN MAP

POND CREEK 1 MINE

Prepared For

WILLIAMSON ENERGY LLC.
JOHNSTON CITY, IL

CAD BY	SMS	06/26/14	PROJECT NO. B14-364-1413	
CHECKED BY	SMS	06/26/14		
APPROVED BY	CEY	06/26/14	DRAWING NO. B14-364-B2	

DOCUMENT

59

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

Subject: Williamson Energy, LLC – Pond Creek Mine

Data: Log No. 4088-14

Reviewed by: D. Maschhoff **Date:** 2/17/15

Log No. 4088-14 ⇒ IBR No. 57 to OMM Permit No. 375

Log No. 4088-14

- IBR consisting of 3.3 acres located in Section 18, Township 8 South, Range 4 East, Williamson County.
- The proposed operation is the completion of two (2) boreholes. One is to be used to set a pump and pump water from the underground workings to the surface where the water will then be pumped through a buried waterline to an existing permitted waterline along Jordan Fort Road.
- A borehole for a monitoring well will also be drilled. The location of this well is depicted on the Operations Map.
- A sediment Pond exemption is requested for this permit area. Silt fence and/or straw bales will be placed for drainage control.
- Topsoil piles will be seeded and mulched to reduce runoff and promote growth.
- An access road will be constructed to the pump borehole site.

* Action: Reference IEPA Log No. 4088-14 in renewed and modified NPDES permit for additional 3.3 acres for the construction of two (2) boreholes and installation of pump and waterline which will carry underground mine pumpage to an existing waterline along Jordan Fort Road.

4088-/14
R10899
Due date: 3-14-14

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Pat Quinn, Governor
Marc Miller, Director

February 20, 2014

Mr. Anthony Webb
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

RECEIVED
FEB 24 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Re: Permit No. 375
Incidental Boundary Revision No. 57

Dear Mr. Webb:

The appropriate Department technical staff has reviewed the proposed incidental boundary revision dated January 30, 2014 submitted by Williamson Energy for the Pond Creek mine. The request would add 3.3 acres to conduct Surface coal mining activities. The additional acres would be used for a mine service borehole to pump water from the underground workings to an existing permitted waterline along Jordan Fort Road.

The Department finds the permittee has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

A sediment pond exemption is requested for an area delineated in the application. The regulations at 62 Ill. Adm. Code 1817.46(e) allows the Department to grant exemptions from the requirement to pass all disturbed drainage through a siltation structure when:

a. The disturbed drainage area within the total disturbed area is small; and

b. Alternate sediment control measures as described in Section 1817.45(b) are used in lieu of a siltation structure, and the permittee demonstrates that siltation structures are not necessary for drainage from the disturbed area to meet the effluent limitations and water quality standards for the receiving waters set forth in Section 1817.42

The Department has determined that the area for which a sediment pond exemption is requested meets the criteria established in Section 1817.46(e) and hereby grants an exemption from the use of a sedimentation pond for this area.

The proposed permit area is within one hundred (100) feet of the outside right-of-way line of public roads in Williamson County.

4088-/14
Due date: 3/4/14
R10900

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

January 29, 2014

Mr. Larry Crislip, P.E.
Illinois Environmental Protection Agency
Manager—Permit Section
Mine Pollution Control Program
Bureau of Water
2309 West Main Street
Marion, IL, 62959

Re: Pond Creek No. 1 Mine, IDNR Permit #375
Non-Contiguous Incidental Boundary Revision
TG # 2—Turbine Pump Borehole

Dear Mr. Crislip:

Two copies of a 3.3-acre IBR application for Williamson Energy, LLC's Pond Creek No. 1 Mine, Permit #375, are provided for your files. The original application, and one copy, was submitted to Mr. Scott Fowler in the IDNR's Springfield office and one copy was submitted to the IDNR's Benton office.

If you need any additional information, or have any questions, please let me know.

Sincerely,

Anthony Webb-- President
Williamson Energy, LLC
Sugar Camp Energy, LLC

Cc: Mark Allaman—Chief Engineer, Mach Mining
Chris Skelton----Engineer, Mach Mining

RECEIVED
FEB 04 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

R10901

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

NON-Contiguous IBR to Permit No. 375

TG # 2, X-Cut 27 Pump Borehole

January, 2014

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS
INCIDENTAL BOUNDARY REVISION IBR-1

PART I

DATE: **January 21 , 2014**

NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill. Rev. Stat. 1987 Ch. 96 1/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

~~(I)(We)~~**(The)** **Williamson Energy, LLC**
(Name of Company, Corporation, Partnership or Individual)

PO Box 99, Johnston City, IL. 62951 (Address)

618-983-3017 (Telephone Number)

hereby submit application for an Incidental Boundary Revision to Permit **375**

Name of Mine **Pond Creek Mine No. 1, LLC**

MSHA No. **11-03141**

I, **Anthony Webb** under penalty
(vice president or his duly authorized representative under the existing permit)

of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Title: Authorized Representative

ADDITIONAL ACRES REQUESTED **3.3** EXISTING PERMIT ACREAGE **669.6**

B) Indicate the type of disturbance and associated acreage.

Type of Disturbance	Existing	Permit IBR	Total
Area Stripping	**20.1**	**0**	**20.1**
Mine Waste Areas	**277.4**	**0**	**277.4**
Processing Areas & Support Facilities	**168.8**	**0.3**	**169.1**
Access, Haul Roads & Transport Facilities	**25.7**	**2.5**	**28.2**
Soil Storage Areas	**76.0**	**0.5**	**76.5**
Diversions	**32.8**	**0**	**32.8**
Coal Recovery (Gob & Slurry)	**0**	**0**	**0**
Other (holding pond, pipeline)	**31.6**	**0**	**31.6**
Not to be Disturbed	**37.2**	**0**	**37.2**
Total	**669.6**	**3.3**	**672.9**

2) A) Provide name and address of every legal or equitable owner of record of the IBR area.

RESPONSE: The IBR surface area is owned by:

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, IL. 62812

B) Provide name and address of the owner of record for all surface and subsurface areas contiguous to any part of the proposed IBR area.

RESPONSE: Please see the Property Tract Map and the corresponding Property Rights Summary sheet at the end of this Part I of the application.

C) Show location of owners of record of those lands, surface and subsurface, included in or contiguous to the IBR area on pre-mining land use map or another map, if necessary.

RESPONSE: See Tract Map in map section and corresponding Property Rights Summary sheet at the end of this Part I of the application.

3) Provide name and address of any holder of record of leasehold interest for the IBR area.

RESPONSE: Williamson Energy, LLC (applicant) has leasehold interest in the surface and coal.

4) Affidavits, Certifications

A) Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.

RESPONSE: The Affidavit at the end of this Part.

B) Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: The Engineering Certificate is at the end of this Part.

5) Areas Designated Unsuitable for Mining

A) Does proposed IBR area include --

(1) Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?

Yes ___ No **X**

(2) National forest land?

Yes ___ No **X**

(3) Any land which will adversely affect any publicly-owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per Sections 1779.12(b)]?

Yes ___ No **X**
If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1

(4) Any public roads which are to be removed, relocated or temporarily closed?

Yes ___ No **X**.

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

B) Will proposed IBR area be located --

(1) Within 100 feet of the right-of-way line of any public road?

Yes **X** No _____

If yes, explain proposed procedure for complying with regulation section 1761.12(c), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

RESPONSE: **An access road will be constructed to the drill/pump site from Jordan's Fort Road, a public road in Williamson County. Please see General Location Map.**

(2) Within 300 feet measured horizontally from any occupied dwelling?

Yes _X_ No

If so, is waiver provided meeting requirements of Section 1761?
RESPONSE: **Yes --- At the end of this Part I.**

(3) Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?
Yes ____ No _X_

(4) Within 100 feet measured horizontally of a cemetery?
Yes ____ No _X_

C) Are valid existing rights (per 1761.11) claimed for any part of the IBR area?

Yes ____ No _X_

If yes, provide documentation to substantiate claim.

D) Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.

RESPONSE: **A draft copy of the Public Notice is at the end of this Part I of the application. It will be published in the West Frankfort Daily American newspaper.**

Revised 1/25/12

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" on the line below if that item is relevant.

(1) _____ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

(2) _____ Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

(3) Certification of the Illinois Environmental Protection Agency-35 Ill. Adm. Code 405.104(a) Permit.

__X__ In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

INDIVIDUAL P.E. CERTIFICATION

James J. Webb
Name

062-046528
Illinois Registration Number

JAMES J. WEBB
REGISTERED
062-046528
ILLINOIS
(Seal)

Firm

503 N. Commercial St-Suite A, Harrisburg, Il. 62946
Address

(618) 715-0870
Phone Number

Signature

1/20/2014
Date

PROFESSIONAL DESIGN FIRM CERTIFICATION

Complete if applicable. If not, respond N/A.

__N/A__ As an employee of a "professional design firm" as defined by the Illinois Department of Financial and Professional Regulation, I certify that the professional design firm is registered and in good standing with the Illinois Department of Financial and Professional Regulation.

Professional Design Firm Name

Professional Design Firm Number

AFFIDAVIT

(I)(~~We~~), **Abijah Queen**
(Individual or Individuals)

under penalties of perjury, declare on behalf of the applicant, **Williamson Energy, LLC**, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area that is located in sections 17 and 18, all in Williamson County, Illinois, and such legal right is not in any way the subject of pending court litigation.

Dated this 28th day of **January** **2014**

Abijah Queen / Authorized Person
Signature/Title

Sworn and subscribed before me

this 28th day of January **2014**

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

Gwen Finnegan
Notary Public

9-6-15
My commission expires

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 28th day of JANUARY, 2014, from New River Royalty, LLC, a Delaware limited liability company, of 208 Public Square, 4th Floor, Benton, Illinois, 62812, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

16009 Jordan's Fort Rd, Pittsburg, IL 62974

East 3/4 of the South 1/2 of the Northeast 1/4, Section 18, except the south 1/4 and except the North 1/3 thereof, Township 8 South, Range 4 east, of the 3rd Principal Meridian, Williamson County, Illinois.

Tax Parcel Number 4-18-200-014

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling for a period of 5 years from execution of this Waiver and Consent, renewable upon mutual consent no later than 4 years from the execution date of this agreement; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

Robert R. Bay 1/22/14
New River Royalty, LLC

STATE OF ILLINOIS)
) SS
COUNTY OF WILLIAMSON)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Rob Boyd (Robert R.), personally known to me to be the the duly authorized person of New River Royalty, LLC, a Delaware Limited Liability Company, and personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as such authorized person pursuant to authority given by the Members of said limited liability company, as his free and voluntary act, and as the free and voluntary act and deed of said Company, for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 28th day of January, 2014.

Gwen Finnegan
Notary Public

My Commission Expires:
9-6-15

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

PROPERTY RIGHTS SUMMARY

SURFACE OWNERSHIP OF PROPOSED PERMIT AREA

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, Il 62812

Walter & Phillis Jagiello
16842 Gaynelle Ave.
Tinley Park, IL. 60477

Unrecorded Surface Land Lease Agreement by and between New River Royalty LLC and Williamson Energy LLC.

Unrecorded Surface Waiver and Consent by and between New River Royalty LLC and Williamson Energy LLC executed pursuant to 62 Ill.Adm.Code 1761.15(b).

SURFACE OWNERSHIP / CONTROL CONTIGUOUS TO PROPOSED PERMIT AREA

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, IL 62812

Walter & Phillis Jagiello
16842 Gaynelle Ave.
Tinley Park, IL. 60477

Williamson County Highway
1817 N. Court Street
Marion, IL 62959

SUBSURFACE OWNERSHIP OF PROPOSED PERMIT AREA

WPP, LLC
c/o Natural Resources Partners, L.P.
5260 Irwin Dr.
Huntington, WV 25705

Williamson Energy, LLC (Leasehold from WPP LLC)
P. O. Box 99
Johnston City, IL 62951

SUBSURFACE OWNERSHIP CONTIGUOUS TO PROPOSED PERMIT AREA

WPP, LLC
c/o Natural Resources Partners, L.P.
5260 Irwin Dr.
Huntington, WV 25705

Williamson Energy, LLC (Leasehold from WPP LLC)
P. O. Box 99
Johnston City, IL 62951

NOTE: Applicant has leasehold interest to the coal under the proposed permit area.

RIGHTS CLAIMED BY APPLICANT

The right to conduct mining and reclamation operations within the approved and proposed areas of coal mining. See Mining Affidavit at end of PART I.

PUBLIC NOTICE

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy, LLC, P. O. Box 99, Johnston City, IL 62951, hereby gives notice that a request for a 3.3 acre Incidental Boundary Revision (IBR) was submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division under the provisions of Section 1774.13 (d) (2 to complete a mine service borehole to be used for pumping water from the underground workings to an existing permitted waterline. The applicant will also bore under Jordan's Fort Road and run the waterline under the road in a casing and hook up to an existing waterline beyond the road. The public road will not be disturbed.

The proposed permit area is described: Part of the S/2, S/2, NE/4, and Part of the NW/4, NW/4, SE/4, all in Sec. 18, Township 8S, R4E of the 3rd Principal Meridian, Williamson County, IL, containing approximately 3.3 acres.

The physical location is approx. 1/2 mile north of the intersection of Jordan's Fort Road with Corinth Road, in Williamson County, Illinois.

The applicant is also requesting to construct an access road off of, and perpendicular to, Jordan's Fort Road, a public road.

Copies of the application are on file for inspection at the following office, and written comments may be addressed to: Illinois Department of Natural Resources, Office of Mines & Minerals, Land Reclamation Div., One Natural Resources Way, Springfield, IL 62702-1271.

The closing date of the comment period for this IBR is seven (7) days from the date of this Public Notice. The general public may submit comments and requests for hearings regarding activities within 100 feet of the public road ROW within 14 days following the publication of this notice.

PART II

PREMINING INFORMATION

Premining information is to be displayed on premining land use map unless otherwise indicated.

1) Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different than the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.

RESPONSE: **The permit boundary will be marked by PVC pipe set over steel fence post ("T"-Posts). From any single post, the posts on either side will be visible.**
For permit reference point, the intersection of Corinth Road and Jordon's Fort Road is approximately one-half mile South of the proposed permit area, on the west side of Jordan's Fort Road. This reference point is noted on the General Location Map.

2) Explain and locate areas where the IBR is contiguous to an existing permit.

RESPONSE: **Please see the General Location Map and the other maps included with this application.**

3) Give the acreages of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on premining land use map existing land uses in the proposed permit area and adjacent to it. Include on the premining land use map the location of all buildings and identify the current use of these buildings.

Pre-Mining Land Use	Existing Permit	IBR	Total
Cropland	524.7	0	524.7
Pasture land	6.6	0	6.6
Grazing Land	0	0	0
Forestry	107.9	3.3	111.2
Residential	5.8	0	5.8
Industrial/Commercial	3.5	0	3.5
Recreation	0	0	0
Fish and Wildlife Habitat	19.7	0	19.7
Developed Water Resources	1.4	0	1.4
Undeveloped land	0	0	0
Total	669.6	3.3	672.9

4) Soils Information Map

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes __X__ No ____. If no, explain.

B) Delineate on the soils map(s) the area which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

RESPONSE: No mining will be conducted on this site.

C) Are any of the identified map units correlated as prime farmland by NRCS criteria? Yes __X__ No ___.

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: All indications are that the proposed IBR Permit Area has never been farmed, or, it has been in forestry for at least the past (+/-)40 years. A Prime Farmland Exemption is requested.

D) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: See Soils Information Chart at the end of this Part II.

E) Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.

RESPONSE: See Soils Information Chart at the end of this Part along with Soils Map.

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes _____ No __X__. If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

PART II (Cont'd)

SOILS INFORMATION CHART

Soil Type	Name	*Slope Class (%)*	*LandUse Capability*	**Crop Productivity Index for Optimum Management*	*PERMIT AREA (ACRES)* *Prime Farmland Soils*	*Other Soils*	*TOTALS (Acres)*
Silt Loam	**Ava (14 C2)**	**5-10**	**III-e**	**93**		**0.5**	**0.5**
Silty Clay Loam	**Ava (14C3)**	**5-10**	**III-e**	**93**		**0.1**	**0.1**
Silt Loam	**Grantsburg (301B)**	**2-5**	**II-e**	**97**	**0.7**		**0.7**
Silty Clay Loam	**Zanesville (340D3)**	**10-18**	**IV-e**	**75**		**1.3**	**1.3**
Clay Loam	**Hickory-Kell (908D3)**	**10-18**	**IV-e**	**80**		**0.2**	**0.2**
Silt L:oam	**Sharon (3072A) (frequently flooded)**	**0-2**	**II-w**	**122**	**0.5**		**0.5**
							Total=3.3 Ac

*** Soils information taken from the USDA/NRCS Soil Web site. Productivity Index Number was calculated from the University of Illinois, College of Agricultural — Bulletin 811, Optimum Crop Productivity Ratings for Illinois Soil, published in August, 2002**

R10917

R10918

Soil Map—Williamson County, Illinois
(soil map)



Map Scale: 1:2,220 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2011—Oct 21, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R10919

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	0.5	15.2%
14C3	Ava silty clay loam, 5 to 10 percent slopes, severely eroded	0.0	0.3%
301B	Grantsburg silt loam, 2 to 5 percent slopes	0.7	22.0%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	1.3	39.5%
908D3	Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded	0.2	7.2%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	0.5	15.9%
Totals for Area of Interest		**3.3**	**100.0%**

Williamson County, Illinois

14C2—Ava silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, eroded, and similar soils: 90 percent

Description of Ava, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Silt loam
9 to 28 inches: Silty clay loam
28 to 64 inches: Silt loam
64 to 78 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Williamson County, Illinois

14C3—Ava silty clay loam, 5 to 10 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, severely eroded, and similar soils: 90 percent

Description of Ava, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 4.9 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Silty clay loam
9 to 28 inches: Silty clay loam
28 to 64 inches: Silt loam
64 to 78 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Williamson County, Illinois

301B—Grantsburg silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Grantsburg and similar soils: 90 percent

Description of Grantsburg

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over residuum

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 11 inches: Silt loam
11 to 24 inches: Silt loam
24 to 38 inches: Silty clay loam
38 to 61 inches: Silt loam
61 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Williamson County, Illinois

340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Zanesville, severely eroded, and similar soils: 90 percent

Description of Zanesville, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over residuum

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 19 to 32 inches to fragipan; 40 to 80 inches to paralithic bedrock; 40 to 80 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: D

Typical profile

0 to 2 inches: Silty clay loam
2 to 19 inches: Silty clay loam
19 to 37 inches: Silt loam
37 to 55 inches: Channery silt loam

55 to 65 inches: Bedrock

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Williamson County, Illinois

908D3—Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Hickory, severely eroded, and similar soils: 50 percent
Kell, severely eroded, and similar soils: 40 percent

Description of Hickory, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Sodium adsorption ratio, maximum: 2.0
Available water capacity: High (about 9.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: B

Typical profile

0 to 8 inches: Clay loam
8 to 46 inches: Clay loam
46 to 58 inches: Clay loam
58 to 80 inches: Loam

Description of Kell, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Clay loam
7 to 13 inches: Clay loam
13 to 35 inches: Very channery silt loam
35 to 60 inches: Bedrock

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Williamson County, Illinois

3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Sharon, frequently flooded, and similar soils: 90 percent

Description of Sharon, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Very high (about 12.4 inches)

Interpretive groups

Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season
Land capability (nonirrigated): 2w
Hydrologic Soil Group: B

Typical profile

0 to 13 inches: Silt loam
13 to 40 inches: Silt loam
40 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

PART III

OPERATIONS PLAN

1) Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.

RESPONSE: **The proposed operation is the completion of two boreholes. One is to be used to set a pump and pump water from the underground workings to the surface where the water will then be pumped through a buried waterline to an existing permitted waterline. The waterline installation will include a road boring under Jordan's Fort Road. The road boring is mentioned in the Public Notice. An electrical power supply line will be buried alongside the buried waterline. A borehole for a monitoring well will also be drilled. Please see the Operations Map in the Map Section.**
The pump hole will be approximately 480 feet in depth, and the steel casing will be 13 3/8-inch diameter set from above the ground surface to immediately above the mine roof. The monitoring well will be also be approximately 480 feet deep, and it will be cased with 6 5/8 inch steel.

2) Surface Drainage Control

A) (1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems. Show drainage patterns of all affected mining areas.

RESPONSE: **The surface drainage pattern is indicated on the attached Pre and Post-Mine Surface Topography Map.**

(2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?

Yes ___ No **X** .

If yes, delineate how and where surface drainage will be collected and treated, and list permit numbers and type of permit that the drainage control systems are operated under. If above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: **A sediment pond exemption is requested for this permit area due to its small size (3.3 acres). Silt fence and/or straw bales will be placed along the down-slope edge of the disturbed area to minimize sediment loss from the disturbed areas.**

The topsoil piles will be seeded and mulched to reduce runoff and promote growth. The work-yard area will be rocked, and the rock will also reduce sediment loss.

Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes ____ No __X__.

If no, please discuss

RESPONSE: **Very little overland surface drainage will migrate to/from this site.**

C) Overland Flow Diversions and Sediment Ponds:

Are either overland flow diversions or sediment ponds to be constructed?

Yes ___ No __X__.

If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (surface drainage control).

D) Does a perennial or intermittent stream occur within the proposed IBR area?

Yes ___ No __X__.

If yes, is an exception to the 100 foot buffer zone being requested or is a stream diversion being proposed. For an exception to the 100 foot buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

3) Roads and other activities

A) Are roads to be constructed in the IBR area?

Yes __X__ No ____

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: **An access road will be constructed to the pump borehole site. The transportation facilities section is at the end of this Part.**

B) If the operations involve other activities not specifically addressed above complete applicable parts of the SCM-1 or UCM-1.

4) Are any existing structures proposed for utilization in the IBR?
. Yes ___ No __X__. If yes, complete Part IV.4 of the SCM-1 or UCM-1.

TRANSPORTATION FACILITIES - (From UCM-1)

1) Provide a detailed description on mining operations map or other map and show location of the following:

   a) Proposed road(s), conveyor system(s), or rail system.

   b) Related sediment control facilities.

   c) Earth borrow locations and/or locations for deposition of excess excavation.

RESPONSE: 1)a)b)c) The Surface Operation Map in the Map Section indicates the proposed access road location. It will be gravel surfaced on subsoil subgrade. A geotextile fabric will be placed on top of the subsoil subgrade, if it is determined to be necessary.

2) Provide specifications and plan profiles of existing gradeline, proposed road centerline, ditch flow lines, road cut, fill embankment, culvert, bridge and drainage structures. Provide typical cross sections where appropriate.

RESPONSE: A typical access road plan follows this page. Two culverts will be placed in the proposed access roadway. The large culvert, just north of the drill hole site, will be at least 48 –inches in diameter. The smaller culvert, midway along the access road, will be at minimum 24- inches in diameter. See Culvert Calculations worksheet following this page. (Talbot's Formula).

3) For all transportation facilities to be constructed, provide construction details for all sediment control facilities to be constructed to prevent additional contributions of suspended solids to streamflow or to runoff outside the permit area.

RESPONSE: For this relatively small area used for the access road, the limestone rocked surface will prevent contributions of soil suspended solids. Straw bales and/or silt fence will be staked on the down-slope of the proposed permit edge to capture surface runoff where erosion would likely occur due to soil disturbance. soil disturbance .

4) Discuss the revegetation of ditch and borrow areas involved in construction.

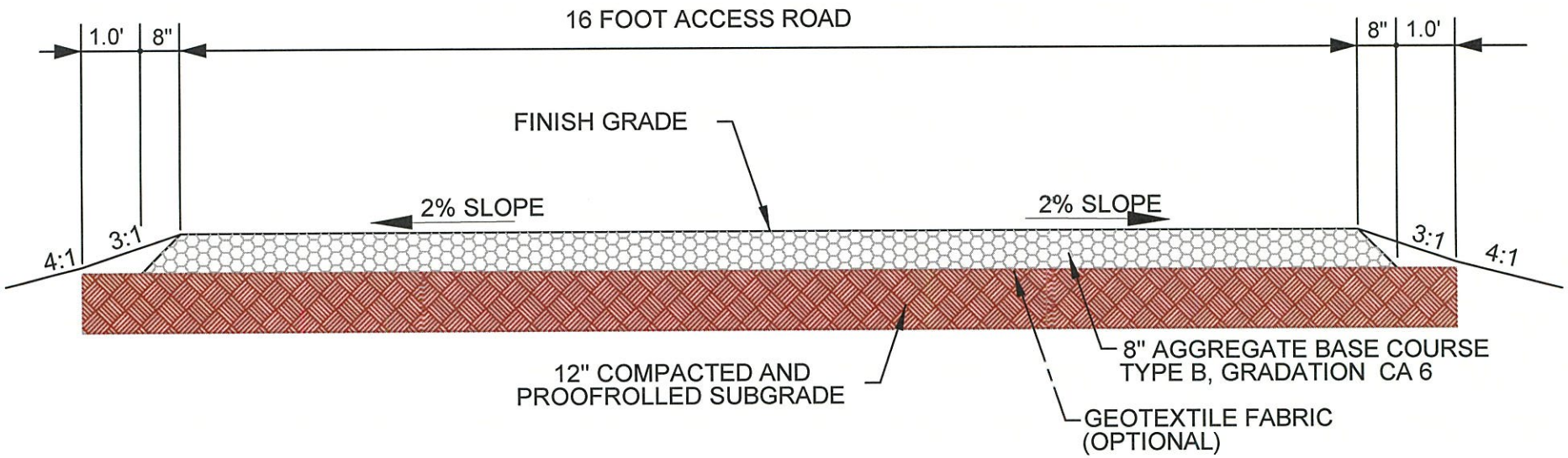
RESPONSE: See Part IV - Reclamation Plan.

5) Discuss the estimated life of each facility and how materials will be removed when the facility becomes inactive.

RESPONSE: The life of the facility is anticipated to be approximately (+/-) five years. See Part IV - Reclamation for facility closing plan.

TYPICAL ACCESS GRAVEL ROAD SECTION

NOT TO SCALE



R10933

Question from Engineering Review of DRAFT IBR Dated 1/21/2014:

"Upon review of the culvert design calculations, the Applicant has utilized Talbots Formula. The Applicant shall provide additional information clarifying these calculations take into account the design to safely pass the peak runoff from a 10 year-6 hour precipitation event in accordance with 62 Ill. Adm. Code 1817.151(d)(1)".

Response:

*The applicant used **Talbots Table for Round Culvert Sizing** as shown in the attached chart. This chart is based on Talbots formula for a 2.5-inches per hour rainfall event.*

*The attached 10-yr. 6 hr. hydrograph was taken from **Bullentin 71-Rainfall Frequency Atlas of the Midwest (Illinois State Water Survey) by Floyd Huff and James Angel.** This hydrograph shows 3.75 inches of rain for the North East portion of Williamson County for the 6 hour duration of a 10 year event. This equates to an average of .625 inches of rain per hour for this 10 year event.*

*Therefore, the 2.5 inches/hour used in the Talbots Table provides for a culvert size that is **more than required** to accommodate the .625 inches/hour as required by a 10 year-6 hour event in accordance with 62 Ill. Adm. Code 1817.151(d)(1).*

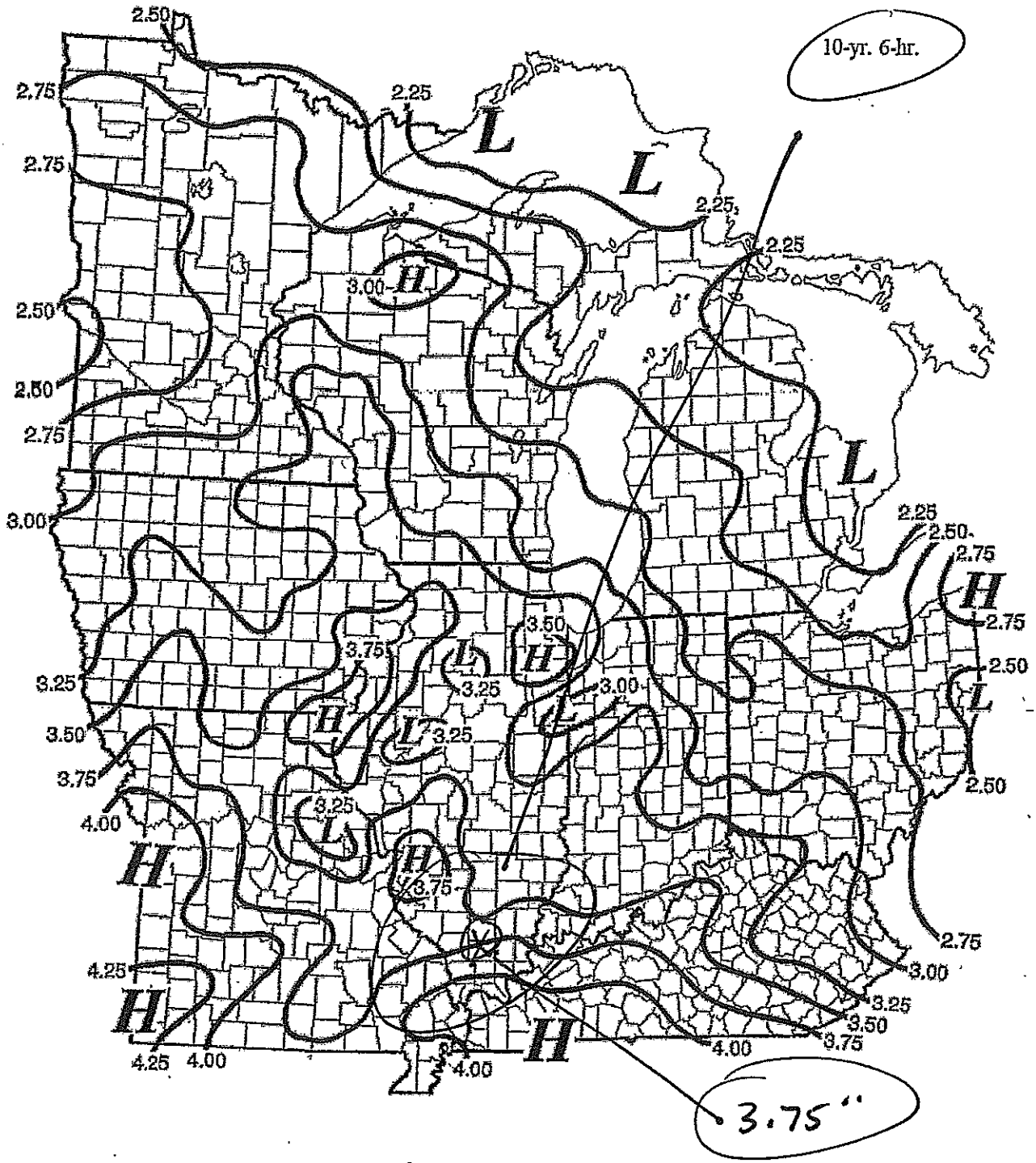


Figure 4. Continued

WATERSHED = 8.9 Acres = 24-inch Culvert

Appendix 9: Talbot's Table for Round Culvert Sizing

Based on Talbot's formula for a 2.5-inches per hour rainfall.

Area in square feet required for waterway

No. of acres	Impervious 100% runoff	Steep slopes, heavy soils, moderate cover		Moderate slopes, heavy to light soils, dense cover		Gentle slopes, agricultural soils and cover		Flatland pervious soils
	C = 1.00	C = .80	C = .70	C = .60	C = .50	C = .40	C = .30	C = .20
2	1.0	0.8	0.7	0.6				
4	1.7	1.4	1.2	1.0				
6	2.3	1.9	1.6	1.4	1.2	0.9	0.6	
8	2.9	2.3	2.0	1.7	1.4	1.2	0.9	0.6
10	3.4	2.7	2.4	2.0	1.7	1.4	1.0	0.7
20	5.8	4.6	4.0	3.5	2.9	2.3	1.7	1.2
30	8.0	6.3	5.4	4.8	4.0	3.2	2.4	1.6
40	9.8	7.8	6.8	5.9	4.9	3.9	3.0	2.0
50	11.6	9.3	8.0	7.0	5.8	4.6	3.5	2.3
60	13.4*	10.7	9.2	8.0	6.7	5.3	4.0	2.7
70	15.0	12.0	10.3	9.0	7.5	6.0	4.5	3.0
80	16.6	13.3	11.5	10.0	8.3	6.6	5.0	3.3
90	18.2	14.6	12.5	11.0	9.1	7.2	5.4	3.6
100	19.7	15.8	13.5	11.8	9.8	7.8	5.8	3.9
150	26.9	21.2	18.5	16.0	13.3	10.7	8.0	5.4
200	33.2	26.8	22.9	20.0	16.7	13.3	10.0	6.6
250	39.5	31.5	27.1	23.8	19.7	15.7	11.8	7.9
300	45.7	36.1	31.0	27.1	27.0	18.0	13.5	9.0
350	51.0	40.6	35.0	30.5	25.3	20.2	15.0	10.1
400	56.0	45.0	39.0	33.9	28.0	22.2	16.7	11.2
450	61.7	49.7	42.0	37.0	30.6	24.2	18.0	12.3
500	66.8	52.8	46.0	40.0	33.2	26.5	19.8	13.2
600	77.0	61.6	52.5	46.0	38.2	30.3	22.8	15.3
700	86.0	68.4	59.5	52.0	43.0	34.0	25.8	17.2
800	96.0	76.1	65.8	57.0	47.5	38.0	28.5	19.0
900	104.0	83.0	71.7	62.2	51.9	41.5	31.1	20.8
1000	113.0	90.0	77.7	68.0	56.5	45.0	33.7	22.4

*Culverts larger than 48 inches in diameter are discouraged. Where watersheds require culverts larger than 48 inches, bridges, fords, or multiple culverts may provide a more suitable crossing solution.

Sizes of round pipe needed for areas of waterway listed in drainage table

Area *(square feet)*	Diameter *(inches)*
1.25	15
1.80 (2.0)	18
3.10	24
4.90	30
7.10	36
9.60	42
12.60	48

R10937

WATERSHED = 53.6 Acres = 48-inch Culvert

Appendix 9: Talbot's Table for Round Culvert Sizing

Based on Talbot's formula for a 2.5-inches per hour rainfall.

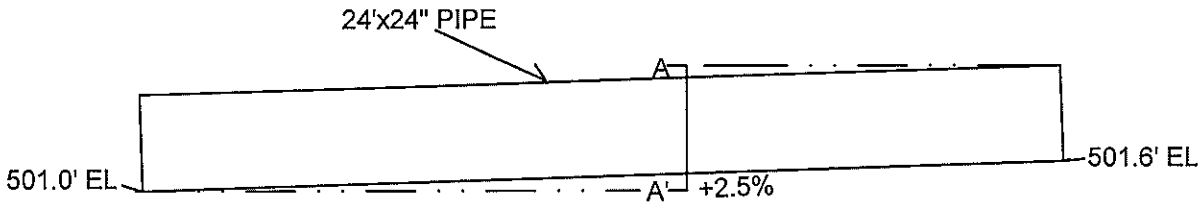
Area in square feet required for waterway

No. of acres	Impervious 100% runoff	Steep slopes, heavy soils, moderate cover		Moderate slopes, heavy to light soils, dense cover		Gentle slopes, agricultural soils and cover		Flatland pervious soils
	C = 1.00	C = .80	C = .70	C = .60	C = .50	C = .40	C = .30	C = .20
2	1.0	0.8	0.7	0.6				
4	1.7	1.4	1.2	1.0				
6	2.3	1.9	1.6	1.4	1.2	0.9	0.6	
8	2.9	2.3	2.0	1.7	1.4	1.2	0.9	0.6
10	3.4	2.7	2.4	2.0	1.7	1.4	1.0	0.7
20	5.8	4.6	4.0	3.5	2.9	2.3	1.7	1.2
30	8.0	6.3	5.4	4.8	4.0	3.2	2.4	1.6
40	9.8	7.8	6.8	5.9	4.9	3.9	3.0	2.0
50	11.6	9.3	8.0	7.0	5.8	4.6	3.5	2.3
60	13.4*	10.7	9.2	8.0	6.7	5.3	4.0	2.7
70	15.0	12.0	10.3	9.0	7.5	6.0	4.5	3.0
80	16.6	13.3	11.5	10.0	8.3	6.6	5.0	3.3
90	18.2	14.6	12.5	11.0	9.1	7.2	5.4	3.6
100	19.7	15.8	13.5	11.8	9.8	7.8	5.8	3.9
150	26.9	21.2	18.5	16.0	13.3	10.7	8.0	5.4
200	33.2	26.8	22.9	20.0	16.7	13.3	10.0	6.6
250	39.5	31.5	27.1	23.8	19.7	15.7	11.8	7.9
300	45.7	36.1	31.0	27.1	27.0	18.0	13.5	9.0
350	51.0	40.6	35.0	30.5	25.3	20.2	15.0	10.1
400	56.0	45.0	39.0	33.9	28.0	22.2	16.7	11.2
450	61.7	49.7	42.0	37.0	30.6	24.2	18.0	12.3
500	66.8	52.8	46.0	40.0	33.2	26.5	19.8	13.2
600	77.0	61.6	52.5	46.0	38.2	30.3	22.8	15.3
700	86.0	68.4	59.5	52.0	43.0	34.0	25.8	17.2
800	96.0	76.1	65.8	57.0	47.5	38.0	28.5	19.0
900	104.0	83.0	71.7	62.2	51.9	41.5	31.1	20.8
1000	113.0	90.0	77.7	68.0	56.5	45.0	33.7	22.4

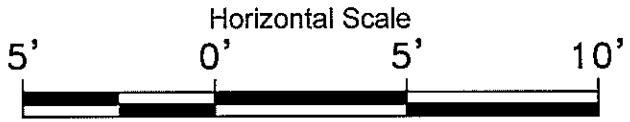
*Culverts larger than 48 inches in diameter are discouraged. Where watersheds require culverts larger than 48 inches, bridges, fords, or multiple culverts may provide a more suitable crossing solution.

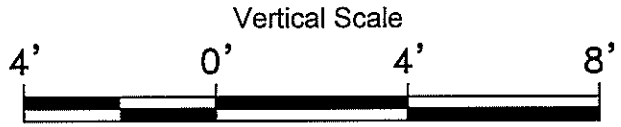
Sizes of round pipe needed for areas of waterway listed in drainage table

Area *(square feet)*	Diameter *(inches)*
1.25	15
1.80	18
3.10	24
4.90	30
7.10	36
9.60	42
12.60	48



24' x 24" Culvert @ STA 1 + 070





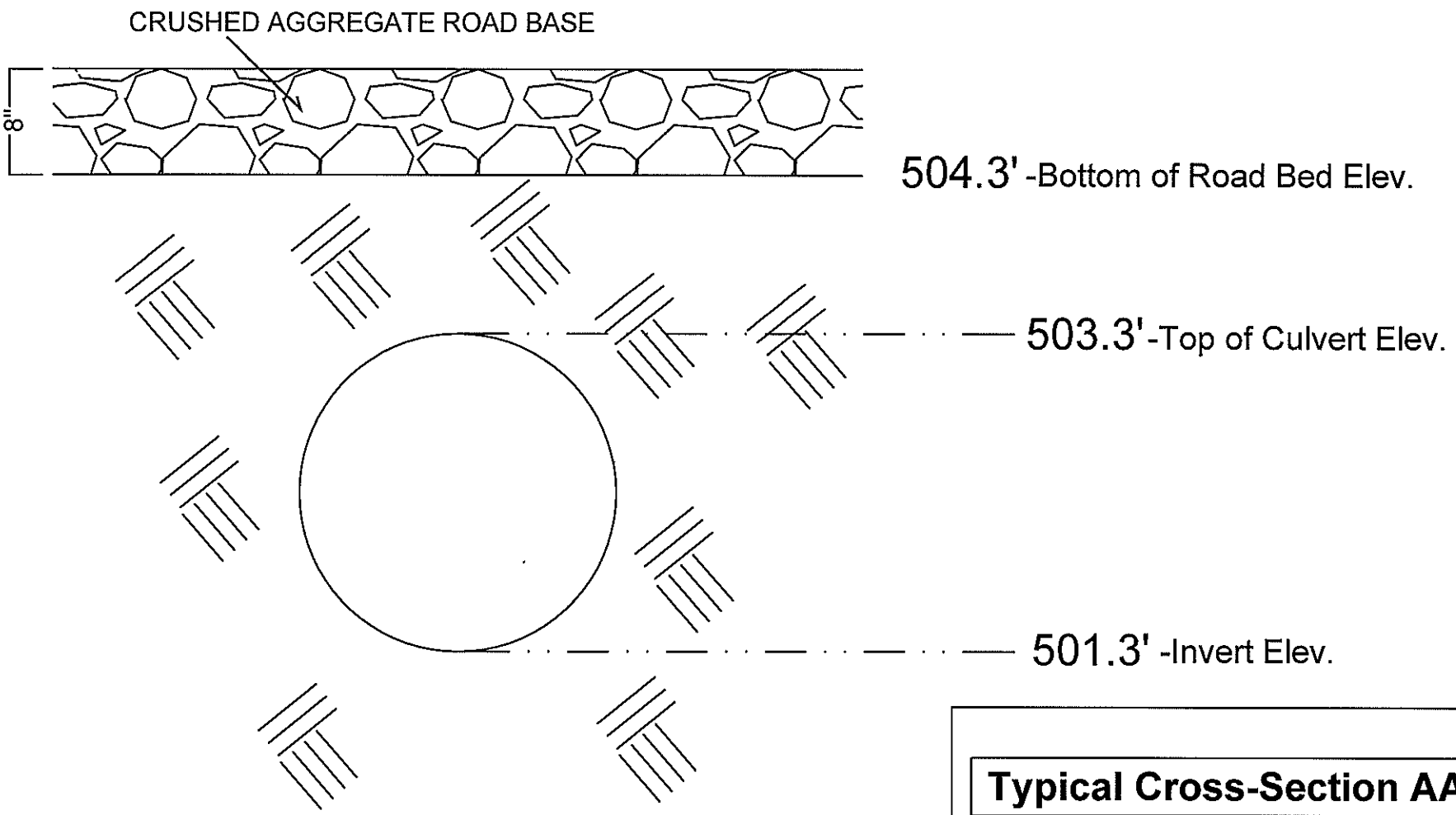
Typical Culvert Profile AA

TG#2, Break 27 IBR

CBC Engineers

Drawn By WDD	Date 1/29/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
Approved By JW	Date 1/29/14	POND CREEK MINE NO. 1
Revised:		Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale as noted	Project No. 15463I	Rev. / Map #

R10938



24" Culvert @ STA 1 + 070
Typ. Culvert Cross Section AA

1' 0' 1' 2'

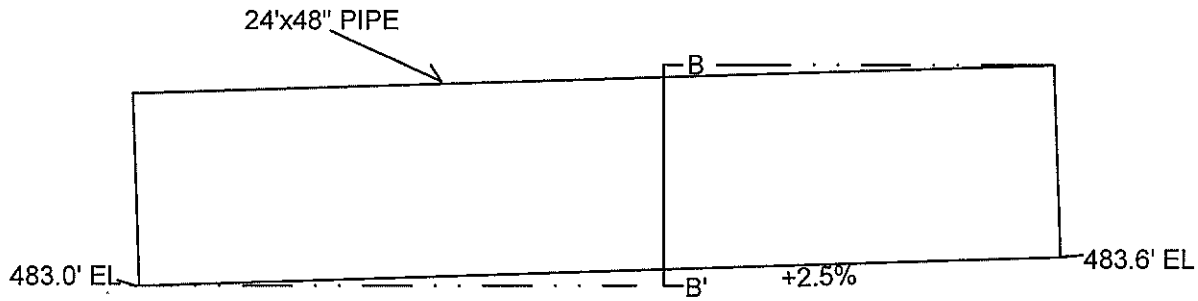
Typical Cross-Section AA

TG#2, Break 27 IBR

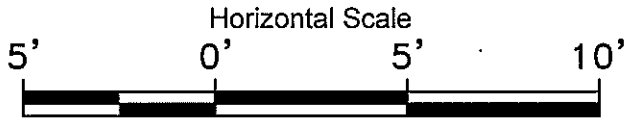
CBC Engineers

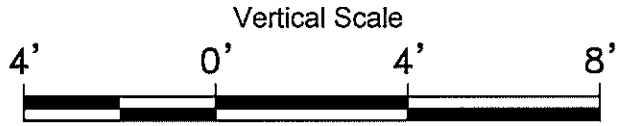
Drawn By WDD	Date 1/29/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
Approved By JW	Date 1/29/14	POND CREEK MINE NO. 1
Revised:		Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale 1"=1'	Project No. 15463I	Rev. / Map #

R10939



24' x 48" Culvert @ STA 1 + 015





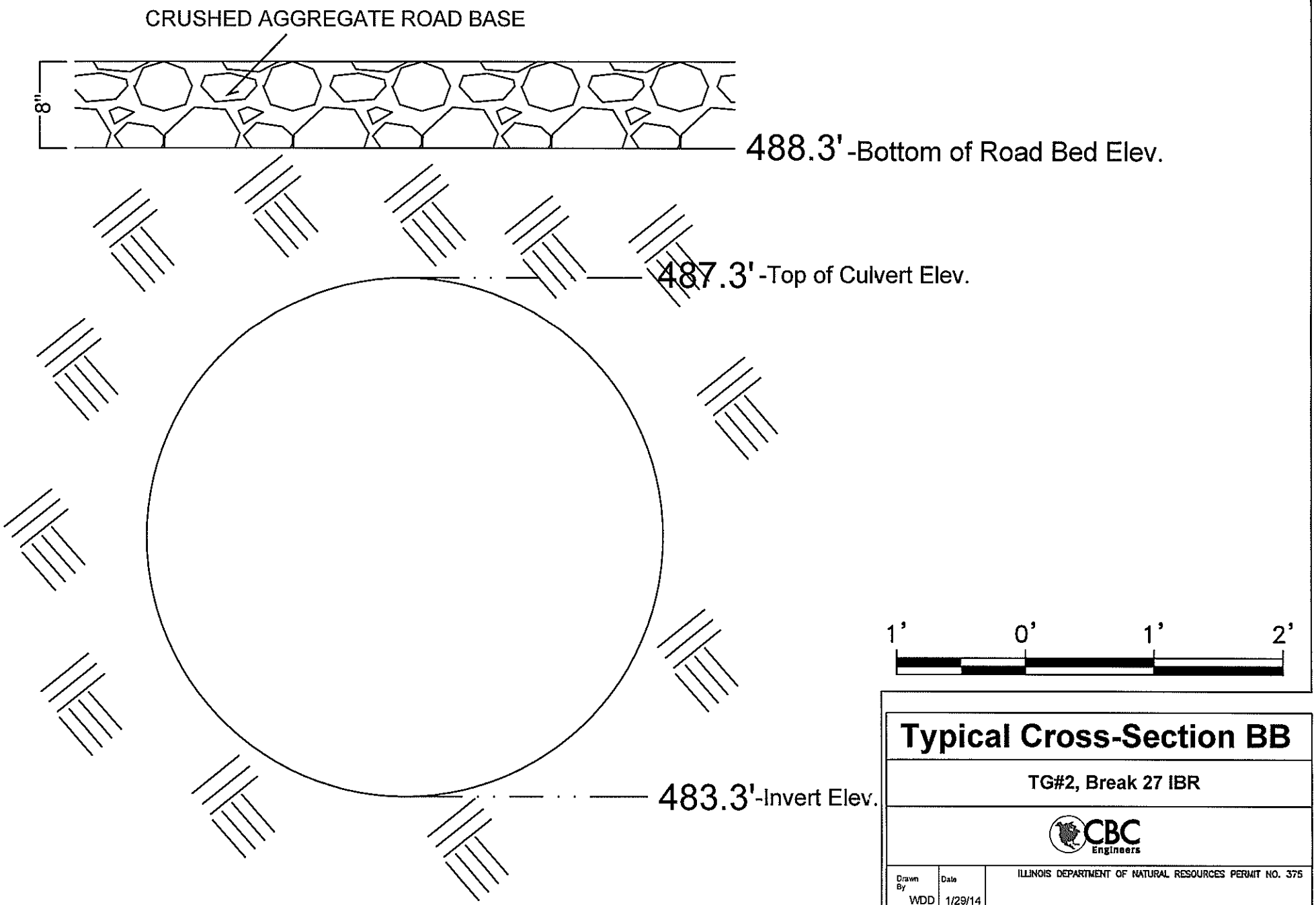
Typical Culvert Profile BB

TG#2, Break 27 IBR

CBC Engineers

Drawn By WDD	Date 1/29/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
Approved By JW	Date 1/29/14	POND CREEK MINE NO. 1
Revised:		Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale as noted	Project No. 15463l	Rev. / Map #

R10940



48" Culvert @ STA 1 + 015
Typ. Culvert Cross Section BB

Typical Cross-Section BB

TG#2, Break 27 IBR

CBC Engineers

Drawn By: WDD	Date: 1/29/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
Approved By: JW	Date: 1/29/14	POND CREEK MINE NO. 1
Revised:		Prepared For: WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale: 1"=1'	Project No.: 15463I	Rev.: / Map #:

R10941

sdw Engineering Progress

CULVERT FOR 53.6 Acre DRAINAGE AREA = 48 INCH DIA.

Talbots Formula

· Hydrology

- Flood Characteristics of Mississippi Streams
- Runoff Curve No.
- Time of Concentration
- Rational C Values
- Mississippi Rainfall Amounts
- Concrete Pipe Sizes
- ADS Pipe Sizes

· Hydraulics

- Pipe Flow
- Channel Flow
- Manning's Formula
- Kutter's Formula
- Talbot's Formula
- Weir Flow
- Head Loss
- Tank Discharge
- Drop Inlet Flow

- Pipe Data
- Equivalent Dia.
- Ductile Iron Pipe
- Sewer Houses
- Average Monthly Water Use
- Non-Residential Water Demand
- Froelich Dam Breach Predictor Equations

• Roadway

- Horizontal Curves
- Vertical Curves
- Parking Lot Design
- Rural Intersections

• Structural

- Allowable Bearing Capacity
- Simple Beam - Uniform Load
- Simple Beam - Triangular Load
- Simple Beam - Load Increasing to Center
- Simple Beam - Concentrated Load
- Plastic Section Modulus
- Welded Wire Fabric
- Reinforcing Steel

Talbot's Formula

$a = C * A^{3/4}$

- a = Required section of waterway in square feet
- A = Drainage area in acres
- C = Talbot's coefficient

Input Data:			Results:		
Drainage Area =	53.6	Ac.	Waterway Area =	11.89	ft²
Talbot's Coefficient =	0.6		Pipe Size =	48	in.

Talbot's Coefficient

	Mountainous		Hilly Land		Rolling Land		Flat Land	

C =	1.00	0.80	0.60	0.50	0.40	0.30	0.20

Pipe Areas

Pipe Size	Pipe Area
12 Inch Pipe:	0.79 ft²
18 Inch Pipe:	1.77 ft²
24 Inch Pipe:	3.14 ft²
30 Inch Pipe:	4.91 ft²
36 Inch Pipe:	7.07 ft²
42 Inch Pipe:	9.62 ft²
48 Inch Pipe:	12.57 ft²
54 Inch Pipe:	15.90 ft²
60 Inch Pipe:	19.63 ft²
66 Inch Pipe:	23.76 ft²
72 Inch Pipe:	28.27 ft²

301 2nd Ave | Hattiesburg, MS 39401 | (p) 601.544.1821 | (f) 601.544.0501

© 2012 SHOWS, DEARMAN & WAITS, INC.
site by RARE

sdw Engineering Progress

- Links
- Warranty
- Site Map
- Contact Us

Search

- **Home**
- **About**
- **Capabilities**
- **Our Work**
- **Our People**
- **Clients**
- **Civil Programs**
- **News**

CULVERT FOR 8.9 ACRE AREA DRAINAGE = 24 inches DIA.

Talbots Formula

· Hydrology

- Flood Characteristics of Mississippi Streams
- Runoff Curve No.
- Time of Concentration
- Rational C Values
- Mississippi Rainfall Amounts
- Concrete Pipe Sizes
- ADS Pipe Sizes

· Hydraulics

- Pipe Flow
- Channel Flow
- Manning's Formula
- Kutter's Formula
- Talbot's Formula
- Weir Flow
- Head Loss
- Tank Discharge
- Drop Inlet Flow

- Pipe Data
- Equivalent Dia.
- Ductile Iron Pipe
- Sewer Houses
- Average Monthly Water Use
- Non-Residential Water Demand
- Froelich Dam Breach Predictor Equations

• Roadway

- Horizontal Curves
- Vertical Curves
- Parking Lot Design
- Rural Intersections

• Structural

- Allowable Bearing Capacity
- Simple Beam - Uniform Load
- Simple Beam - Triangular Load
- Simple Beam - Load Increasing to Center
- Simple Beam - Concentrated Load
- Plastic Section Modulus
- Welded Wire Fabric
- Reinforcing Steel

Talbot's Formula

$a = C * A^{3/4}$

- a = Required section of waterway in square feet
- A = Drainage area in acres
- C = Talbot's coefficient

Input Data:			**Results:**		
Drainage Area =	8.9	Ac.	Waterway Area =	3.09	ft²
Talbot's Coefficient =	0.6		Pipe Size =	24	in.

Talbot's Coefficient

	Mountainous	Hilly Land	Rolling Land	Flat Land

C =	1.00	0.80	0.60	0.50	0.40	0.30	0.20

Pipe Areas

Pipe Size	Pipe Area
12 Inch Pipe:	0.79 ft²
18 Inch Pipe:	1.77 ft²
24 Inch Pipe:	3.14 ft²
30 Inch Pipe:	4.91 ft²
36 Inch Pipe:	7.07 ft²
42 Inch Pipe:	9.62 ft²
48 Inch Pipe:	12.57 ft²
54 Inch Pipe:	15.90 ft²
60 Inch Pipe:	19.63 ft²
66 Inch Pipe:	23.76 ft²
72 Inch Pipe:	28.27 ft²

301 2nd Ave | Hattiesburg, MS 39401 | (p) 601.544.1821 | (f) 601.544.0501

© 2012 SHOWS, DEARMAN & WAITS, INC.
site by RARE

PART IV

RECLAMATION PLAN

1) Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.

RESPONSE: **See the Mine Reclamation Map in the Map Section of this application.**

Topsoil from the access road, water/power line and pump hole work yard will be removed and stored as indicated on the Operations Map. It will be mulched and seeded to protect from erosion.
A temporary drill pit will be dewatered after meeting Illinois stream Standards, or the settled pit water will be pumped into a container, hauled and released to the mine NPDES sedimentation pond.

- **The temporary subsoil stockpile from the borehole drill pit will be placed back in the drill pit, and covered with topsoil.**

- **The borehole will be plugged from top to bottom according to all IDNR Oil and Gas Division regulatory standards after the borehole is no longer needed. The top of casing will be cut off six feet below natural soil level and filled with subsoil, and then covered with topsoil, mulched and seeded.**

- **Rock from the yard/laydown and access road will remain in place to serve as property access where there is no road access now per the request of the landowners.**

2) Post Mining Land Use

A) Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the post-mining land uses on the Post Mining Land Use Map. Acreage figures for post-mining land use must differentiate between mined and surface disturbance areas based on the mining line used in the pre-mining section of the application.

B)

RESPONSE: **Please see the Land Use / Capability Chart on the following page.**

Land Use / Capability Chart

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCrop	Prime	HCap	NonCrop	Prime	HCap	NonCrop
Cropland	9.5	3.5	2.5				9.5	3.5	2.5
Pasture Land		0.8	4.9					0.8	4.9
Grazing Land									
Forestry			14.29			3.3			17.59
Residential			1.51						1.51
Industrial/Commercial									
Recreation									
Fish & Wildlife Habitat (Herbacious)		2.8	42.4					2.8	42.4
Fish & Wildlife Habitat (Woody)		0.8	567.3					0.8	567.3
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.3						19.3
Undeveloped Land									
Total	9.5	7.9	652.2			3.3	9.5	7.9	655.5

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

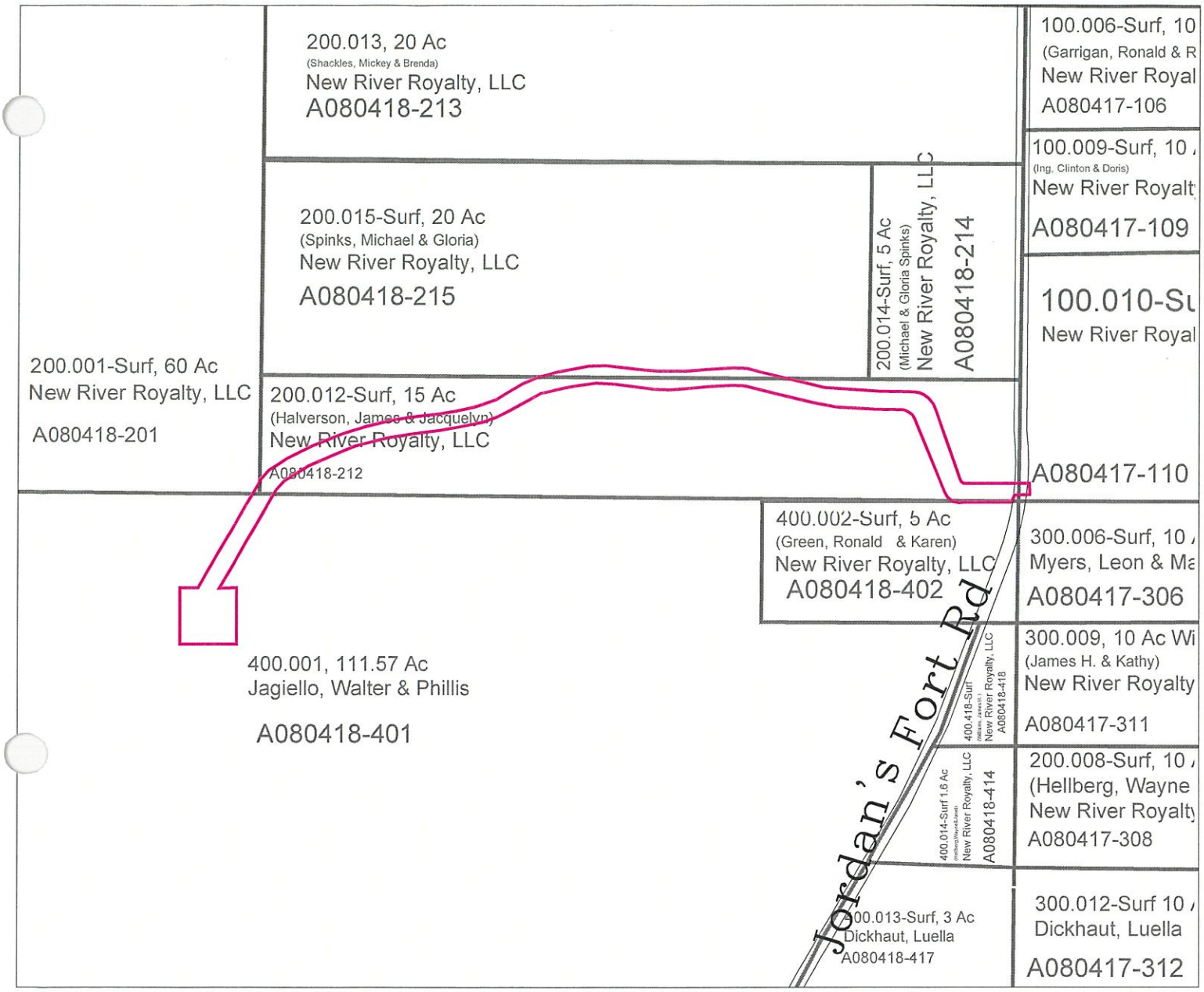
Updated 02/25/2011

3) Pursuant to Section 1784.21, the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.

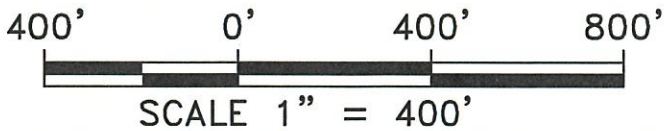
RESPONSE:

The proposed site is 100% forestry. A PEP for this area has been approved by the US Fish and Wildlife Service. If it necessary to take an Indiana Bat habitat tree from the proposed permit area, it will be cut on, or before, the IDNR March 31 tree removal expiration date.

R10951



The Proposed Permit Area is located in part of the S/2, S/2, NE/4, and part of the NW/4, NW/4, SE/4, all in Section 18, in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL, containing approximately 3.3 acres.



Proposed Surface Permit Area

Public Road

300.014, 18.5 Ac
& Brenda
Fleming, Charles

Tract Information Including PIN #, Acreage and Owner's Name

Surface Ownership Map

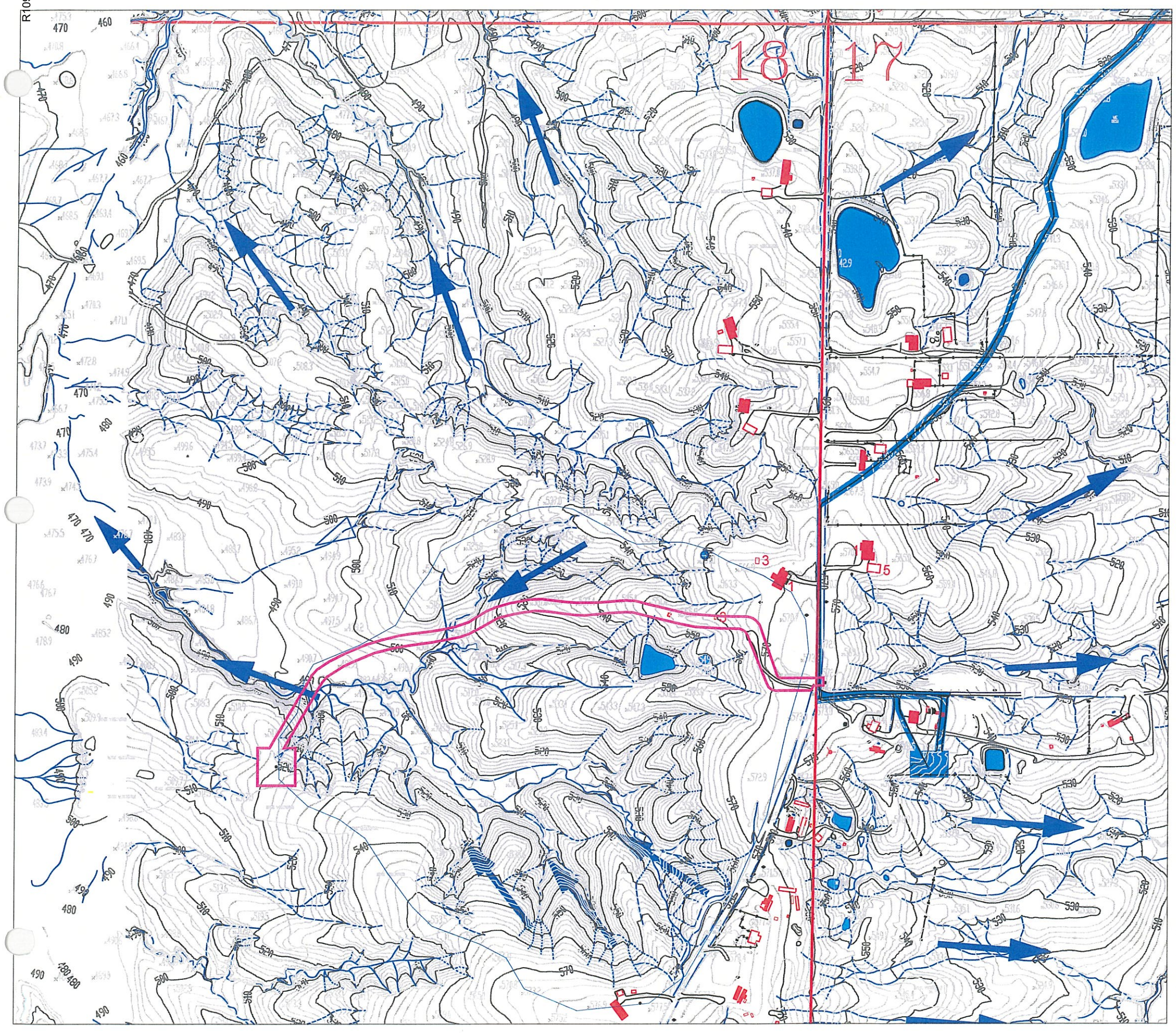
TG#2, Break 27 IBR

CBC Engineers

Drawn By	Date	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
WDD	1/16/14	Surface Ownership Map
		POND CREEK MINE NO. 1
Approved By	Date	Prepared For
GLD	1/17/14	WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

Scale	Project No.	Rev.	Map #
AS NOTED	15463I		Map 2

R10952



N

W E

S

Legend

- Proposed Surface Permit Area
- Pending Surface Permit Area
- Drainage Direction
- Public Road
- 1 Residence (Occupied)
- 1VAC Residence (Unoccupied)
- 2 Mobile Home (Occupied)
- 2VAC Mobile Home (Unoccupied)
- 3 Shed
- 4 Garage
- 5 Barn
- 6 Grain Bin or Silo
- Pond/Lake
- Streams/Lakes/Ditches
- 2' Topo Line
- 10' Topo Line

The Proposed Permit Area is located in part of the S/2, S/2, NE/4, and part of the NW/4, NW/4, SE/4, all in Section 18, in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL, containing approximately 3.3 acres.

400' 0' 400' 800'

SCALE 1" = 400'

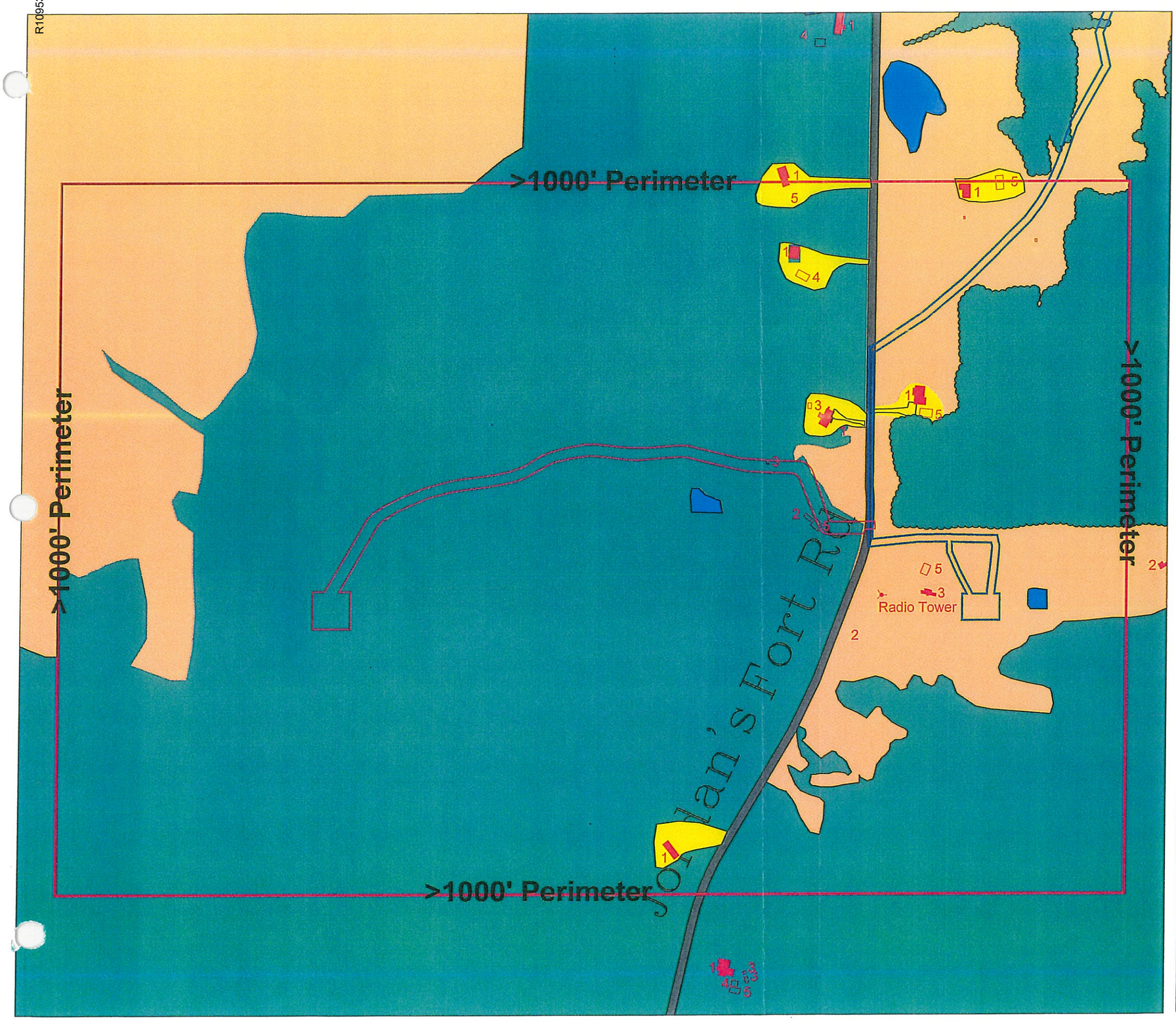
Topographic Map

Tailgate #2, Break 27

CBC Engineers

Drawn By: WDD	Date: 1/19/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375	
		TOPOGRAPHIC MAP	
		POND CREEK MINE NO. 1 REVISION NO. 8	
Approved By: GLD	Date: 1/19/14	Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951	
Scale: AS NOTED		Project No.: CBC-15463I	Rev.
			Map #: Map 3

R10953



N
W E
S

LEGEND

- Forestry
- Pastureland
- Residential
- Proposed IBR Boundary
- Pending Permit Area
- Road
- 1 Residence (Occupied)
- 1VAC Residence (Unoccupied)
- 2 Mobile Home (Occupied)
- 2VAC Mobile Home (Unoccupied)
- 3 Shed
- 4 Garage
- 5 Barn
- 6 Grain Bin or Silo

The Proposed Permit Area is located in part of the S/2, S/2, NE/4, and part of the NW/4, NW/4, SE/4, all in Section 18, in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL, containing approximately 3.3 acres.

400' 0' 400' 800'

SCALE 1" = 400'

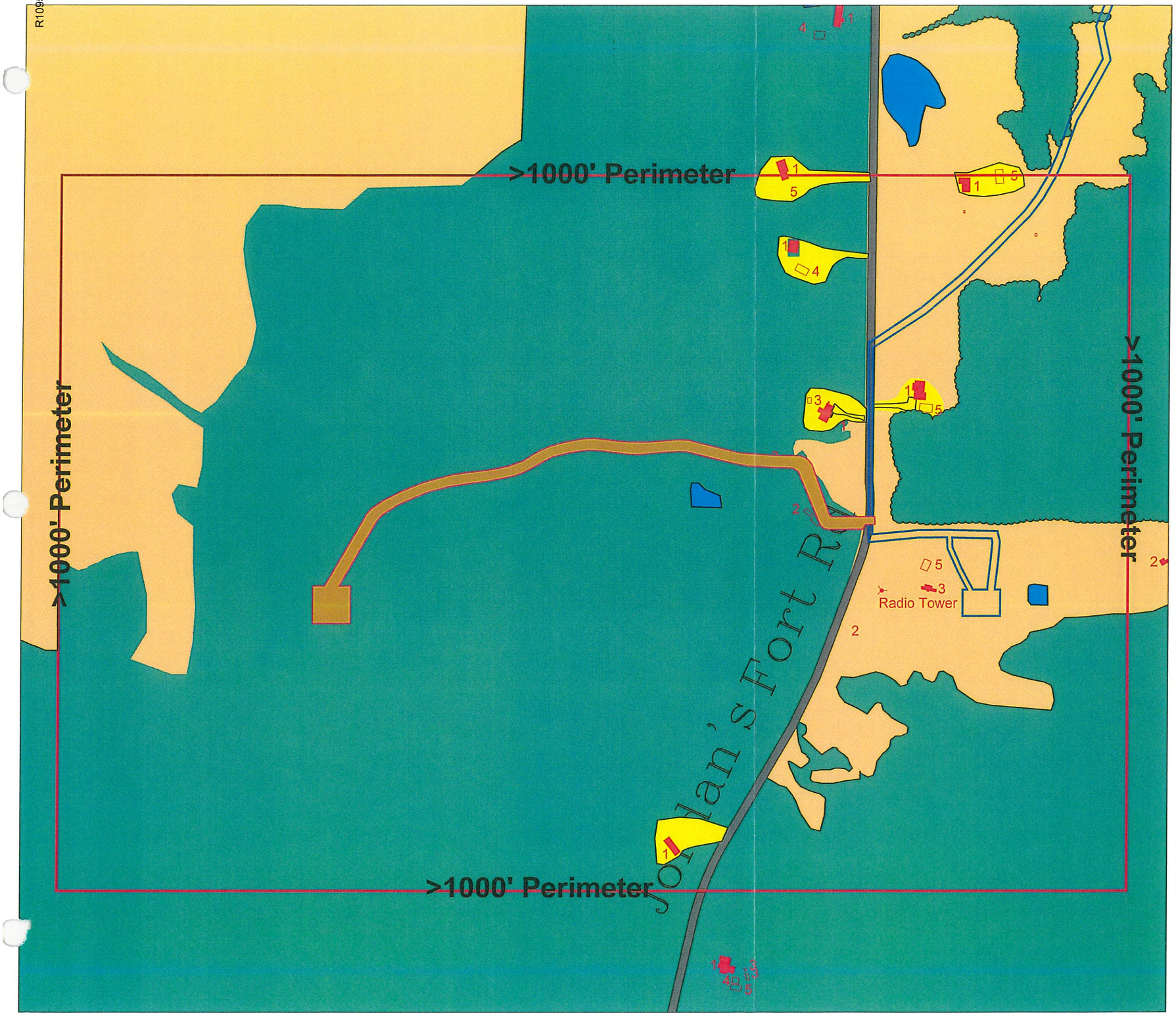
Pre Mine Land Use Map

TG#2, Break 27 IBR

CBC Engineers

Drawn By WDD	Date 1/17/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375 PRE MINE LAND USE MAP POND CREEK MINE NO. 1
Approved By GLD	Date 1/17/14	Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale AS NOTED	Project No. 15463I	Rev. / Map # Map 4

R10954



N
W E
S

LEGEND

- Recreation
- Forestry
- Pastureland
- Residential
- Proposed IBR Boundary
- Pending Permit Area
- Road
- 1 Residence (Occupied)
- 1VAC Residence (Unoccupied)
- 2 Mobile Home (Occupied)
- 2VAC Mobile Home (Unoccupied)
- 3 Shed
- 4 Garage
- 5 Barn
- 6 Grain Bin or Silo

The Proposed Permit Area is located in part of the S/2, S/2, NE/4, and part of the NW/4, NW/4, SE/4, all in Section 18, in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL, containing approximately 3.3 acres.

400' 0' 400' 800'

SCALE 1" = 400'

Post Mine Land Use Map

TG#2, Break 27 IBR

CBC Engineers

Drawn By WDD	Date 1/17/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375 PRE MINE LAND USE MAP POND CREEK MINE NO. 1
Approved By GLD	Date 1/17/14	Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale AS NOTED	Project No. 15463I	Rev. / Map # Map 5

R10955

PROPOSED PERMIT AREA (3.3 Acres)

Watershed = 8.9 Acres
To This Culvert (24-inch dia.)

Topsoil
Stockpiles

Access Road

Pending
Permit
Area

Topsoil
Stockpiles

Waterline and
Electrical Power Supply

Watershed = 53.6 Acres
To This Culvert (48-inch dia.)

18

Const. Yard

Pump Borehole
(13 3/3 inch cased)

Monitoring Well
(6 5/8 inch cased)

Topsoil Stockpile

The Proposed Permit Area is located in part of the S/2, S/2, NE/4, and part of the NW/4, NW/4, SE/4, all in Section 18, in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL, containing approximately 3.3 acres.

N
W E
S

200' 0' 200' 400'

SCALE 1" = 200'

Operations Map

TG#2, Break 27

CBC Engineers

Drawn By WDD	Date 1/18/14	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375 OPERATIONS MAP POND CREEK MINE NO. 1
Approved By GLD	Date 1/18/14	Prepared For WILLIAMSON ENERGY, LLC. P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale 1"=200'	Project No. 15463I	Rev. / Map # Map 6

ARCHAEOLOGICAL SURVEY SHORT REPORT
Illinois Historic Preservation Agency
1 Old State Capitol Plaza, Springfield, Illinois 62701-1507
(217) 782-4836

Reviewer:
Date:
Accept: **Reject:**

IHPA Log Number:

LOCATIONAL INFORMATION AND SURVEY CONDITIONS:
County: Williamson **Quadrangle:** Pittsburg, Illinois 1963 7.5'.

Project Type/Title: Phase I Cultural Resources Survey and Assessment of the TG#2, Brk 27 Turbine Pump Hole for Williamson Energy's Mach Mining Operation, Williamson County, Illinois (ARG CRM 1830)
Funding and/or Permitting Federal/State Agencies: Illinois Department of Natural Resources

Legal Location: Align SE: S ½, NE ¼ and NW¼, NW¼, SE¼ **Sections:** 18 **Township:** 8S **Range:** 4E
UTM Coordinates: Zone 16 UTM SW Start: 341662E 4188162N; **UTM NE End:** 341015E 4188059N
Project Description: Phase I archaeological survey of a proposed, 50-feet-wide access road, and vertical turbine pump borehole site (3.3 acres) for Williamson Energy's Mach Mining Operation.
Topography: Ridge top and slope in dissected uplands
Elevation (' AMSL): 570'–520'
Soils: Ava-Bluford-Wynoose
Drainage: Unnamed Intermittent Stream, Pond Creek, Big Muddy River
Land Use/Ground Cover (include % visibility): Wooded area (0%)
Survey Limitations: None

ARCHAEOLOGICAL AND HISTORICAL INFORMATION:
Historic Plats/Atlases/Sources: IHPA Site File Search (ArcIMS Viewer); 1876 Atlas of the State of Illinois (Warner and Beers, Chicago); 1908 *Standard Atlas of Williamson County, Illinois* (Geo. A. Ogle & Co., Chicago); (Attachment B, Figure B-1); 1909 USGS West Frankfort, Ill. 15-minute series topographic quadrangle (Attachment B, Figure B-2).

Previously Reported Sites: There are no sites recorded within the project area. In the proximity of the project area: 11WM123–11WM128, 11WM366, 11WM138–11WM144, 11WM153, 11WM388
Previous Surveys: Within project area: none. In the proximity of project area: Doc. #90364, Doc. #669, Doc. #18699, Doc. #90345, Doc. #11295, Doc. #5025, and Doc. #90388
Regional Archaeologist Contacted: None

Investigation Techniques: Systematic, screened (¼-inch) shovel testing at 15-m intervals
Time Expended: 14.5 Hours
Sites/Find Spots Located: 11WM389

Cultural Material: Historic, glass, nails, metal; See Attachment D

Curated At: Illinois State Museum

Collection Techniques: Complete artifact collection

Area Surveyed (acres and square meters): 3.3 acres; 13,355 square meters

OVER

RESULTS OF INVESTIGATIONS AND RECOMMENDATIONS: (check one)

__ **Phase I archaeological reconnaissance has located no archaeological material; project clearance is recommended.**

_X_ **Phase I archaeological reconnaissance has located archaeological materials; site(s) does(do) not meet requirements for National Register eligibility; project clearance is recommended.**

__ **Phase I archaeological reconnaissance has located archaeological materials; site(s) may meet requirements for National Register eligibility; further testing is recommended.**

__ **Phase II archaeological investigation has indicated that site(s) does(do) not meet requirements for National Register eligibility; project clearance is recommended.**

Phase II archaeological investigation has indicated that site(s) meet requirements for National Register eligibility; formal report is pending and a determination of eligibility is recommended.

Comments: see Attachment C

ARCHAEOLOGICAL CONTRACTOR INFORMATION:

Archaeological Contractor: American Resources Group, Ltd.
Address/Phone: 127 North Washington Street
Carbondale, Illinois 62901-1507 / (618) 529-2741
Surveyor(s): Alycia Giedd, Bob Sadler, James Burrow, Mike Brawley, and Brendan Scahill
Survey Date(s): January 25, 2014
Report Completed by: Alycia Giedd **Date:** January 28, 2014
Submitted by (signature and title): Steve Titus, Principal Investigator

ATTACHMENT CHECK LIST: (#1 through #4 are mandatory)

_x_ 1) **Relevant portion of USGS 7.5' topographic quadrangle map(s) showing project location and any recorded site;**
_x_ 2) **Project map(s) depicting survey limits and, when applicable, approximate site limits and concentrations of cultural materials;**
_x_ 3) **Site form(s): (two copies of each form);**
_x_ 4) **All relevant project correspondence;**
_x_ 5) **Additional information sheets as necessary.**

Address of Owner/Agent/Agency To Whom SHPO Comment Should Be Mailed To:

CBC Engineers
503 N. Commercial Street, Suite A
Harrisburg, IL 62946
Contact Person: Gerald DeNeal
Telephone Number: (618) 715-0870

American Resources Group Ltd.
127 North Washington Street
Carbondale, Illinois 62901
Contact Person: Mr. Steve Titus
Telephone Number: (618) 529-2741

REVIEWERS COMMENTS:

List of Attachments

Attachment A: Project Area and Site Maps.
Figure A-1. Topographic location of the project area and site 11WM389.
Figure A-2. Site map, 11WM389.

Attachment B: Historic Plats/Atlases/Sources.
Figure B-1. 1908 Standard Atlas of Williamson County, Illinois (1908 Geo. A. Ogle & Co., Chicago).
Figure B-2. Portion of the 1909 USGS West Frankfort, Ill. 15-minute series topographic quadrangle.

Attachment C: Site Description and Photographs
Figure C-1. Site overview, view northwest.
Figure C-2. Well pump, view east, with inset close-up of brand-name embossing.

Attachment D: Historic Artifact Inventory Table
Table D-1. Historic Artifact Inventory, Site 11WM389.

Attachment E: Site Form

Attachment A

Project Area and Site Maps

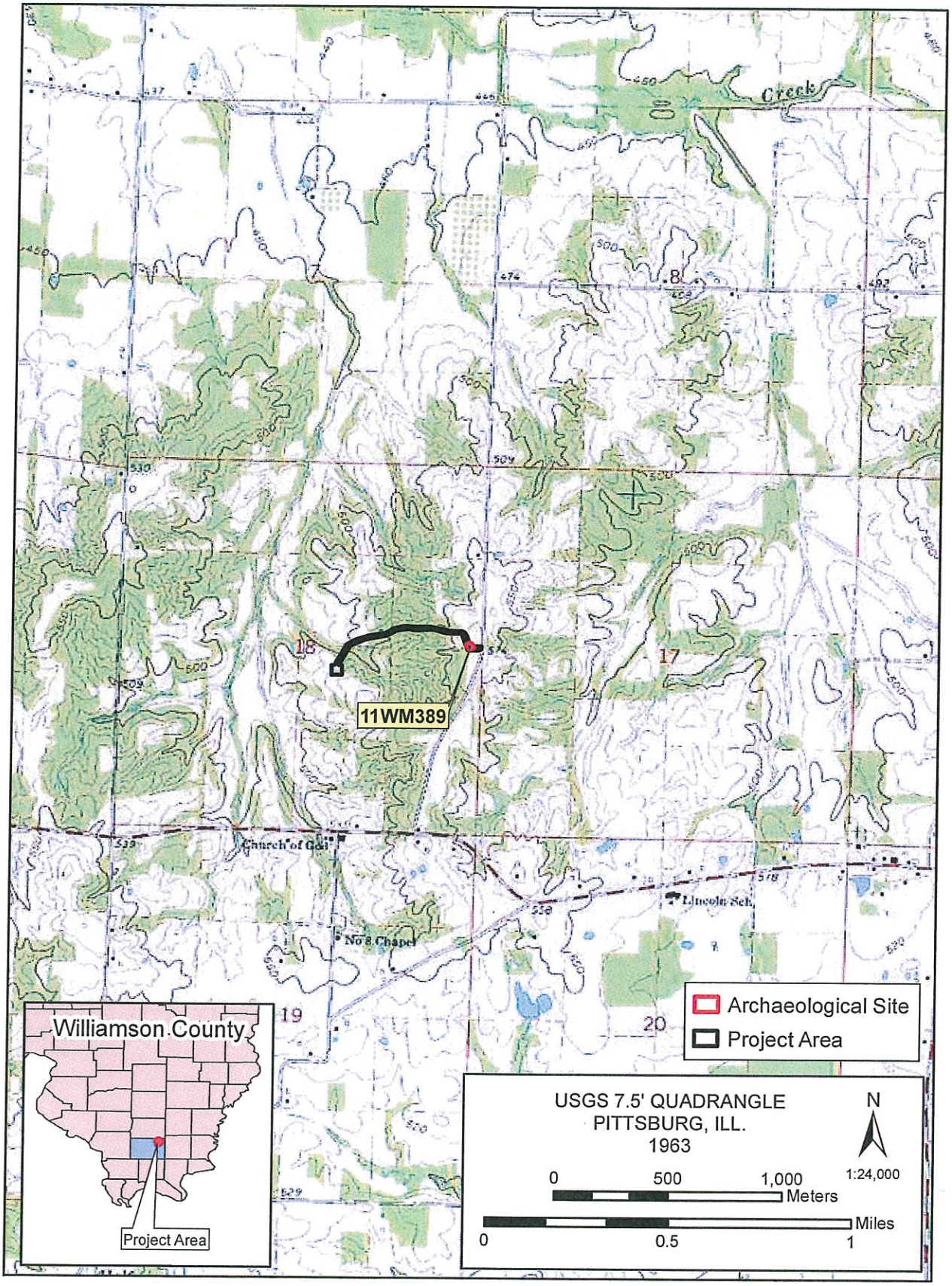


Figure A-1. Topographic location of the project area and site 11WM389.

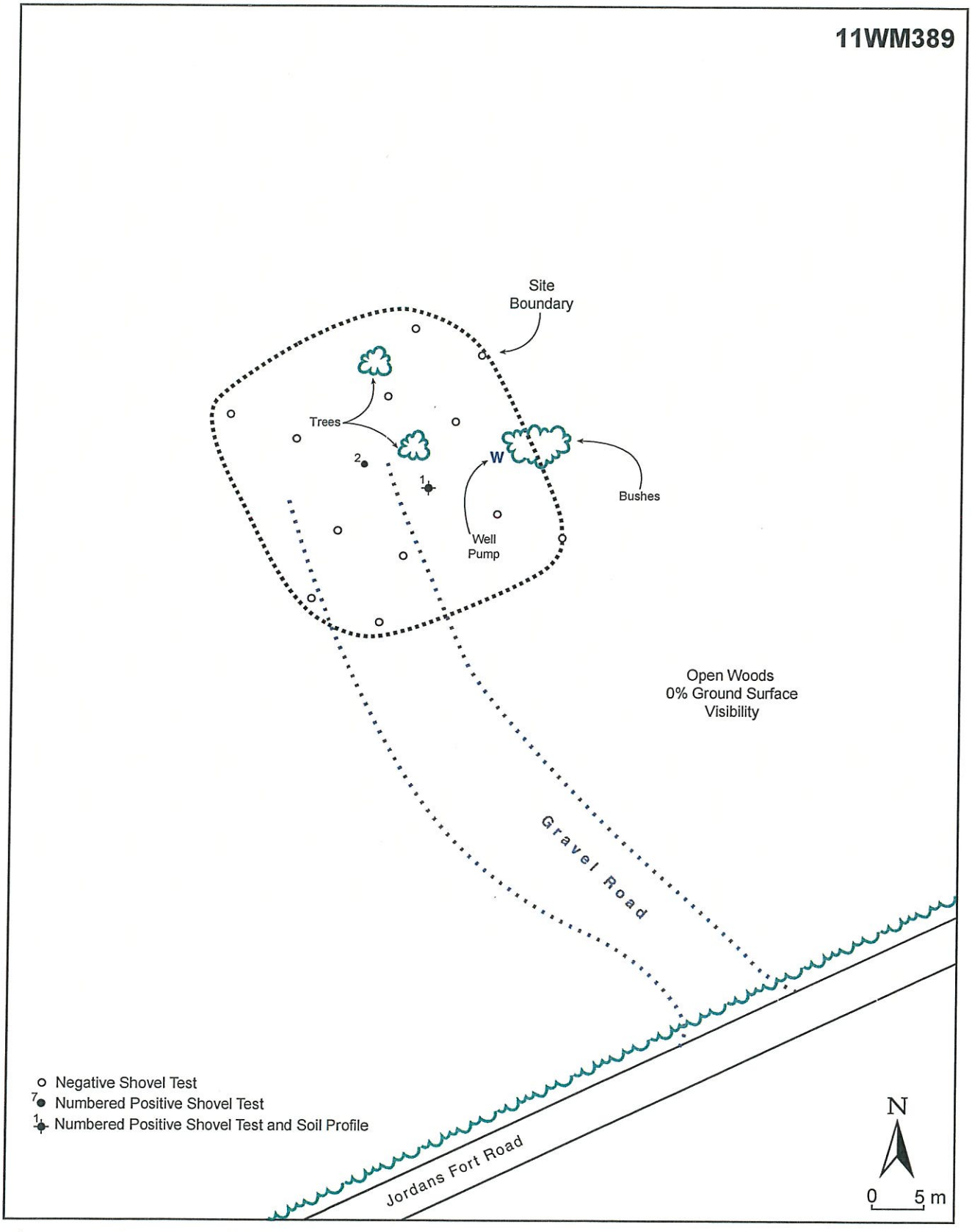


Figure A-2. Site map, 11WM389.

Attachment B

Historic Plats/Atlases/Sources

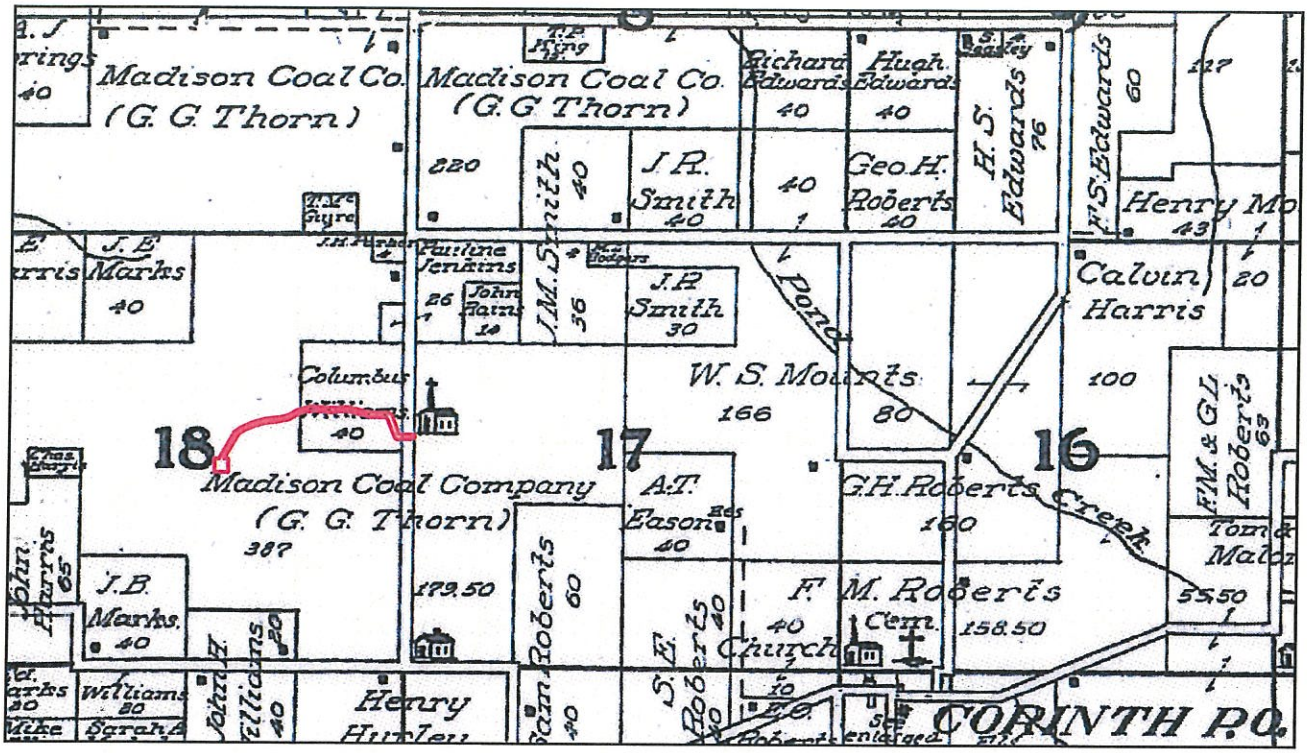


Figure B-1. 1908 Standard Atlas of Williamson County, Illinois (1908 Geo. A. Ogle & Co., Chicago).

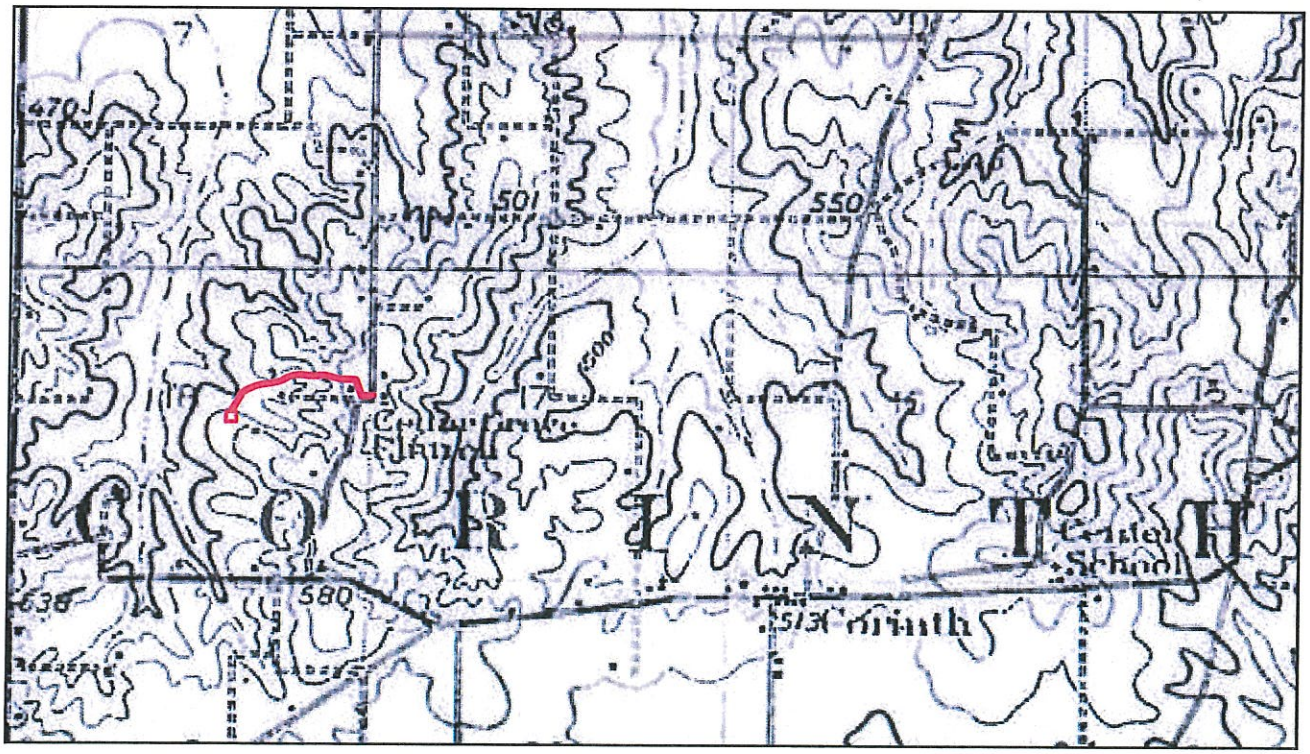


Figure B-2. Portion of the 1909 USGS West Frankfort, Ill. 15-minute series topographic quadrangle.

Attachment C

Site Description and Photographs

American Resources Group conducted an intensive, Phase I cultural resources survey of Williamson Energy's Mach Mining Operation Project Area on January 25, 2014. The project area consists of a proposed permit area, TG # 2 Vertical Turbine Pump borehole site, totaling 3.3-acres. The project area is located approximately 1.4 miles (2.3 km) northwest of Corinth, Illinois (Attachment A, Figure A-1). The pre-field site-file search and architectural records review revealed that no professional cultural resources surveys had been conducted, and no archaeological sites or architectural properties had been recorded, in the project area. The pre-field review of historic maps suggested that there was moderate potential for the project area to contain historic sites (Attachment B, Figures B-1 and B-2). At the time of the survey, the project corridor traversed a wooded area that exhibited 0% ground surface visibility.

One site was recorded during the present investigation.

11WM389

Site Type: Historic farmstead/rural household
Component: Early to mid-twentieth-century historic
Site Location: SE¼, SE¼, NE¼, NW¼; Section 18, Township 8 South, Range 4 East, Williamson County
UTM at Main Datum (NAD 83): 4188174N 341620, Zone 16N
Approximate Site Area: 747.7 m^2
Topographic Location: Upland ridge
Elevation: 174 m (570 feet) amsl
Soil Type: Grantsburg silt loam, 2 to 5 percent slopes
Nearest Water: Unnamed intermittent drainage of Pond Creek
Survey Method: Systematic screened (¼-inch) shovel testing along transects spaced 5 m apart
Site Condition: At the time of survey the site was in an open wooded area with 0 percent ground surface visibility.
NRHP Evaluation: Ineligible

Site Description
Site 11WM389 is a small, low-density scatter of historic artifacts located on ridge approximately .5 mile (.8 km) northeast of the intersection of Jordan's Fort Road and Corinth Road and roughly 1.4 miles (2.3 km) northwest of Corinth, Illinois (Attachment A, Figure A-1). Material in this scatter covered an area measuring roughly 30 m (98 feet) north to south by 25 m (82 feet) east to west (Attachment A, Figure A-2; Attachment C, Figure C-1).

At the time of the survey, site 11WM389 was located in an open wooded area where ground surface visibility was completely obscured (0 percent) (Attachment A, Figure A-2). The site was located and defined entirely through systematic, screened shovel testing along transects spaced 5 m (16 feet) apart within the 50-foot-wide (15-m-wide) project corridor. A total of 14 shovel tests were excavated, 2 of which were positive. The soil profile observed in a shovel test excavated at the site consisted of a 25-cm-thick dark yellowish brown (10YR 4/4) silt loam over a light yellowish brown (10YR 6/4) silty clay loam subsoil.

The only feature observed on the surface was an historic well pump, with Woodford Iowa embossed on the top (Attachment C, Figure C-2, see inset). The pump is most likely from the mid-twentieth century and is manufactured by Woodford Manufacturing Company which has been manufacturing these specific pumps in Iowa at least since the 1920s.



Figure C-1. Site overview, view northwest.



Figure C-2. Well pump, view east, with inset close-up of brand-name embossing.

Artifact Analysis
Four functional artifact groups were identified in the historic artifact assemblage, including kitchen (N=9), architecture (N=6), clothing (N=2), and other (N=3). Overall, the artifact analysis suggests a historic occupation dating to the early to mid-twentieth century.

The kitchen-related artifacts consist of only glass. The glass artifacts were all of unknown container types and consists of opaque, colorless, green, and aqua fragments.

Architectural items include five wire nails and one screw. The only artifacts within the clothing-related artifacts consist of a two-piece rivot. Other artifacts collected consist of an iron block and pieces of a possible copper electrical conduit.

Site History
The site is situated on a 40-acre tract owned by Columbus Williams in 1908 (Attachment B, Figure B-1). There is no structure depicted at the site location on this map, but there is one located in the vicinity of the site on the 1909 West Frankfort USGS 15 minute topographic map (Attachment B, Figure B-2).

Interpretation
Site 11WM389 is a historic site consisting of a low-density scatter of historic artifacts. Site 11WM389 is interpreted as a historic farmstead/rural household that appears to date to the early to mid-twentieth century.

Site Evaluation and Recommendation
Site 11WM389 is common for its age and type in southern Illinois. Further investigation of the site is not expected to yield new information that would contribute to our understanding of the historic settlement of Williamson County from the early to mid-twentieth century. The site is evaluated as ineligible for listing to the National Register of Historic Places. No further archaeological investigation is recommended.

Project Recommendation
The results of the Phase I cultural resources investigation of the Williamson Energy's Mach Mining Operation Project Area indicate the proposed undertaking will not have an adverse effect on significant cultural properties. It is recommended that the proposed undertaking be allowed to proceed as planned without further archaeological investigation.

Attachment D

Historic Artifact Inventory Table

Table D-1. Historic Artifact Inventory, Site 11WM389.

Description	Date Range	ST1	ST2	Total	Reference
KITCHEN					
GLASS				0	
CONTAINER				0	
Unknown				0	
opaque white curved body fragment			1	1	
colorless bottle base fragment			1	1	
small mouth screw cap machine made aqua neck, body, and base fragment (with corrugated base)	1900+		3	3	
melted aqua body fragment		1		1	
colorless body fragment with fabric marked lines		1		1	
green curved body fragment			2	2	
KITCHEN TOTAL		***2***	***7***	***9***	
ARCHITECTURE					
wire nail, size 10d	1880+	2	1	3	
wire nail, size 6d	1880+		1	1	
wire nail fragment	1880+		1	1	
unidentified screw			1	1	
ARCHITECTURE TOTAL		***2***	***4***	***6***	
CLOTHING					
2-piece clothing rivot			2	2	
CLOTHING TOTAL		***0***	***2***	***2***	
OTHER					
iron block with channel through it			1	1	
possible copper electrical conduit			2	2	
OTHER TOTAL		***0***	***3***	***3***	
OVERALL TOTAL		***4***	***16***	***20***	

Attachment E

Site form

ILLINOIS ARCHAEOLOGICAL SITE RECORDING FORM

County: Williamson
Site Name:
Revisit: N
Field Number: ARG-1
State Site No.: 389
Quadrangle (7.5'): Pittsburg
Date Recorded: 2014.01.28

LEGAL DESCRIPTION (to quarter quarter quarter section)

Align: SE	**1/4s:** SESENENW	**Section:** 18	**Township:** 8	S	**Range:** 4	E
Align:	**1/4s:**	**Section:** 0	**Township:** 0		**Range:** 0	
Align:	**1/4s:**	**Section:** 0	**Township:** 0		**Range:** 0	
Align:	**1/4s:**	**Section:** 0	**Township:** 0		**Range:** 0	

UTM Coordinates (by ISM): **UTM Zone:** 16 **UTM North:** 4187964 **UTM East:** 341618

Ownership: Private

ENVIRONMENT

Topography: Upland Ridge
Elevation (in meters): 174
Nearest Water Supply: Intermittent
Drainage: Big Muddy
Soil Association: Ava-Bluford-Wynoose
Description: The site is situated on an upland ridge

SURVEY

Project Name: Phase I, Mach Mining
Site Area (square meters): 740
Ground Cover (List up to 3): Weeds Rock Brush
Visibility (%): 0
Survey Methods (List up to 2): Shovel Testing
Standing Structures: N
Site Type (List up to 2): Habitation

SITE CONDITION

Extent of Damage: Moderate
Main Cause of Damage: Erosion

MATERIAL OBSERVED

Number of Prehistoric Artifacts (count or estimate): 0
Number of Historic Artifacts (count or estimate): 20
Prehistoric Diagnostic Artrifacts: N
Historic Diagnostic Artifacts: Y
Prehistoric Surface Features: N
Historic Surface Features: Y
Description: Low density scatter of glass, wire nails, clothing rivots, unidentified metal.

TEMPORAL AFFILIATION (check all that apply)

Prehistoric Unknown:	**Late Archaic:**	**Mississippian:**	**Colonial (1673-1780):**
Paleoindian:	**Woodland:**	**Upper Mississippian:**	**Pioneer (1781-1840):**
Archaic:	**Early Woodland:**	**Protohistoric:**	**Frontier (1841-1870):**
Early Archaic:	**Middle Woodland:**	**Historic Native American:**	**Early Industrial (1871-1900):**
Middle Archaic:	**Late Woodland:**	**Historic (generic):**	**Urban Industrial (1901-1945):** Y
			Post-War (1946-present):

Description: Site appears to be an early twentieth-century farmstead based on artifact analysis and map evidence. One structure is depicted on the 1909 15 minute topographic map.

Surveyor: Steve Titus **Institution:** ARG **Survey Date:** 01-25-2014 **Curation Facility:** ISM
Site Report by: Alycia Giedd **Institution:** ARG **Date:** 01-28-2014
IHPA Log No.: **IHPA First Sur. Doc. No.:**
Compliance Status: **NRHP Listing:** N

DOCUMENT

60

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

Subject: Williamson Energy, LLC – Pond Creek Mine

Data: Log No. 5477-13

Reviewed by: D. Maschhoff **Date:** 2/17/15

Log No. 5477-13 ⇒ IBR No. 58 to OMM Permit No. 375

Log No. 5477-13

- IBR consisting of 3.3 acres located in Section 8 and 17, Township 8 South, Range 4 East, Williamson County.
- The proposed operation is the completion of two (2) boreholes. One (1) borehole will be used to pump mine water from the underground mine workings to ensure proper underground ventilation, and the other borehole will be used to place concrete underground where it is needed to facilitate mine support with pumpable cribs.
- The vertical pump will pump mine water to an existing buried waterline.
- A sediment pond exemption is requested for this permit area. Silt fence and/or straw bales will be placed for drainage control.
- Topsoil piles will be seeded and mulched to reduce runoff and promote growth.
- Access road ditches will divert some site drainage.

* Action: Reference IEPA Log No. 5477-13 in renewed and modified NPDES permit for additional 3.3 acres for the installation of a vertical pump, a concrete borehole and buried waterline.

5477-/13
Due date: 12-6-13
R10974

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

March 20, 2014

Mr. Anthony Webb
Williamson Energy
P.O. Box 99
Johnston City, Il 62951

Re: Permit No. 375
Incidental Boundary Revision No 58

Dear Mr. Webb:

The appropriate Department technical staff has reviewed the proposed incidental boundary revision dated October 23, 2013 and supplemental information dated December 17, 2013, submitted by Williamson Energy for Pond Creek Mine, Permit No. 375. The request would add 3.3 acres to conduct surface coal mining activities. The additional acres would be used for installation of a vertical turbine pump, a concrete bore hole and buried waterline.

The Department finds the permittee has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

Section 1817.46(e) A sediment pond exemption is requested for an area delineated in the application. The regulations at 62 Ill. Adm. Code 1817.46(e) allow the Department to grant exemptions from the requirement to pass all disturbed drainage through a siltation structure when:

a. The disturbed drainage area within the total disturbed area is small; and

b. Alternate sediment control measures as described in Section 1816/1817.45(b) are used in lieu of a siltation structure, and the permittee demonstrates that siltation structures are not necessary for drainage from the disturbed area to meet the effluent limitations and water quality standards for the receiving waters set forth in Section 1816/1817.42

The Department has determined that the area for which a sediment pond exemption is requested meets the criteria established in Section 1817.46(e) and hereby grants an exemption from the use of a sedimentation pond for this area.

Section 1785.17 The prime farmland in the permit area has not been historically used for cropland.

Section 1761.11(d) The proposed permit area is within one hundred (100) feet of the outside right-of-way line of public roads in Williamson County.

RECEIVED
MAR 24 2014
IL Environmental Protection Agency
MARION REGIONAL OFFICE

5477 · / 13
Due date: 12/2013
R10975

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

IBR
to Permit No. 375

TG # 2 / Break 49

--Vertical Turbine Pump
--Slickline Borehole

October, 2013

R10976

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

October 23, 2013

Mr. Larry Crislip, P.E.
Illinois Environmental Protection Agency
Manager—Permit Section
Mine Pollution Control Program
Bureau of Water
2309 West Main Street
Marion, IL, 62959

Re: Pond Creek No. 1 Mine, IDNR Permit #375
Non-Contiguous Incidental Boundary Revision
Location: Tailgate no. 2 at Break no. 49
1)--Vertical Turbine Pump Borehole and Buried Waterline
2)—"Pumpable" Concrete Borehole

Dear Mr. Crislip:

Two copies of a 3.3-acre IBR application for Pond Creek No. 1 Mine, Permit #375, are herein provided for your files. The original application, and one copy, was submitted to Mr. Scott Fowler in the IDNR's Springfield office and one copy was submitted to the IDNR's Benton office.

If you need any additional information, or have any questions, please let me know.

Sincerely,

Anthony Webb-- President
Williamson Energy, LLC
Sugar Camp Energy, LLC

Cc: Mark Allaman—Chief Engineer, Mach Mining
Chris Skelton----Engineer, Mach Mining

RECEIVED
NOV 07 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

October 23, 2013

Mr. Scott Fowler
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, Il 62702-1271

Re: Pond Creek No. 1 Mine, Permit #375
Non-Contiguous Incidental Boundary Revision
Location: Tailgate no. 2, at Break no. 49
1)--Vertical Turbine Pump Borehole and Buried Waterline
2)—"Pumpable" Concrete (Slickline) Borehole

Dear Mr. Fowler:

Please find enclosed one original and one copy of a 3.3 acre Non-Contiguous IBR application to the Pond Creek No. 1 Mine, Permit #375. One copy of this application has been sent to Mr. Robert Schoeppel in your Benton office.

The IBR is needed to pump mine water from underground workings to ensure proper underground ventilation.

A vertical turbine pump will be installed, and it will pump accumulated mine water to an existing approved surface-buried waterline.

A concrete borehole ("slickline") is also needed for concrete to be delivered to the underground workings from this same surface site.

The applicant requests that a Cultural Resource Survey be waived, as almost 75% of the total 3.3-acre site will be trenched for a buried waterline. Should any item(s) of historic note be discovered during the waterline work, the applicant will immediately notify the local INDR-Land Reclamation inspector.

If you need any additional information, or have any questions, please let me know

Sincerely,

Anthony Webb-- President
Williamson Energy, LLC
Sugar Camp Energy, LLC

Cc: ILDNR/OMM Benton attn. R. Schoeppel
ILEPA Marion, attn. L. Crislip
Mark Allaman—Chief Engineer, Mach Mining
Chris Skelton----Engineer, Mach Mining

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

October 23, 2013

Mr. Scott K. Fowler, Supervisor
Office of Mines & Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Pond Creek No. 1 Mine, Permit 375
Incidental Boundary Revision
Vertical Turbine Pump & Slick Line Borehole Tailgate 2 Break 49

Dear Mr. Fowler:

This letter authorizes Mr. Mark Allaman and Mr. Chris Skelton permission to perform work on, receive comments and submit corrections on the above referenced application. Please send copies of any comments to Williamson Energy, LLC at the above address.

Thank you for your cooperation.

Sincerely,

Anthony Webb
Authorized Representative

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS
INCIDENTAL BOUNDARY REVISION IBR-1

PART I

DATE: **October 23, 2013**

NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill. Rev. Stat. 1987 Ch. 96 1/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

~~(I)(We)~~**(The)** **Williamson Energy, LLC**
(Name of Company, Corporation, Partnership or Individual)

PO Box 99, Johnston City, IL. 62951
(Address)

618-983-3017
(Telephone Number)

hereby submit application for an Incidental Boundary Revision to Permit **375**

Name of Mine **Pond Creek Mine No. 1, LLC**

MSHA No. **11-03141**

I, **Anthony Webb**
(vice president or his duly authorized representative under the existing permit) under penalty

of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Anthony Webb
Title: Authorized Representative

ADDITIONAL ACRES REQUESTED **3.3** EXISTING PERMIT ACREAGE **665.1**

B) Indicate the type of disturbance and associated acreage.

Type of Disturbance	Existing	Permit IBR	Total
Area Stripping	**20.1**	**0**	**20.1**
Mine Waste Areas	**277.4**	**0**	**277.4**
Processing Areas & Support Facilities	**167.8**	**0.3**	**168.1**
Access, Haul Roads & Transport Facilities	**23.6**	**1.8**	**24.4**
Soil Storage Areas	**75.7**	**0.1**	**75.8**
Diversions	**32.8**	**0**	**32.8**
Coal Recovery (Gob & Slurry)	**0**	**0**	**0**
Other (holding pond, **pipeline**)	**30.5**	**1.1**	**31.6**
Not to be Disturbed	**37.2**	**0**	**37.2**
Total	**665.1**	**3.3**	**668.4**

2) A) Provide name and address of every legal or equitable owner of record of the IBR area.

RESPONSE: **The IBR surface area is owned by:**

Marilyn Myers
15878 Jordans Fort Road
Pittsburg, Illinois 62974

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, Il 62812

Williamson County Highway
1817 N. Court Street
Marion, Illinois 62959

B) Provide name and address of the owner of record for all surface and subsurface areas contiguous to any part of the proposed IBR area.

RESPONSE: **Please see the Property Tract Map and the corresponding Property Rights Summary sheet at the end of this Part I of the application.**

C) Show location of owners of record of those lands, surface and subsurface, included in or contiguous to the IBR area on pre-mining land use map or another map, if necessary.

RESPONSE: See Tract Map in map section and corresponding Property Rights Summary sheet at the end of this Part I of the application.

3) Provide name and address of any holder of record of leasehold interest for the IBR area.

RESPONSE: Williamson Energy, LLC (applicant) has leasehold interest in the coal.

4) Affidavits, Certifications

A) Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.

RESPONSE: The Affidavit at the end of this Part.

B) Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: The Engineering Certificate is at the end of this Part.

5) Areas Designated Unsuitable for Mining

A) Does proposed IBR area include --

(1) Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?

Yes ___ No _X_

(2) National forest land?

Yes ___ No _X_

(3) Any land which will adversely affect any publicly-owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per Sections 1779.12(b)]?

Yes ___ No _X_
If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1

(4) Any public roads which are to be removed, relocated or temporarily closed?

Yes ___ No _X_.

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

B) Will proposed IBR area be located --

(1) Within 100 feet of the right-of-way line of any public road?

Yes _X_ No _____

If yes, explain proposed procedure for complying with regulation section 1761.12(c), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and land owners affected will be protected.

RESPONSE: **A road entrance and access road will be constructed perpendicular to the public road (County Road 100 East). Under agreement with Williamson County Road Authority, a buried waterline will be installed along a portion of the public road ROW (see General Location Map and Land Use Map).**

(2) Within 300 feet measured horizontally from any occupied dwelling?

Yes _X_ No ___

If so, is waiver provided meeting requirements of Section 1761.12(d)?
RESPONSE: **Yes**

(3) Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park? Yes ___ No _X_

(4) Within 100 feet measured horizontally of a cemetery?

Yes ____ No _X_

C) Are valid existing rights (per 1761.11) claimed for any part of the IBR area?

Yes ____ No _X_

If yes, provide documentation to substantiate claim.

D) Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.

RESPONSE: **A draft copy of the Public Notice is at the end of this Part I of the application. It will be published in the West Frankfort Daily American newspaper.**

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" on the line below if that item is relevant.

(1) _____ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

(2) _____ Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

(3) Certification of the Illinois Environmental Protection Agency-35 Ill. Adm. Code 405.104(a) Permit.

__X__ In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

INDIVIDUAL P.E. CERTIFICATION

JAMES J. WEBB — Name

062-046528 — Illinois Registration Number (Seal)

JAMES J. WEBB REGISTERED 062-046528 ILLINOIS PROFESSIONAL ENGINEER

Firm

1503 Golf Calise Rd — Address

MADISON, IL 62459

618-715-0870 — Phone Number

Signature

10/23/2013 — Date

PROFESSIONAL DESIGN FIRM CERTIFICATION

Complete if applicable. If not, respond N/A.

__N/A__ As an employee of a "professional design firm" as defined by the Illinois Department of Financial and Professional Regulation, I certify that the professional design firm is registered and in good standing with the Illinois Department of Financial and Professional Regulation.

Professional Design Firm Name

Professional Design Firm Number

AFFIDAVIT

(I)(~~We~~), **Gary Schmitz**
(Individual or Individuals)

under penalties of perjury, declare on behalf of the applicant, **Williamson Energy, LLC**, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area, and such legal right is not in any way the subject of pending court litigation.

Dated this 23rd day of OCTOBER **2013**

Gary L Schmitz, Authorized Person
Signature/Title

Sworn and subscribed before me

this 23rd day of October **2013**

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

Gwen Finnegan
Notary Public

9-06-15
My commission expires

PUBLIC NOTICE

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy, LLC, P. O. Box 99, Johnston City, IL 62951, hereby gives notice that a request for a 3.3 acre Incidental Boundary Revision (IBR) was submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division to complete two mine service boreholes. One borehole for a vertical turbine pump, and one to pump concrete to the underground mine workings. A laydown/work-yard area, an access road, and a buried waterline will also be permitted under the provisions of Section 1774.13 (d) (2) (Incidental Boundary Revision) to Permit No. 375.

The proposed permit area is described: Part of the S/4, SW/4 of Sec. 8, Part of the W/2, NW/4, Sec. 17, and Part of the NW/4, SW/4, Sec. 17, all in Township 8S, R4E of the 3rd Principal Meridian, Williamson County, IL, containing approximately 3.3 acres.

The applicant is requesting to construct a road entrance off of, and perpendicular to, Jordan's Fort Road, and bury a waterline alongside approx. 800 feet of the ROW of Jordan's Fort Rd.

Copies of the application are on file for inspection at the following office, and written comments may be addressed to:

Illinois Department of Natural Resources, Office of Mines & Minerals, Land Reclamation Div., One Natural Resources Way, Springfield, IL 62702-1271.

The closing date of the comment period for this IBR is seven (7) days from the date of this Public Notice. The general public may submit comments and requests for hearings

regarding activities within 100 feet of the public road ROW within 14 days following the publication of this notice.

PROPERTY RIGHTS SUMMARY

SURFACE OWNERSHIP OF PROPOSED PERMIT AREA

Marilyn Myers
15878 Jordans Fort Road
Pittsburg, Illinois 62974

Unrecorded Surface Land Lease Agreement dated September 11, 2013, by and between Marilyn Myers, a widow, and Williamson Energy, LLC, (applicant)

Unrecorded Surface Waiver and Consent dated September 11, 2013, by and between Marilyn Myers, a widow, and Williamson Energy, LLC executed pursuant to 62 Ill.Adm.Code1761.15(b).

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, Il 62812

SURFACE OWNERSHIP / CONTROL CONTIGUOUS TO PROPOSED PERMIT AREA

New River Royalty, LLC
208 Public Square, 4th Floor
Benton, Il 62812

Williamson County Highway
1817 N. Court Street
Marion, Illinois 62959

PROPERTY RIGHTS SUMMARY (Cont'd)

SUBSURFACE OWNERSHIP OF PROPOSED PERMIT AREA

WPP, LLC (Coal Owner)
5260 Irwin Road
Huntington, WV 25705

Williamson Energy, LLC (Leasehold from WPP, LLC)
P. O. Box 99
Johnston City, Illinois 62951

Applicant has leasehold interest to the coal under the proposed permit area.

SUBSURFACE OWNERSHIP CONTIGUOUS TO PROPOSED PERMIT AREA

WPP, LLC (Coal Owner)
5260 Irwin Road
Huntington, WV 25705

Williamson Energy, LLC (Leasehold from WPP, LLC)
P. O. Box 99
Johnston City, Illinois 62951

RIGHTS CLAIMED BY APPLICANT: The right to conduct mining and reclamation operations within the approved and proposed areas of coal mining. See Mining Affidavit at end of PART I.

PART II

PREMINING INFORMATION

Premining information is to be displayed on premining land use map unless otherwise indicated.

1) Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different than the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.

RESPONSE: **The permit boundary will be marked by PVC pipe set over steel fence post ("T"-Posts). From any single post, the posts on either side will be visible.**
For permit reference point, the intersection of Corinth Road and Jordan's Fort Road is approximately ½ mile south/southwest of the main body of the proposed permit area. This reference point is noted on the General Location Map.

2) Explain and locate areas where the IBR is contiguous to an existing permit.

RESPONSE: **Please see the General Location Map and the other maps included with this application.**

3) Give the acreages of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on premining land use map existing land uses in the proposed permit area and adjacent to it. Include on the premining land use map the location of all buildings and identify the current use of these buildings.

Pre-Mining Land Use	Existing Permit	IBR	Total
Cropland	523.8	0	523.8
Pasture land	4.2	2.4	6.6
Grazing Land	0	0	0
Forestry	107.7	0	107.7
Residential	4.8	0.9	5.7
Industrial/Commercial	3.5	0	3.5
Recreation	0	0	0
Fish and Wildlife Habitat	19.7	0	19.7
Developed Water Resources	1.4	0	1.4
Undeveloped land	0	0	0
Total	665.1		668.4

4) Soils Information Map

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes __X__ No ___.

If no, explain.

B) Delineate on the soils map(s) the area which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

RESPONSE: No mining will be conducted on this site.

C) Are any of the identified map units correlated as prime farmland by NRCS criteria?

Yes __X__ No ___.

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: The requirements of Section 1785.17 are applicable to underground mining operations and will be followed.

D) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: See Soils Information Chart at the end of this Part II.

E) Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.

RESPONSE: See Soils Information Chart at the end of this Part, and see Soils Map in the Map Section.

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes _____ No __X__.

If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

SOILS INFORMATION CHART

Soil Type	Name	*Slope Class (%)*	*LandUse Capability*	**Crop Productivity Index for Optimum Management*	*PERMIT AREA (ACRES)*		
					Prime Farmland Soils	*Other Soils*	*TOTALS (Acres)*
Silt Loam	Grantsburg (301B)	2-5	II-e	97	1.9		1.9
Silt Loam	Grantsburg (301C2)	5-10	III-e	92		0.2	0.2
Silty Clay Loam	Zanesville (340D3)	10-18	VI-e	79		1.2	1.2

* The Productivity Index Number was calculated from the University of Illinois, College of Agricultural — Bulletin 811, Optimum Crop Productivity Ratings for Illinois Soil, published in August, 2002.

R10992

301B—Grantsburg silt loam, 2 to 5 percent slopes

Setting

Landform and landscape: Loess hills on uplands
Position on the landform: Summits

Map Unit Composition

Grantsburg and similar soils: 90 percent
Dissimilar soils: 10 percent

Soils of Minor Extent

Similar soils:
- Soils that are less brittle in the subsoil
- Soils that are moderately eroded
- Soils that have bedrock at a depth as shallow as 4 feet
- Soils that formed in loess over very thin drift over bedrock

Dissimilar soils:
- The somewhat poorly drained Robb soils on broad, nearly level summits

Properties and Qualities of the Grantsburg Soil

Parent material: Peoria and Roxana Loess over residuum
Drainage class: Moderately well drained
Slowest permeability within a depth of 40 inches: Very slow
Permeability below a depth of 60 inches: Very slow or slow
Depth to restrictive feature: 24 to 40 inches to a fragipan
Available water capacity: About 8 inches to a depth of 60 inches
Content of organic matter in the surface layer: 1 to 3 percent
Shrink-swell potential: Moderate
Depth and months of highest perched seasonal high water table: 1.5 feet, January through April

Potential for frost action: High
Hazard of corrosion: High for steel and concrete
Surface runoff class: High
Susceptibility to water erosion: Moderate
Susceptibility to wind erosion: Low

Interpretive Groups

Land capability classification: 2e
Prime farmland category: Prime farmland
Hydric soil status: Not hydric

301C2—Grantsburg silt loam, 5 to 10 percent slopes, eroded

Setting

Landform and landscape: Loess hills on uplands
Position on the landform: Shoulders, backslopes

Map Unit Composition

Grantsburg and similar soils: 90 percent
Dissimilar soils: 10 percent

Soils of Minor Extent

Similar soils:
- Severely eroded soils that have a surface layer of silty clay loam
- Soils that formed in loess over very thin drift over bedrock
- Soils that are less brittle

Dissimilar soils:
- The somewhat poorly drained Belknap and moderately well drained Sharon soils along drainageways

Properties and Qualities of the Grantsburg Soil

Parent material: Peoria and Roxana Loess over residuum
Drainage class: Moderately well drained
Slowest permeability within a depth of 40 inches: Very slow
Permeability below a depth of 60 inches: Slow
Depth to restrictive feature: 24 to 40 inches to a fragipan
Available water capacity: About 7.6 inches to a depth of 60 inches
Content of organic matter in the surface layer: 0.5 to 3.0 percent
Shrink-swell potential: Moderate
Depth and months of highest perched seasonal high water table: 1.5 feet, January through April
Accelerated erosion: The surface layer has been thinned by erosion.
Potential for frost action: High
Hazard of corrosion: High for steel and concrete
Surface runoff class: High
Susceptibility to water erosion: High
Susceptibility to wind erosion: Low

Interpretive Groups

Land capability classification: 3e
Prime farmland category: Not prime farmland
Hydric soil status: Not hydric

340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded

Setting

Landform and landscape: Hillslopes on uplands
Position on the landform: Backslopes

Map Unit Composition

Zanesville and similar soils: 90 percent
Dissimilar soils: 10 percent

Soils of Minor Extent

Similar soils:
- Moderately eroded soils that have a surface layer of silt loam
- Soils that do not have a fragipan
- Soils that are brittle within a depth of 20 inches
- Soils that have slopes of more than 18 percent
- Soils that formed in loess over very thin drift over bedrock

Dissimilar soils:
- The moderately well drained Sharon and somewhat poorly drained Belknap soils along drainageways and on flood plains

Properties and Qualities of the Zanesville Soil

Parent material: Loess over residuum
Drainage class: Moderately well drained
Slowest permeability within a depth of 40 inches: Slow
Permeability below a depth of 60 inches: Very slow or slow
Depth to restrictive feature: 19 to 32 inches to a fragipan; 40 to 80 inches to lithic or paralithic bedrock
Available water capacity: About 7.4 inches to a depth of 60 inches
Content of organic matter in the surface layer: 0.5 to 1.0 percent
Shrink-swell potential: Low
Depth and months of highest perched seasonal high water table: 1.5 feet, January through April
Accelerated erosion: The surface layer is mostly subsoil material.
Potential for frost action: Moderate
Hazard of corrosion: Moderate for steel and high for concrete
Surface runoff class: Very high
Susceptibility to water erosion: High
Susceptibility to wind erosion: Very low

Interpretive Groups

Land capability classification: 6e
Prime farmland category: Not prime farmland
Hydric soil status: Not hydric

PART III

OPERATIONS PLAN

1) Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.

RESPONSE: **The proposed operation is the completion of two boreholes: one to pump mine water from the underground workings to ensure proper underground ventilation, and one borehole to place concrete underground where it is needed to facilitate mine support with pumpable cribs. Please see the Operations Map in the Map Section.**

Both Drill holes will be approximately 378-feet in depth. The holes will be cased with 10-inch steel, and a 12'X12'X1' concrete pad will surround the pump hole.

2) Surface Drainage Control

A) (1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems. Show drainage patterns of all affected mining areas.

RESPONSE: **The surface drainage pattern is indicated on the attached Pre and Post Mine Surface Topography Map.**

(2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?

Yes ___ No X .

If yes, delineate how and where surface drainage will be collected and treated, and list permit numbers and type of permit that the drainage control systems are operated under. If above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: **A sediment pond exemption is requested for this permit area due to its small size. Silt fence and/or straw bales will be placed along the outside edge of the disturbed areas to minimize sediment loss from the construction site.**

The topsoil pile will be seeded and immediately mulched to reduce runoff and promote growth.

The work-yard area will be rocked to reduce sediment loss.

B) Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes ____ No __X__.

If no, please discuss.

RESPONSE: Access road ditches will divert some site drainage.

C) Overland Flow Diversions and Sediment Ponds:

Are either overland flow diversions or sediment ponds to be constructed?

Yes ___ No __X__.

If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (surface drainage control).

D) Does a perennial or intermittent stream occur within the proposed IBR area?

Yes ____ No __X__.

If yes, is an exception to the 100 foot buffer zone being requested or is a stream diversion being proposed. For an exception to the 100 foot buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

3) Roads and other activities

A) Are roads to be constructed in the IBR area?

Yes __X__ No ___.

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: A site entrance road will be constructed for access. The transportation facilities section is at the end of this Part.

B) If the operations involve other activities not specifically addressed above complete applicable parts of the SCM-1 or UCM-1

TRANSPORTATION FACILITIES - (From UCM-1)

1) Provide a detailed description on mining operations map or other map and show location of the following:

   a) Proposed road(s), conveyor system(s), or rail system.

   b) Related sediment control facilities.

   c) Earth borrow locations and/or locations for deposition of excess excavation.

   RESPONSE: 1)a)b)c) The Surface Operation Map in the Map Section indicates the proposed access road location. The road will be gravel surfaced on subsoil subgrade. A geotextile fabric will be placed on top of the subsoil subgrade, if it is determined to be necessary.

2) Provide specifications and plan profiles of existing gradeline, proposed road centerline, ditch flow lines, road cut, fill embankment, culvert, bridge and drainage structures. Provide typical cross sections where appropriate.

   RESPONSE: A typical road cross section and road entrance plan view drawings are attached at the end of this PART III.

3) For all transportation facilities to be constructed, provide construction details for all sediment control facilities to be constructed to prevent additional contributions of suspended solids to streamflow or to runoff outside the permit area.

   RESPONSE: For this relatively small area used for the access road, the limestone rocked surface will prevent contributions of soil suspended solids.

4) Discuss the revegetation of ditch and borrow areas involved in construction.

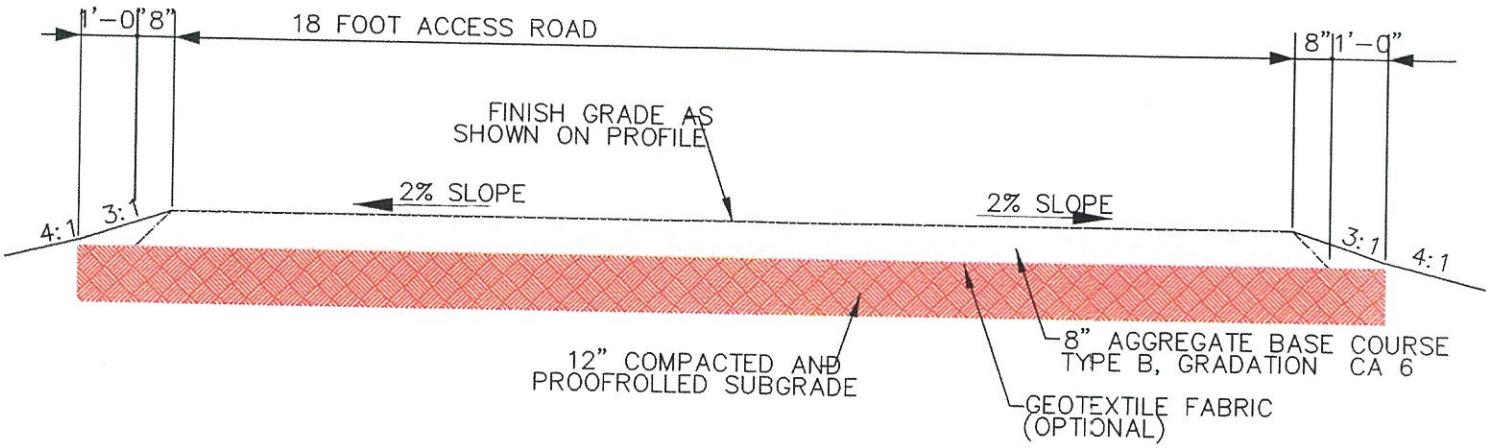
   RESPONSE: See Part IV - Reclamation Plan.

5) Discuss the estimated life of each facility and how materials will be removed when the facility becomes inactive.

   RESPONSE: The life of the facility is anticipated to be approximately (+/-) five years. See Part IV - Reclamation for facility closing plan.

TYPICAL GRAVEL ROAD SECTION

NOT TO SCALE



The Proposed Permit Area is located in part of S/4 of the SW/4 of Section 8, part of the W/2 of the NW/4 of Section 17 and part of the NW/4 of the SW/4 of Section 17 in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL.

Typical Road Section

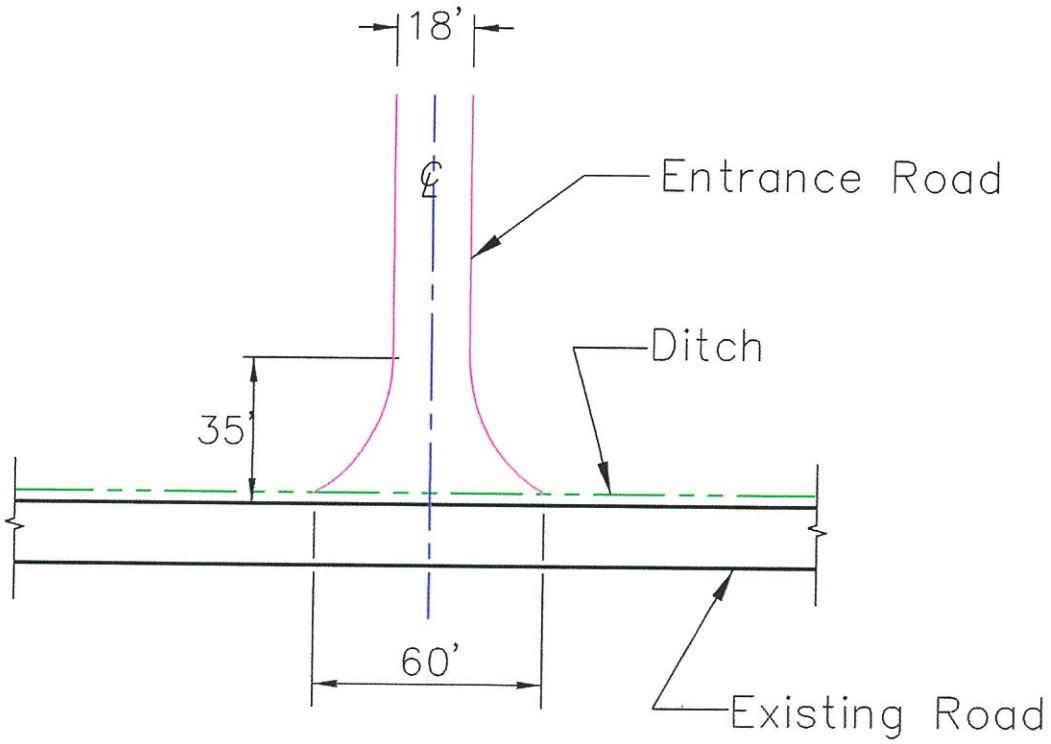
Typical Road Section

TG#2, Break 49 IBR

CBC Engineers

Drawn By	Date	ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375
WDD	10/3/13	POND CREEK MINE NO. 1
Approved By	Date	Prepared For
GLD	10/7/13	WILLIAMSON ENERGY, LLC P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951
Scale	Project No.	Rev. / Map #
NOT TO SCALE	15448I	NA

R10999



Entrance Plan (Typical)

The Proposed Permit Area is located in part of S/4 of the SW/4 of Section 8, part of the W/2 of the NW/4 of Section 17 and part of the NW/4 of the SW/4 of Section 17 in Township 8 South, Range 4 East of the Third Prinicipal Meridian, Williamson County, IL.

0 50 100

Typical Road Section

TG#2, Break 49 IBR

CBC Engineers

Drawn By	Date
WDD	10/3/13
Approved By	Date
GLD	10/7/13

ILLINOIS DEPARTMENT OF NATURAL RESOURCES PERMIT NO. 375

POND CREEK MINE NO. 1

Prepared For
WILLIAMSON ENERGY, LLC.
P.O. BOX 99, JOHNSTON CITY, ILLINOIS 62951

Scale	Project No.	Rev	Map #
1"=50'	15448I		NA

PART IV

RECLAMATION PLAN

1) Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.

RESPONSE: **See the Mine Reclamation Map in the Map Section of this application.**

Note: The pre-mining land use of the proposed permit area is residential, (ie., part of a yard/garden/driveway) and pastureland.

- **The temporary drill pit will be dewatered after meeting Illinois stream Standards, or the settled pit water will be pumped into a container, hauled and released to the mine NPDES sedimentation pond.**
- **Stockpiled subsoil from the borehole drill pit will be returned to the drill pit, and moderately compacted.**
- **The borehole will be plugged according to all IDNR Oil and Gas Division regulatory standards after the borehole is no longer needed.**
- **Rock from the yard/laydown and access road will be removed and stockpiled for reuse at a subsequent facility site, or stockpiled at the mine site to fill the mine shaft/slope during final mine reclamation.**
- **Deep tillage will be applied to the subsoil after rock removal.**
- **The entire disturbed area will be graded for positive drainage. The access road ditches will be filled and graded level with the immediate adjacent surface.**

Topsoil removed and stored, during initial site construction, will be redistributed and graded over the exposed subsoil. The topsoil will be limed, fertilized, prepared and seeded in accordance with the following schedule:

If the site is reclaimed in the spring season before normal planting season, the graded soil will be planted to a pasture mixture, as determined by the tenant farmer.

If the site is reclaimed in the fall season, the site will be seeded to a pasture mixture, and a temporary cover crop of winter wheat will be planted, and the site mulched at two tons/acre, to protect the soil over the winter season.

Planting will occur during the first available period after proper seedbed preparation has been achieved.

2) Post Mining Land Use

A) Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the post-mining land uses on the Post Mining Land Use Map. Acreage figures for post-mining land use must differentiate between mined and surface disturbance areas based on the mining line used in the pre-mining section of the application.

RESPONSE: **Please see the Land Use / Capability Chart on the following page.**

Land Use / Capability Chart

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCrop	Prime	HCap	NonCrop	Prime	HCap	NonCrop
Cropland	8.6	3.5	2.5				8.6	3.5	2.5
Pasture Land		0.8	2.5			2.4		0.8	4.9
Grazing Land									
Forestry			14.0						14.0
Residential			0.6			0.9			1.5
Industrial/Commercial									
Recreation									
Fish & Wildlife Habitat (Herbacious)		2.8	42.4					2.8	42.4
Fish & Wildlife Habitat (Woody)		0.8	567.3					0.8	567.3
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.3						19.3
Undeveloped Land									
Total	8.6	7.9	648.6				8.6	7.9	651.9

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

3) Pursuant to Section 1784.21, the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.

RESPONSE:

A survey of the Approved Shadow Area previously resulted in negative findings for the Indiana bat or its habitat, leading the U.S. Fish and Wildlife Service to grant clearance on 3/14/12 for a period of up to five years. More recently, mist net surveys were conducted by Alliance Consulting, Inc. during the period from May 15 - July 31, 2012 resulting in the capture of two adult male specimens and the location of multiple roost sites. All of the proposed IBR area is located within the Approved Shadow Area and none is located within the 2.5-mile roost tree buffer radius. As a result, the FWS concurred on 11/05/12 that a Protection and Enhancement Plan specific to this proposed IBR would not be warranted. A Protection and Enhancement Plan (PEP) was developed for Williamson Energy, LLC dated December 2012 detailing specific avoidance and minimization measures only required within the 2.5-mile roost tree buffer radius where the species was observed. Refer to the Pre-Mining Land Use Map 3 for a map of the site with the IBR boundary delineated.

DOCUMENT

61

5378-/13
R11006

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

INSIGNIFICANT PERMIT REVISION
PERMIT NO. 375

POND CREEK NO. 1 MINE
COAL REFUSE DISPOSAL FACILITY NO. 2
DTE IMPOUNDMENT PLAN

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B13-106-1413
MARCH 2013

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

INSIGNIFICANT PERMIT REVISION
PERMIT NO. 375

POND CREEK NO. 1 MINE
COAL REFUSE DISPOSAL FACILITY NO. 2
DTE IMPOUNDMENT PLAN

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B13-106-1413
MARCH 2013



Alliance Consulting, Inc.
Engineers · Constructors · Scientists

September 30, 2013

Project No. B13-106-1413

Mr. Larry Crislip
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Mine Pollution Control Program
2309 West Main Street, Suite 116
Marion, IL 62959

Transmittal
Insignificant Permit Revision
Pond Creek 1 - Permit No. 375
Coal Refuse Disposal Facility Nos. 1 and 2
DTE Impoundment Plan
Williamson Energy, LLC

Dear Mr. Crislip:

On behalf of our client, Williamson Energy, LLC, please find one copy of an Insignificant Permit Revision for the permit referenced above. The purpose of the application is to increase the life of the facility.

One copy has been sent to Mr. Scott Fowler and Mr. Brad Murphy with the Illinois Department of Natural Resources on March 21, 2013.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:kjm
Enclosures

FILE: 13106-04

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

March 7, 2013

Mr. Scott K. Fowler, Supervisor
ILLINOIS DEPARTMENT OF
NATURAL RESOURCES
One Natural Resources Way
Springfield, IL 62702-1271

Re: Williamson Energy, LLC - Permit No. 375; Insignificant Permit Revision

Dear Mr. Fowler:

This letter authorizes Mr. James Plumley and Alliance Consulting, Inc. (Alliance) and its representatives, permission to perform work on, receive comments and submit corrections on the above referenced application. Please send copies of any comments to Alliance Consulting, Inc. at 124 Philpott Lane, Beaver, WV 25813, as well as Williamson Energy, LLC at the above address.

Thank you for your cooperation.

Sincerely,

WILLIAMSON ENERGY, LLC

Anthony Webb
Authorized Agent

AW:kjm

13106-03

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

March 21, 2013

Project No. B13-106-1413

Mr. Scott Fowler
ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
Land Reclamation Division
One Natural Resources Way
Springfield, IL 62702-1271

Transmittal
Insignificant Permit Revision
Pond Creek 1 - Permit No. 375
Coal Refuse Disposal Facility Nos. 1 and 2
DTE Impoundment Plan
Williamson Energy, LLC

Dear Mr. Fowler:

On behalf of our client, Williamson Energy, LLC, please find one original and one copy of an Insignificant Permit Revision for the permit referenced above. The purpose of the application is to increase the life of the facility.

One copy has been sent to Mr. Brad Murphy in the Benton Office.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:kjm
Enclosures

FILE: 13106-01

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

March 21, 2013

Project No. B13-106-1413

Mr. Brad Murphy
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
Office of Mines and Minerals
Land Reclamation Division
503 E. Main; FL001
Benton, IL 62812

Transmittal
Insignificant Permit Revision
Pond Creek 1 - Permit No. 375
Coal Refuse Disposal Facility Nos. 1 and 2
DTE Impoundment Plan
Williamson Energy, LLC

Dear Mr. Murphy:

On behalf of our client, Williamson Energy, LLC, please find one copy of an Insignificant Permit Revision for the permit referenced above. The purpose of the application is to increase the life of the facility.

An original and one copy have been sent to Mr. Scott Fowler in the Springfield Office.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Claudio E. Yon, P. E.
Senior Project Manager

CEY:kjm
Enclosures

FILE: 13106-02

ENGINEERING DESIGN PLAN AND PLAN MODIFICATION COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2 DTE IMPOUNDMENT PLAN IMPOUNDMENT ID NOS. IL 08-03141-01 AND IL 08-03141-02 MACH MINE # 1 MACH MINING, LLC JOHNSTON CITY, ILLINOIS

TABLE OF CONTENTS

		PAGE
1.0 INTRODUCTION		1
2.0 EXISTING SITE CONDITIONS		2
2.1	Site Characteristics	2
2.2	Geology	2
3.0 MINING OPERATIONS AND COAL REFUSE PRODUCTION		2
3.1	Mining Operations	2
3.2	Coal Refuse Production	3
4.0 SUBSURFACE EXPLORATION		3
5.0 FIELD AND LABORATORY TESTING		4
5.1	Soil	4
5.2	Coarse Coal Refuse	4
5.3	Fine Coal Refuse	5
5.4	Piezo-Seismic Cone Penetration Testing	5
6.0 COAL REFUSE DISPOSAL PLAN		5
6.1	DTE Impoundment Embankment Construction	6

TABLE OF CONTENTS (continued)

7.0 ENGINEERING ANALYSES 7

7.1 Hydrologic and Hydraulic Analyses 7
7.2 Slope Stability Analyses 8

8.0 SUMMARY 9

9.0 CERTIFICATION OF PLAN 10

APPENDIX A – GUIDELINE TECHNICAL SPECIFICATIONS

APPENDIX B – CALCULATION BRIEF

APPENDIX C – SOIL BORING AND LABORATORY TESTS

APPENDIX D – ANALYSIS OF 8-INCH GAS PIPELINE

FIGURES

LIST OF FIGURES

FIGURE NO.	DRAWING NO.	TITLE
1	B13-055-E1	Phase 2-3 Connector Plan
2	B13-055-E2	Slope Stability Sections D – D, E – E, and F – F
3	B13-055-M1	Miscellaneous Details

ENGINEERING DESIGN PLAN AND PLAN MODIFICATION COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2 DTE IMPOUNDMENT PLAN IMPOUNDMENT ID NOS. IL 08-03141-01 AND IL 08-03141-02 MACH MINE # 1 MACH MINING, LLC JOHNSTON CITY, ILLINOIS

1.0 INTRODUCTION

Plans have been developed for the expansion of an existing coarse and fine coal refuse disposal facility located near Johnston City in Williamson County, Illinois. The proposed coal refuse disposal facility expansion will provide disposal capacity for both coarse and fine coal refuse produced by the Mach #1 Mine, Mine ID No. 11-03141, coal preparation plant located approximately 0.25 mile west of the proposed facility. The location of the site is just southwest of the intersection of Dwina Road and Dean Road. The facility will connect the existing Facility Nos. 1 and 2, MSHA I.D. Nos. IL08-03141-01 and IL08-03141-02

The plan, as presented herein, provides for the disposal of approximately 0.48 years of coarse coal refuse and 0.73 years of fine coal refuse based on production rates provided by Mach Mining, LLC (Mach). The proposed expansion shall be constructed by placement of two coarse coal refuse embankments to close the gap between the existing Phase 2 and Phase 3 embankments. The proposed embankment shall then raise the existing Phase 2 crest to elevation 538 and match the Phase 7 crest. The proposed embankment will cover the existing 8-inch gas pipeline. Prior to construction, the 8-inch gas pipeline will be fitted with appropriate filter diaphragms and outlet drains to prevent internal erosion along the pipeline. At the beginning of construction of the proposed phase, fine coal refuse shall be disposed in the existing phases of the impoundment[1] MSHA ID No. IL08-03141-02 (Phases 4/6/7).

The proposed facility has been designed as a high hazard impoundment using the Probable Maximum Flood (PMF) storm event. The facility has been designed to be capable of storing the runoff associated with the design storm event. The stored runoff volume, as well as operational water, shall be evacuated using a pump.

Existing combination, sedimentation, and perimeter ditches, access road gutters and bench gutters will be used to convey storm runoff away from the embankment in a controlled manner. The ditches have been designed for routing the runoff associated with the 100-year, 6-hour recurrence interval storm event.

This report presents the design drawings, guideline technical specifications (Appendix A),

---

[1] Alliance Consulting, Inc. report entitled "Plan Modification Mach #1 Mine, Coal Refuse Disposal Facility No. 2, Phase 4 Through 7, Impoundment ID No. IL08-3141-02"" prepared for Mach Mining, LLC, Johnston City, Illinois, dated March 2011.

calculations (Appendix B), soil borings and laboratory tests (Appendix C), and analysis of 8-inch gas line (Appendix D) necessary for the design and construction of the embankment.

2.0 EXISTING SITE CONDITIONS

2.1 Site Characteristics

The general area of the proposed impoundment has previously been used for agricultural purposes and has relatively flat to mild slopes to the ridgeline at approximate Elevation 572. The surrounding landscape is characterized by extensive agricultural and rural residential land use. Regionally, the proposed permit area is located on the southern shelf of the Illinois Basin in the Mt. Vernon Hill Country physiographic division. Surrounding landforms are the results of both Wisconsinian glaciations and normal degradation processes such as weathering, mass wasting, and stream erosion. Surrounding topography is characterized by generally flat ridge tops, moderately steep hill slopes and broad flat valley floors associated with major streams. The local drainage pattern is dendritic reflecting the regional generally horizontal bedrock stratigraphy. The total relief of the Facility No. 2 footprint is approximately 32 feet ranging from approximately 436' to 468' above mean seal level (based on aerial photography).

Glacial deposits of the Carmi Member of the Equality Formation, consisting of quiet water lake silt and clay, constituted the original surface materials within the proposed permit area.

2.2 Geology

The proposed permit area is underlain by lower Pennsylvanian age rocks consisting of shale, sandstone, and siltstone with minor underclay, coal and limestone. These sequences reflect fluctuating shorelines, deltas, and shallow seas indicating deltaic, fluvial, and coal swamp depositional environments. These bedrock units can be highly variable in thickness and continuity. Mississippian rocks unconformably underlie the Pennsylvanian, however, they do not outcrop in the subject area and were not penetrated during exploration drilling.

The major stratigraphic marker is the Herrin No. 6 coal which is generally uniform and continuous in the subject area and occurs at approximate Elevation 10 beneath the proposed refuse disposal facility. Shale and sandstone units in the subject area exhibit a high degree of lateral facies changes and interbedding. The Herrin No. 6 seam is described as a normal bright-banded coal with a lower portion that contains a prominent claystone parting. The base of the Herrin No. 6 exhibits an undulating surface with a general structural trend toward the north-northeast dipping approximately 60 feet per mile. No major faults or other structural anomalies are known to be present within the proposed permit.

3.0 MINING OPERATIONS

3.1 Mining Operations

The Herrin No. 6 coal seam (average Elevation 10 feet above mean sea level) has been mined by both longwall and conventional mining techniques beneath the footprint area of the proposed facility.

Concerning breakthrough potential, the Bureau of Mines Information Circular 8741 recommends an overburden thickness equal to 60 times the extraction height for total extraction mining. The lowest level of the subsided pool area is approximately Elevation 420, and the bottom of coal seam is at average Elevation 10 feet with an extraction height of 6.5 feet. Therefore, the existing overburden thickness is greater than the recommended thickness and there is no significant potential for a catastrophic breakthrough of fine coal refuse slurry into the mine to occur.

No proposed underlying mining will occur during construction of the proposed phases, therefore, the majority of subsidence has already occurred and is not expected to impact construction of the new phases.

Based on these conditions and recommended guidelines, it is expected that no adverse effects shall impact the stability or breakthrough potential of the impoundments.

3.2 Coal Refuse Production

Based on current plant operation information provided by Mach Mining, the following annual production quantities were used in the design.

- Coarse Coal Refuse 2,568,200 cubic yards/year
- Fine Coal Refuse 2,064,400 cubic yards/year

4.0 SUBSURFACE EXPLORATION

During the month of July 2012, a new subsurface exploration program was conducted within the footprint of the proposed East of Dwina embankment. The intent of the program was to obtain soil samples to define the conditions and engineering characteristics relative to the construction and operation of the fine coal refuse slurry disposal impoundment. The soil borings and laboratory test results report can be found in Appendix C. In addition to the new soil borings, the results of a previous subsurface exploration program performed by Holcomb Foundation Engineering Co. (Holcomb) indicate the following:

- Sample number, type, standard penetration test blow counts, and depth;
- An overall description of the consistency, color and character of the soil; and,
- Indication of the observed groundwater level in the boreholes at the time of drilling.

Generally, the soils encountered beneath the dam footprint consist of brown and gray silty clay with sand and pebbles. The thickness of the soil varied from 11' to 70' while the surface elevation for the borings varied from Elevation 440.0± to Elevation 488.0±. Each of the borings was terminated at the top of the bedrock.

Groundwater was encountered in one (1) of the twenty-two (22) borings (i.e. No. D2). Following drilling, the depth from the ground surface to groundwater level varied from 8 to 25 feet or from Elevation 415.0± to Elevation 480.0± in the borings.

5.0 FIELD AND LABORATORY TESTING

5.1 Soil

Samples of the soils obtained during the subsurface exploration program from Boring Nos. D1 and D2 were used for laboratory testing. The scope of the testing is discussed below.

Visual classification tests were performed by Holcomb on the split spoon samples obtained during drilling. Samples from the borings represent the foundation conditions for the proposed embankment. Additional testing performed on the borings included the following:

- Atterberg Limits Test – Atterberg Limits tests were performed on a sample from Boring Nos. D1 and D2.
- Consolidation Test – A consolidation test was performed on Boring No. D1.
- Shear Strength Test – A consolidated, undrained triaxial shear strength test with pore pressure measurements was performed on a Shelby tube sample from Boring Nos. D1 and D2.

5.2 Coarse Coal Refuse

The proposed embankment shall be constructed with coarse coal refuse. The coarse coal refuse used to construct the embankment has previously been sampled from the Mach #1 Mine coal processing plant for baseline laboratory testing. The scope of the testing is discussed below.

- Grain Size Analysis – A grain size analysis was performed on the coarse coal refuse sample.
- Shear Strength Test – A consolidated, undrained triaxial shear strength test with pore pressure measurements was performed on re-molded samples of the coarse coal refuse. Material from the sample was re-molded to a density equivalent to approximately 95 percent of Standard Proctor maximum dry density.
- Permeability – A constant head permeability test was performed on a re-molded sample to determine the permeability characteristics of the coarse coal refuse for the embankment construction. The sample was compacted to approximately 95 percent of the Standard Proctor maximum dry density.
- Compaction Test – A Standard Proctor compaction test was performed on the coarse coal refuse sample.

A grain size analysis, moisture content and compaction testing are tested monthly to verify the properties of the coarse coal refuse.

5.3 Fine Coal Refuse

Two fine coal refuse bulk samples were obtained from the South Pond (Phase 2) for laboratory testing. The scope of the testing is discussed below and the results are presented in Appendix I[(2)] (under separate cover).

- Moisture Content – Moisture contents were performed on the two fine coal refuse samples.
- Grain-size Analysis – Grain size distribution analysis was performed on the two fine coal refuse samples (sieve and hydrometer).
- Atterburg Limits – Atterberg Limit tests were performed on the two fine coal refuse samples.
- Specific Gravity – Specific gravity tests were performed on the two fine coal refuse samples.
- Shear Strength – Six consolidated – undrained triaxial tests were run on remolded fine coal refuse samples. These six tests included moisture content and total and dry density determinations.

5.4 Piezo-Seismic Cone Penetration Testing

- Fifteen piezo-seismic cone penetration soundings were performed at the Pond Creek site to measure tip stress, sleeve stress, pore water pressure, and shear wave velocities. The testing was used to correlate index and strength parameters for the coarse coal refuse and foundation soil and for use in a deformation analysis.
- The testing data and results are presented in Appendix I[(2)] (under separate cover).

6.0 COAL REFUSE DISPOSAL PLAN

The proposed plan provides disposal capacity for approximately 0.48 years of coarse and 0.73 years of fine coal refuse production. The plan has been developed in accordance with prudent engineering principles and practices and current Mine Safety and Health Administration (MSHA) design criteria for coal refuse disposal facilities. Additionally, an analysis of the 8-inch gas pipeline was conducted to ensure the pipe can adequately withstand the embankment loading. The analysis was performed also to verify the pipeline will remain within the allowable stress limits since prior longwall mining induced a stress on the pipe. The analysis can be found in Appendix D. It is intended that the construction of the facility be monitored by experienced persons knowledgeable of the design, specifications and regulatory requirements.

A brief description of the disposal plan is as follows:

[(2)] GAI Consulting, Inc. report entitled "Response to MSHA Comment Nos. 1, 3, 7 and 8, Pond Creek Mine No. 1, Coal Refuse Disposal Facility No. 2, Phases 3 and 7, Impoundment ID No. 1211-IL08-03141-02, Williamson Energy, LLC, Mach Mining Company, Williamson County, Illinois," prepared for Alliance Consulting, Inc. Project C090403.01, May 2009

2. Sedimentation control for the construction of the embankment shall be provided by existing sedimentation ponds and ditches. Bench gutters and conveyance ditches shall be constructed to route the runoff from the embankment area to the sedimentation ditches.

3. The Phase 2-3 Connector will be constructed over the existing 8-inch gas pipeline and close the gap between the existing Phase 2 and Phase 3 embankments. The proposed plan will then raise the Phase 2 crest to elevation 538 and will be constructed to match the Phase 7 crest Elevation. A portion of the Phase 2 crest raising construction will be done following upstream construction techniques in the area of Phase 2 that was not previously capped by coarse coal refuse. Safety precautions and safe working practices for upstream construction have been outlined in Appendix A.

4. Fine coal refuse slurry shall be pumped into the Phase 4/6/7 impoundment upon commencement of construction. The discharge line(s) shall be moved to result in a relatively uniform surface of fines throughout the impoundment and to minimize the depth of any water impounded directly against the embankment slope. Generally, a delta of fine coal refuse shall be maintained along the embankment slope.

5. Operational pump(s) and discharge line(s) shall be maintained to remove clarified water and normal rainfall from the impoundment. The facility has been designed to store the runoff associated with a PMF design storm event. Pumps with independent power supplies (diesel motors or generators) will be kept on site and used to evacuate storm water.

6. An internal drainage system located within the west embankment shall be installed to aid in controlling the phreatic level within the embankment for future upstream expansion[(2)]. Animal guards shall be installed on all internal drain outlets to prevent vector infiltration.

6.1 Phase 2-3 Connector Construction

The Phase 2-3 Connector, which is shown in plan on Figure No. 1 and cross section on Figure No. 2 will be constructed in two stages and requires approximately 0.48 years of coarse coal refuse production to construct and will create an impoundment between existing Phases 2 and 3, and raise the Phase 2 crest to match the Phase 7 crest at approximately Elevation 538. The maximum fine coal refuse level has been established to account for displacement of fines during future upstream construction to be submitted under separate cover following review of this plan[(2)]. Pertinent construction items include:

1. Embankment Construction – The Phase 2-3 Connector embankments shall be constructed as shown on Figure No. 1. The embankment will require the placement of approximately 1.25 million cubic yards of coarse coal refuse and will match the crest elevation of Phase 7. The upstream and downstream slopes of the embankment

[(2)] A future upstream expansion is proposed for this facility. The plan will be submitted with a proposed Facility No. 3, Permit No. 417.

shall be constructed on a grade of 3H:1V. Prior to embankment construction, an existing underlying 8" gas pipeline will be fitted with a filter diaphragm as shown on Figure No. 1. Excavated material shall be backfilled and compacted prior to coarse refuse placement. It is anticipated that coarse coal refuse will submerge a minimum of 20 feet into the fine coal refuse during construction over the uncapped portion of Phase 2 as shown on Figure No. 2.

2. Fine Coal Refuse Disposal – During construction of the Phase 2-3 Connector, the fine coal refuse slurry will continue to be pumped into the existing Phase 4/6/7 impoundment. Fine coal refuse may be pumped into the Phase 2-3 Connector cell upon completing the east and west embankments to elevation 500± and matching the existing Phase 2 and Phase 3 crests. The Phase 2-3 Connector will provide for the disposal of 1.50 million cubic yards of fine coal refuse at a life of 0.73 years.

3. Internal drain – An internal drainage system consisting of perforated pipe imbedded in a non-calcareous gravel wrapped with a geotextile, shall be installed during construction to aid in controlling the phreatic level within the future upstream embankment[3]. The location and invert elevations for the internal drain are presented on Figure No. 1. Animal guards shall be installed on drain outlets to prevent vector intrusion of the internal drains. Details pertaining to the drain construction are provided in the guideline technical specifications and on Figure No. 3.

4. Surface Drainage – Existing sedimentation/perimeter ditches shall be used as shown on Figure No. 1, to collect surface water and clarify the runoff before it is discharged into an existing channel.

5. Gas Pipeline Filter Diaphragm – A filter diaphragm and outlet drain has been designed to be installed on the existing 8-inch gas pipeline to prevent internal erosion (piping) along the pipeline. The locations of the filter and outlet shall be installed at the location shown on Figure No. 1. Details of the filter and outlet drain, and backfill procedures are on Figure No. 3.

7.0 ENGINEERING ANALYSES

In support of the plan, engineering analyses included slope stability analyses and the hydrologic and hydraulic studies for the impoundment and surface drainage facilities. The calculations describing the design assumptions, methodology and results are included in Appendix B.

7.1 Hydrologic and Hydraulic Analyses

The proposed facility has been evaluated using storm criteria for high hazard dams. The impoundment shall be capable of storing the runoff associated with a PMF design storm event plus three feet of freeboard.

Evacuation of the stored runoff shall be accomplished by diesel pumps. The required pumping capacity is based on storing the runoff and evacuating 90 percent of the runoff associated with one design storm event within 10 days. Pumps with an independent power source (diesel motor

or generator) and associated discharge lines and connections will be kept on site to evacuate the storage storm runoff. The required pumping capacity has been defined in Appendix B.

7.2 Slope Stability Analyses

Slope stability analyses have been performed for the upstream and downstream slopes of the embankments using PCSTABL5, a computerized version of the modified Bishop Method of Slices, developed by Purdue University and the Indiana State Highway Commission. The critical potential failure surfaces, minimum factors of safety, and material properties used in the slope stability analyses are presented on Figure No. 2, and in the Appendix B.

Slope stability was analyzed for static loading conditions for the downstream and upstream embankment slopes. Effective properties for the coal refuse and existing soil were used. The use of effective stress properties for the coal refuse and total stress properties for the existing cohesive soils is appropriate, giving the effects of the sudden loading in an earthquake event and the relatively slow drainage characteristics of the soils. The phreatic level used in the stability analyses was conservatively based on top flow line calculations performed on a transformed section. The transformed section was based on the horizontal permeability of the embankment material being nine times greater than the vertical permeability. The engineering properties of the embankment material were based on laboratory test results and our experience with similar materials.

Section D – D of the analysis was performed through the east embankment to determine the placement of the internal drain. Section E – E was performed through the west embankment to determine static stability. The upstream stability analysis of Section E – E is representative of Section D – D. Section F – F was analyzed over the capped portion of Phase 2. This is still relative of the embankment construction over the uncapped portion of Phase 2. The cap represents the portion of the embankment that will occupy the storm storage and freeboard zones. The analysis conservatively assumes no submergence of coarse refuse occurs.

The most critical potential long-term failure surfaces, as shown on Figure No. 2 is summarized below:

STAGE	CASE	MINIMUM STATIC F. S.
Phase 2-3 Connector	Downstream Upstream	1.51 1.88

As indicated in the above table, the computed factors of safety meet the minimum requirements (1.5 for the static case).

8.0 SUMMARY

The design plans for the proposed Pond Creek No. 1 Mine DTE Impoundment Plan are based on the subsurface exploration program, field and laboratory testing, and the engineering analyses as described.

The plan should provide disposal for approximately 0.48 years of coarse coal refuse and 0.73 years of fine coal refuse.

9.0 CERTIFICATION OF PLAN

I, Claudio E. Yon, P.E., certify[3] the plan entitled "Insignificant Permit Revision, Permit No. 375, Pond Creek No. 1 Mine, Coal Refuse Disposal Facility Nos. 1 and 2, DTE Impoundment Plan" prepared for Williamson Energy, LLC, Johnston City, Illinois and was developed in accordance with prudent engineering principles and practices, and applicable Mine Safety and Health Administration and Illinois Department of Natural Resources design criteria.

SIGNED: _____
Claudio E. Yon, P.E.

DATE: 3/21/13
ALLIANCE CONSULTING, INC.

[3] The term "certify," as used herein, is defined as follows: "An Engineer's certification of conditions is a declaration of professional judgment. It does not constitute a warranty or guarantee, either expressed or implied, nor does it relieve any other party of their responsibility to abide by contract documents, applicable codes, standards, regulations and ordinances."

APPENDIX A

GUIDELINE AND TECHNICAL SPECS

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2
DTE IMPOUNDMENT PLAN
IMPOUNDMENT ID NOS. IL 08-03141-01 AND IL 08-03141-02
MACH MINE # 1
MACH MINING, LLC
JOHNSTON CITY, ILLINOIS

TABLE OF CONTENTS

		PAGE
INTRODUCTION		A-1
1.0 SITE PREPARATION		A-2
1.01	Surface Sealing/Proofrolling	A-2
1.02	Stripping and Topsoil Removal	A-2
1.03	Surface Sealing/Proofrolling	A-2
1.04	Subsidence Crack Repair	A-3
2.0 EMBANKMENT CONSTRUCTION		A-3
2.01	General	A-3
2.02	Gas Pipeline Filter Diaphragm	A-3
2.03	Coarse Coal Refuse Placement and Compaction	A-4
2.04	Construction Procedures	A-5
2.05	Safety Precautions and Safe Working Practices	A-6
2.06	Keying and Benching	A-7
2.07	Survey Control	A-7
2.08	Subsurface Drains	A-7
2.09	Standpipe Piezometers	A-8
2.10	Quality Control	A-8
3.0 FINE COAL REFUSE DISPOSAL		A-9
3.01	General	A-9
3.02	Clarified Water Removal	A-9
4.0 SUBSURFACE EXPLORATION		A-9
4.01	General	A-9
4.02	Benches and Bench Gutters	A-9
5.0 REVEGETATION OF COMPLETED AREAS		A-9

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
Table of Contents (Continued)

6.0	MONITORING AND MAINTENANCE	A-10
6.01	Piezometers and Impoundment Level	A-10
6.02	General Observations	A-10
6.03	Upstream Construction Observations	A-11
6.04	Maintenance	A-11
6.05	Data Review	A-12
7.0	DRAWINGS	A-12

APPENDIX A

GUIDELINE TECHNICAL SPECIFICATIONS
COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2
DTE IMPOUNDMENT PLAN
IMPOUNDMENT ID NOS. IL 08-03141-01 AND IL 08-03141-02
MACH MINE # 1
MACH MINING, LLC
JOHNSTON CITY, ILLINOIS

INTRODUCTION

These specifications are intended to serve as guidelines for the construction of the Pond Creek No. 1 Mine Refuse Disposal Facility Nos. 1 and 2, Phase 2-3 Connector, to serve Mach Mining, LLC's (Mach Mining) coal preparation plant in Williamson County, Illinois. The information contained herein, including the accompanying drawings which illustrate the disposal plan, is sufficiently detailed to provide Mach Mining with the technical guidance required to perform coal refuse disposal operations in a manner consistent with the design assumptions and sound engineering practice. These specifications are intended to be supplemented with periodic site visits by persons knowledgeable of the design in order to conduct inspections of the construction procedures, conduct field tests and, if necessary, obtain samples and perform laboratory testing.

The specifications have been prepared to aid Mach Mining in the design, planning, and construction of the specific project. Its scope is limited to the project and location described herein and represents our understanding of the significant aspects relevant to the planned operations. If there are any differences in location and/or design features, the modification should be reviewed to determine if revision of conclusions or recommendations is required.

This refuse disposal plan provides for the expansion of Facility No. 1 and 2, utilizing coarse coal refuse to form an impoundment for the disposal of fine coal refuse slurry. The disposal plan for the facility will provide approximately 0.48 years of coarse and 0.73 years of fine coal refuse disposal capacity based on refuse production rates determined by Mach Mining.

Briefly, the work items required in the coal refuse disposal plan include:

1. Site Preparation - In areas of embankment construction, the site preparation items include topsoil stripping and stockpiling and proofrolling/sealing. During the disposal operations, benching of each lift of material into existing slopes shall be required as well as scarifying previously compacted surfaces.

2. Embankment Construction – Two coarse coal refuse embankments will be constructed to join Facility Nos. 1 and 2. The Facility No. 1 crest will then be raise to match the Facility 2 crest at Elevation 538.

3. Subsurface Drainage – An internal drainage system (rock gravels, perforated pipe, and filter fabric) shall be installed in the Phase 2-3 Connector embankment to aid in controlling the phreatic level.

4. Fine Coal Refuse Disposal – At the beginning of construction, fine coal refuse will continue to be disposed of in the existing Phase 4/6/7 impoundment. Fines disposal may begin in the Phase 2-3 Connector upon completing the east and west embankments to match the existing Phase 2 and 3 crests. A water pumping system shall be used to remove excess clarified slurry water and precipitation from the impoundment.

5. Surface Drainage Facilities - To control and direct surface water runoff from the embankment, access road bench gutters, flumes, perimeter/sediment ditches and conveyance ditches shall be constructed concurrent with construction operations.

6. Abandonment – An abandonment grading plan will be provided in the future, if required.

7. Revegetation - To control erosion and provide an acceptable post mining land use, all completed embankment surfaces shall be revegetated in accordance with Mach Mining's Mine Permit.

8. Monitoring and Maintenance - A program of regular monitoring and maintenance of the disposal operations is described herein.

1.0 SITE PREPARATION

1.01 General

Site preparation shall be required beneath all areas of the refuse disposal facility.

1.02 Stripping and Topsoil Removal

Stripping and stockpiling of topsoil and root matter are required to provide an adequate foundation for facility construction. All topsoil shall be removed prior to embankment, impoundment, and road construction. The stripped topsoil shall be stockpiled. Stockpile areas for topsoil are presented on the drawings. As areas are prepared for final reclamation, topsoil may be removed from future disposal areas and hauled directly to areas being reclaimed.

1.03 Surface Sealing/Proofrolling

The footprint of the embankment and the impoundment area shall be proofrolled following stripping and topsoil removal to seal and compact the foundation soils. A minimum of three passes shall be made over each area using a large sheepsfoot roller or rubber-tired equipment (i.e. loaded truck) to produce a minimum 95 percent of the maximum dry density attainable by the Standard Proctor method of compaction (ASTM D 698).

Before being backfilled with compacted coarse coal refuse or compacted earthfill, the surface shall be inspected to determine whether any mine spoil or excessively wet or soft soils are present at the bottom of the excavation. Any soft or wet soils shall be

removed to a minimum depth of 2 feet below the previously excavated surface and replaced with coarse coal refuse. The over-excavated area shall be backfilled with silty, clayey soil, placed in 8-inch lifts, and compacted to 95 percent of the Standard Proctor maximum dry density (ASTM D 698).

1.04 Subsidence Crack Repair

All substantial subsidence effects of longwall mining underlying the proposed embankments should have previously occurred by the time construction of the proposed phases commences. Should subsidence surface cracks appear, the area shall be excavated to a depth of at least four feet, proof rolled, and backfilled and sealed with compacted coarse coal refuse placed to the compaction standard in these specifications. In the event that extensive, deep cracking is discovered, a cutoff trench will be extended to bedrock through the affected areas. The trench will be located beneath the underdrain alignment where applicable. If it is discovered that a cutoff trench needed, a specific design will be submitted for approval prior to its construction.

2.0 EMBANKMENT CONSTRUCTION

2.01 General

To provide storage capacity for approximately 0.48 years of coarse and 0.73 years of fine coal refuse, two coarse coal refuse embankments will be constructed to connect the existing Facility Nos. 1 and 2. The north and south sides of the proposed impoundment will be formed by the existing Facility Nos. 1 and 2 embankments. The Facility No. 1 crest will then be raised with coarse coal refuse to match the Facility No. 2 crest at Elevation 538.

Sediment control shall be provided by the existing sediment ditches.

2.02 Gas Pipeline Filter Diaphragm

a. General - A filter diaphragm shall be installed at the locations shown on Drawing No. B13-055-E1 and in detail on Drawing No. B13-055-M1, to minimize internal erosion (piping) along the pipeline. Extreme caution should be used when working in areas of the gas pipeline.

b. Material - The diaphragm shall be constructed of crushed, hard, angular sandstone aggregate within the following gradation range and wrapped entirely in "Geotex 501" filter fabric or an equivalent approved by the Engineer.

Sieve Size	Percent Finer
1-1/2-inch	100
1-inch	66.7
3/8-inch	0 - 5

c. Filter and Drainage Diaphragm Outlet Drain - To convey seepage collected by the filter and drainage diaphragm to a surface drainage ditch, an outlet drain shall be constructed, as shown on Drawing No. B13-055-E1. The drain shall be constructed in accordance with the detail presented on Drawing No. B13-055-M1.

Gradation testing shall be performed on compacted samples of the coarse coal refuse and gravel prior to installation of the filter drainage diaphragm to verify the parameters used in the design of the diaphragm.

2.03 Coarse Coal Refuse Placement and Compaction

a. Lines and Grades – Coarse coal refuse shall be placed to the lines and grades shown on the drawings for the various stages. Control for placement can be established from the coordinate system provided on the drawing.

b. Material – Run-of-plant coarse coal refuse shall be spread in lifts not more than one foot thick when compacted. Material that is too wet to be properly compacted shall be spread and graded to facilitate drainage. Upon drying to within the acceptable moisture content range, compaction may proceed.

c. Placement and Compaction – The placement and compaction of the soil shall be in accordance with the procedures for the coarse coal refuse discussed in Section 2.03.d and 2.03.e of these guidelines technical specifications. The maximum compacted lift thickness shall not exceed 8 inches.

d. Compaction: The coarse coal refuse in the impounding embankment shall be spread in layers having a thickness of 1 foot or less. The material shall be compacted by routing heavy equipment (dozers and trucks, etc.) over it or utilizing specialized compaction equipment to attain the specified degree of compaction. No special compaction procedures are anticipated to be required to provide resulting densities which are consistent with those used in the design. A field density testing program shall be conducted during the placement operations to determine the actual dry density being achieved. A compacted dry density of at least 95 percent of the maximum dry density achieved with a Standard Proctor test (ASTM D 698) shall be required for all coarse coal refuse placed within the impounding embankment.

Field density testing of the foundation soil and coarse coal refuse placed in the embankment areas shall be performed to confirm that the compactive effort employed is yielding an in-place dry density of at least 95 percent of the maximum density obtainable by the Standard Proctor Compaction Method (ASTM D698). Density testing shall be performed at equivalent frequencies of one test per 2,000 cubic yards of material placed and compacted and at least one test for each lift. Locations, elevations, and dates of the tests shall be recorded and maintained for documentation purposes. The moisture at time of compaction shall be within the range of optimum moisture by -2 percent to +3 percent. If in-place



dry densities are observed to be less than that required, additional compaction shall be performed on the effective test area and the area retested. Such work shall continue until satisfactory results are obtained.

At least one Standard Proctor test of the material shall be verified for every 20 field density tests performed. Additionally, should mining or preparation plant operations change such that a change in refuse material properties is anticipated, the Proctor shall be verified.

2.04 Construction Procedures

The work surface shall be advanced upward in nearly horizontal layers. To minimize penetration of precipitation, the work surface shall be sloped and backbladed as the material is spread. No fill shall be placed on frozen material. If the surface where fill is to be placed is frozen, the frozen material shall be removed over an area where one day's refuse will be placed prior to placement of a new lift. The frozen material shall be stored until it is thawed and then replaced. Surface material in the impounding embankment too wet to support construction equipment shall be removed to expose drier material prior to placement of the next refuse layer. After drying, these wet materials can be reused in the embankment. As the level of the embankment is raised, it shall be graded smoothly to the contours shown on the plans. Additional considerations for upstream construction are as follows:

1. Alternate between upstream and downstream construction when possible to allow excess pore pressures to dissipate. The rate of placement for advancing push-out material is critical;
    - Rapid placement of push-out material during construction of the upstream push-out results in excess pore pressures.
    - Excessive pore pressure reduces the residual strength between the particles of the push-out material.
    - Loss of strength results in instability problems.
2. Pump the water level down as much as possible, for as long as possible, to expose the slurry delta, prior to initiating push-outs.
3. The initial lift shall be of sufficient thickness to support the construction equipment. Generally, the top of the initial push-out should be maintained within 5 feet of the pool level.
4. If pumping of the fill material is observed due to excess pore pressures, fill placement will halt until the excess pore pressures dissipate.
5. Spread construction out across full length or width of the push-out. Do not concentrate placement in one area.
6. Monitor Pore pressures – use pneumatic or vibrating wire piezometers.
7. A detail plan should be developed and followed for the construction of the upstream push-out. The coarse refuse placement procedures should proceed in a systematic manner.
8. All push-outs shall begin at the left or right abutment against solid ground.
9. Grade controls shall be maintained at all times.



2.05 Safety Precautions and Safe Working Practices

The following safety guidelines should be exercised regarding upstream construction:

1. Safety meetings shall be conducted and procedures discussed on a weekly basis, education and training is essential. Operators will be aware of the proper procedure for advancing the push-out.
2. All equipment operators working on or near the impoundment area shall be given additional hazard training. The safety procedures with regards to upstream construction shall be reviewed, along with all existing equipment and material handling safety policies.
3. Equipment operators shall always exercise caution during upstream construction, especially when a new push-out is started. They should be cognizant that the initial pad of a push-out will likely contain soft areas, and that differential settlement or other movements could cause the subgrade to become unstable. Accordingly, equipment operators shall continually examine the work area for unsafe conditions.
4. Oversight by knowledgeable personnel – preferably a person who is familiar with mechanics of upstream construction and can recognize and immediately have corrected unsafe work practices and conditions.
5. Use a spotter to watch for settlement cracks and slumps.
6. Use equipment operators who are experienced in this type of work. Required initial push-out lift thickness is not intuitive. Inexperienced equipment operators, especially contractors who are used to working in other settings, sometimes think thicker lifts are better, and may not understand that excessively thick lifts can result in cracking and rapid sinking of the push-out into the impoundment.
7. Equipment operators shall continually check for cracks in the push-out area. If a crack is detected, the operator will not proceed past the crack for any reason. Cracking of the push-out material is a sign of movement and potential instability. Push-out areas on the pool side on the pool of the crack shall be allowed time to settle before additional coarse coal refuse is gradually worked out over the cracked area.
8. Develop an exclusion zone for trucks, scrapers, and compactors until a firm base is established;
    - Exclusion zone 50-100 feet back from leading edge of push-out.
    - Clearly mark the zone with cones, stakes or barrels.
9. Trucks shall not travel or dump near the edge of an upstream push-out because the refuse may give way. Trucks shall dump a safe distance back from the edge and the material shall be pushed toward the pool by a dozer.
10. Use low ground pressure (LGP) track dozers.
11. Dozer operators shall not operate parallel to the edge of a push-out; dozers will always be operated perpendicular to the edge. Dozer operators must take extreme care not to get too close to the edge of the push-out.
12. Dozer tracks shall be offset when returning back to stockpile.
13. Dozers shall not contain a "submarine kit", thick break resistant windows, or brush guards over the windows.

14. Dozer operators will wear life vests during construction of initial push-out.
15. The dozer shall not push a full blade of material completely into the pool; the blade should be "double loaded". A berm of coarse refuse material, approximately 3 to 6 feet high, measured on the same plane that the dozer is pushing, shall be left in-place on the front edge of the lift leading into the pool to insure that the dozer has sufficient refuse beneath it for support. Subsequent dozer pushes into the pool shall push the existing berm into the pool, leaving a berm in its place, lessening the chance of the operator getting the dozer too close to the pool area.
16. For safety purposes, a minimum of two dozers shall be used during the construction of a push-out. The dozer operators shall sequence their push patterns, such that only one operator is near the upstream edge of the push-out during fill placement. The dozer operators shall be in visual sight of each other at all times.
17. Two way radios or similar devices shall be used by equipment operators during construction, so that if potential hazards are observed they can be quickly communicated to other operators.
18. A work skiff w/oars and life jackets is recommended (proper access and training should be provided).
19. A floatation ring attached to a rope, a throw back or other similar devise shall be maintained near the push-out area.
20. Material will only be pushed into the pool in daylight under good visibility conditions.

2.06 Keying and Benching

To tie new coarse refuse fill adequately into the existing embankment surfaces, any previously placed coarse refuse slopes shall be benched as each lift of the new fill is placed. Tie-in construction shall extend into the previously placed embankment a minimum of 4 feet or until acceptable compacted material is encountered.

2.07 Survey Control

Survey control shall include establishment of permanent monuments outside of, but adjacent to the refuse disposal facility limits. This control shall be used for the management of day-to-day operations.

2.08 Subsurface Drains

a. General – To minimize the possible rise in the phreatic level as the impoundment level rises, internal under drains shall be installed within the embankment. The drains shall consist of an HDPE perforated pipe embedded in non-calcareous gravel wrapped entirely with filter fabric. A detail for the installation can be found on Drawing No. B13-055-M1. The approximate alignment and elevations of the drains are indicated on the drawings.

b. Rock Gravel – Competent, durable clean gravel in the size range of 3/8 to 1½ inches shall be used in the drains. The gravel shall consist of non-acid, non-toxic, non-calcareous rock that will not slake in water or degrade to soil material during the life of the facility, and which is free of coal, clay or other non-durable material.

c. Pipe – The pipe used in the internal drain shall be perforated high-density polyethylene pipe. The perforations shall be in accordance with the detail on Drawing No. B13-055-M1.

d. Filter Fabric – The filter fabric shall be "Geotex 501" manufactured by Propex Fabrics, Inc., or an approved equivalent geotextile that is ultraviolet stabilized to resist deterioration. The filter fabric shall be protected from ultraviolet exposure during storage.

e. Installation – Details pertaining to the internal drains are presented on Drawing No. B13-055-M1. As shown on the drawing, the gravel shall be wrapped entirely with filter fabric with a minimum 2-foot overlap.

The installation of the underdrains shall be monitored by the engineer responsible for certifying the construction of the embankment or by a qualified person designated by the engineer.

2.09 Standpipe Piezometers

Standpipe piezometers shall be installed at the locations shown on the drawings and in accordance with the detail on Drawing No. B13-055-E1. Clean concrete sand may be substituted for the pea gravel if the latter is difficult to obtain. The perforated section of the piezometer pipe shall be wrapped with filter fabric. Bentonite seals shall be placed immediately above the perforated section and just below the ground surface to isolate the piezometer tip from potential perched water tables and minimize any influence associated with surface water. A piezometer installation detail has been provided on Drawing No B13-055-M1.

2.10 Quality Control

Field density testing of natural soil and coarse coal refuse placed in the embankment areas shall be performed to confirm that the compactive effort employed is yielding an in-place density of at least 95 percent of the maximum density obtainable by the Standard Proctor Compaction Method (ASTM D 698). Density testing shall be performed at equivalent frequencies of one test per 2,000 cubic yards of material placed and compacted and at least one test for each lift. Locations, elevations and dates of the tests shall be recorded and maintained for documentation purposes. The moisture at time of compaction shall be within the range of optimum moisture by -2 percent to +3 percent. If in-place densities are observed to be less than that required, additional compaction shall be performed on the effective test area and the area retested. Such work shall continue until satisfactory results are obtained.

3.0 FINE COAL REFUSE DISPOSAL

3.01 General

Fine coal refuse will continue to be pumped into the constructed Phase 4/6/7 cell at the beginning of construction. Disposal of fines may begin in the Phase 2-3 Connector upon completing the east and west embankments between existing Phases 2 and 3. The slurry line(s) shall be periodically moved along the embankment perimeter to maintain a relatively uniform fines level within the impoundment and to promote sealing of the coarse coal refuse in the impounding embankment, reducing seepage. Discharge shall initiate on the impoundment cell bottom and continue on fine coal refuse beaches as the slurry settles. In no case shall direct discharge onto embankment slopes be allowed.

3.02 Clarified Water Removal

Clarified water from the slurry impoundment shall be removed by a pumping system and directed into the existing perimeter ditch system. The water level in the impoundment shall be maintained as low as practicable.

4.0 SURFACE WATER DRAINAGE FACILITIES

4.01 General

A system of existing perimeter/sediment ditches, benches, access road gutters and conveyance ditches shall control surface runoff and minimize erosion. All runoff collected from the embankment area will be directed toward the perimeter/sediment ditches located beyond the toe of the embankment slopes. The perimeter ditches convey the flow to the existing sedimentation ponds.

4.02 Benches and Bench Gutters

Benches are provided to aid in controlling runoff and slope erosion. Permanent benches shall slope at about 3 percent toward a gutter at their upstream edge and at about one percent toward the conveyance ditches where the runoff will discharge. Details for the bench gutter are shown in Drawing No. B13-055-M1. The final gutters shall be lined with soil and seeded to reduce erosion.

Benches of an interim nature during facility construction shall be maintained as described in Section 6.04 of these specifications. Care shall be taken during grading to avoid development of ponding locations or excessive gradients.

5.0 REVEGETATION OF COMPLETED AREAS

Revegetation of coarse coal refuse slopes can be accomplished by placing a cover of natural soil or other materials capable of supporting vegetation and subsequent



planting to establish a continuous stand of vegetation. Soil cover and vegetation shall be in accordance with the Illinois reclamation permit.

6.0 MONITORING AND MAINTENANCE

6.01 Piezometers and Impoundment Level

Water level readings from the piezometers and the impoundment level shall be recorded at 7-day intervals and compared to the levels used in the design. The piezometers shall be flushed on an annual basis to ensure they are functioning properly. Should the piezometers become damaged during operations, they shall be repaired or replaced. Maximum piezometer water levels used in the design of the embankments are shown on Drawing No. B13-055-E2. The phreatic levels shown are based on an estimated maximum surface to maintain a minimum slope stability factor of 1.5 for the static condition, and 1.2 for the post-earthquake condition. Exceedance of the phreatic levels shown does not necessarily mean that the slope stability has been reduced to unacceptable levels. It does mean that maximum anticipated phreatic levels have been exceeded and that action in the form of reevaluation of the slope stability, reduction of the amount of water in the impoundment, reduction in the rate of embankment construction, installation of additional piezometers, or other remedial measures may be required.

Pneumatic or vibrating wire piezometers shall be monitored before and during construction of an upstream push-out. If unacceptable pore pressures are observed, the information shall be reported to the engineer and the operator. Equipment and personnel should be moved to another work area until the pore pressures have dissipated to an acceptable level. Results of the inspection shall be documented.

6.02 General Observations

Observations of the embankment and its appurtenant structures shall be made at 7-day intervals and immediately following any unusual events such as floods, heavy rainfalls, abnormal structural behavior, subsidence cracking, etc. Any unusual features shall be reported immediately to the engineer responsible for certifying the construction.

a. Embankment Slopes - Any irregularities such as scarps, wet areas, or vegetation disturbance shall be recorded.

b. Working Disposal Surface - Irregularities shall be recorded.

c. Access Road Gutters and Discharge Channels - General condition of channels, soil erosion adjacent to or beneath riprap and seeded slopes, blockage by debris, etc. shall be noted.

d. Vicinity of the Embankment - General conditions throughout the area of the embankment shall be observed to note any changes which could be associated with the behavior of the embankment and its foundation.

6.03 Upstream Construction Observations

Monitoring and inspection of the upstream construction area should be performed by a qualified person who is familiar with upstream construction methods and risks. Prior to and during initial push-out construction, this person should inspect the refuse embankment and the area of the upstream construction. The inspection should focus on identifying conditions that could affect the safety of the equipment operators as well as conditions that could affect the safety of the embankment. These include the following conditions:

- Development of cracks with vertical displacement or scarps in the vicinity of the push-out (the orientation and shape of the cracks may indicate shearing rather than differential settlement)
- Excessive pumping of the push-out surface
- Excessive bulging of the fine refuse delta (e.g., bulge or displacement height in excess of the push-out lift level) where work is being performed
- A situation posing a threat that the embankment could be overtopped by water or slurry
- Sudden or major subsidence of the embankment crest
- Longitudinal or transverse cracking of the embankment crest
- Major sliding/failure of upstream or downstream embankment slopes or abutment slopes adjacent to the embankments
- Unusual seepage from areas of the downstream face or from the toe of the embankment
- Unusual conditions of the embankment downstream slopes that develop during upstream construction
- Significant landslides within the impoundment area

6.04 Maintenance

The following maintenance shall be performed regularly:

a. Routine Maintenance - Maintenance, including replacement or patching of grouted riprap, regrading temporary bench and access road gutters, backfilling of erosion rills and gullies, removal of debris from the ditches at the site, etc. shall be performed.

b. Maintenance After Unusual Meteorological Events (Heavy Precipitation Events and Floods). - The most important maintenance tasks at these times are the timely backfilling of all erosion scarps and slumps and the repair and improvement of drainage systems and riprap.



c. Maintenance After Abnormal Changes in the Behavior of the Structure - If abnormal behavior of any portion of the embankment is observed, qualified persons knowledgeable of the facility design characteristics shall be advised immediately and any recommended maintenance measures undertaken.

6.05 Data Review

All facility performance data and data obtained during periodic inspections and maintenance shall be reviewed by qualified persons knowledgeable of the facility construction and disposal requirements, including the design recommendations presented in these documents.

7.0 DRAWINGS

The following drawings shall form a part of these specifications:

FIGURE NO.	DRAWING NO.	TITLE
1	B13-055-E1	Phase 2-3 Connector Plan
2	B13-055-E2	Slope Stability Sections D – D, E – E, and F – F
3	B13-055-M1	Miscellaneous Details

5378-13 Part 2

R11039

APPENDIX B

CALCULATION BRIEF

APPENDIX B

CALCULATION BRIEF
COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2
DTE IMPOUNDMENT PLAN
IMPOUNDMENT ID NOS. IL 08-03141-01 AND IL 08-03141-02
MACH MINE # 1
MACH MINING, LLC
JOHNSTON CITY, ILLINOIS

TABLE OF CONTENTS

TOPIC	PAGE
Embankment Volumes	1
Impoundment Volumes	2
Embankment Construction and Fines Level Schedule	4
Surface Drainage Design	5
Internal Drainage System	15
Phreatic Level Determination	15
Pipe Size and Capacity	21
Perforations	23
Structural Capacity	24
Gravel Capacity	28
Geotextile Design	31
Animal Guards	33
Pump Capacity Calculations	36
Slope Stability Analyses	43

Phase 2-3 Connector Volumes by elevation zone Tue Nov 13 10:34:21 2012

Zone 458.00 to 478.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 3,257,208.1 C.F., 120,637.34 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 3,257,208.1 C.F., 120,637.34 C.Y.

Zone 478.00 to 498.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 5,300,170.6 C.F., 196,302.61 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 8,557,378.7 C.F., 316,939.95 C.Y.

Zone 498.00 to 518.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 14,160,191.5 C.F., 524,451.54 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 22,717,570.3 C.F., 841,391.49 C.Y.

Zone 518.00 to 538.00
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 10,901,733.3 C.F., 403,767.90 C.Y.
Running total:
Cut volume : 0.0 C.F., 0.00 C.Y.
Fill volume: 33,619,303.6 C.F., 1,245,159.39 C.Y.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, PHASE 2-8 EXPANSION PLAN

PROJECT NO.: B13-055-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 2-3 CONNECTOR

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMALTIVE VOLUME C.F.	CUMMALTIVE VOLUME C.Y.
458	0.504						
		2.318	8.00	18.54	18.54	807,776.64	29,917.65
466	4.132						
		5.515	8.00	44.12	62.66	2,729,469.60	101,091.47
474	6.897						
		7.712	8.00	61.70	124.36	5,416,947.36	200,627.68
482	8.527						
		9.402	8.00	75.21	199.57	8,693,182.08	321,969.71
490	10.276						
		11.454	8.00	91.63	291.20	12,684,497.76	469,796.21
498	12.631						
		17.675	8.00	141.40	432.60	18,843,881.76	697,921.55
506	22.719						
		23.913	8.00	191.30	623.90	27,176,909.76	1,006,552.21
514	25.106						
		26.353	8.00	210.82	834.72	36,360,228.96	1,346,675.15
522	27.599						
		30.206	16.00	483.30	1,318.01	57,412,602.72	2,126,392.69
538	32.813						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 9/21/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: MACH NO. 1 MINE, PHASE 2-8 EXPANSION PLAN

PROJECT NO.: B13-055-1413 SHEET _____ OF _____

DESCRIPTION: IMPOUNDMENT VOLUMES - PHASE 2-3 CONNECTOR/PHASE 8

ELEVATION	AREA (Ac.)	AVG. AREA	STAGE INTERVAL	STORAGE (AC-FT)	CUMMULATIVE VOLUME AC-FT	CUMMALTIVE VOLUME C.F.	CUMMALTIVE VOLUME C.Y.
520	11.834						
		12.091	2.00	24.18	24.18	1,053,324.36	39,012.01
522	12.347						
		12.564	2.00	25.13	49.31	2,147,856.48	79,550.24
524	12.780						
		13.001	2.00	26.00	75.31	3,280,460.04	121,498.52
526	13.221						
		13.445	2.00	26.89	102.20	4,451,788.44	164,881.05
528	13.669						
		13.896	2.00	27.79	129.99	5,662,364.40	209,717.20
530	14.122						
		14.354	2.00	28.71	158.70	6,912,841.32	256,031.16
532	14.585						
		14.817	2.00	29.63	188.33	8,203,698.36	303,840.68
534	15.049						
		15.286	2.00	30.57	218.90	9,535,371.12	353,161.89
536	15.522						
		15.738	2.00	31.48	250.38	10,906,465.68	403,943.17
538	15.954						

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/10/2013 CHKD BY: _____ DATE: _____

PROJECT NAME: **MACH MINING - DTE IMPOUNDMENT PLAN MODIFICATION**

PROJECT NO.: **B13-055-1413** SHEET 1 OF 1

DESCRIPTION: **Embankment Construction and Fines Level Schedule**

Based on the approved plan, the production rates are:

Coarse Production Rate = 2,568,200 CY/Yr
Fines Production Rate = 2,064,400 CY/Yr

The proposed plan and timing begins upon approval. Mach will build the Phase 2-3 Connector concurrently with Phase 5A (pending approval). Fines will continue to be disposed in the Phase 4/6/7 cell at the beginning of construction. Mach may begin fines disposal in the Phase 2-3 Connector upon completing the east and west embankments to elevation 500±, matching the existing Phase 2 and 3 crests.

Construction of Phase 2-3 Connector:
Volume to construct = 1,245,159.39 CY
Time to construct = (1,245,159.39 / 2,568,200) = 0.4848 Yr

Fines produced = (0.4848)(2,064,400) = 1,000,898.31 CY

Phase 2-3 Connector available storage will be:
1 PMF Volume for Crest at El. 538 = (41")(1 ft / 12")(40.80 Ac)(43,560 ft^2 / Ac)(1 CY / 27 CF) = 224,898.67 CY

Max Storm Level = 538 - 3 ft Freeboard = 535
Storage vol. at El. 535 =

Elev.	Volume
534.00	303,840.68
535.00	X
536.00	353,161.89

X = 328,501.29 CY (Conservatively using the volume of upstream Phase 8, from Phase 2-3/8 volume sheet. See note below)

Fines Volume Available = (328,501.29 - 224,898.67) = 103,602.62 CY
Phase 2-3 Connector Max Fines Level =

Elev.	Volume
524.00	79,550.24
X	103,602.62
526.00	121,498.52

X = 525.1 Volume at 525.1 = 1,497,745.42 CY (From Phase 2-3 Imp. Volumes)

Total fines disposal life = (1,497,745.42 / 2,064,400) = 0.7255 CY

Note:
The maximum fine coal refuse level was established to account for the drainage area and fines displacement based on a future upstream stage (Phase 8) of Facility Nos. 1 and 2 proposed under separate cover. Ref: "Engineering Design Plan and Plan Modification; Coal Refuse Disposal Facility Nos. 1, 2, and 3 Expansion Plan; Impoundment ID No. IL08-03141-01, IL08-03141-02, and IL08-03141-03; Mach No. 1 Mine, Mine ID No. 11-03141" prepared by Alliance Consulting, Inc., December 2012.

NOAA Atlas 14, Volume 2, Version 3
Location name: Thompsonville, Illinois, US*
Coordinates: 37.8420, -88.7850
Elevation: 456ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.416 (0.379-0.457)	0.493 (0.449-0.541)	0.583 (0.530-0.639)	0.654 (0.593-0.716)	0.745 (0.673-0.814)	0.816 (0.735-0.891)	0.884 (0.793-0.966)	0.957 (0.854-1.04)	1.05 (0.934-1.15)	1.13 (0.991-1.23)
10-min	0.646 (0.588-0.710)	0.770 (0.701-0.845)	0.906 (0.823-0.994)	1.01 (0.916-1.11)	1.14 (1.03-1.25)	1.24 (1.11-1.35)	1.33 (1.19-1.45)	1.43 (1.27-1.56)	1.55 (1.37-1.69)	1.64 (1.44-1.79)
15-min	0.792 (0.721-0.870)	0.942 (0.857-1.03)	1.11 (1.01-1.22)	1.24 (1.13-1.36)	1.41 (1.27-1.54)	1.53 (1.38-1.67)	1.65 (1.48-1.81)	1.78 (1.59-1.94)	1.93 (1.71-2.11)	2.05 (1.80-2.24)
30-min	1.05 (0.954-1.15)	1.26 (1.15-1.38)	1.52 (1.38-1.67)	1.72 (1.57-1.89)	1.99 (1.80-2.17)	2.19 (1.97-2.39)	2.39 (2.14-2.61)	2.59 (2.31-2.83)	2.87 (2.54-3.13)	3.07 (2.70-3.36)
60-min	1.28 (1.17-1.41)	1.55 (1.41-1.70)	1.91 (1.74-2.10)	2.19 (1.99-2.40)	2.58 (2.33-2.82)	2.88 (2.60-3.15)	3.19 (2.86-3.49)	3.52 (3.14-3.84)	3.96 (3.51-4.33)	4.32 (3.80-4.72)
2-hr	1.55 (1.41-1.71)	1.87 (1.70-2.07)	2.33 (2.11-2.57)	2.69 (2.43-2.96)	3.18 (2.86-3.49)	3.57 (3.21-3.92)	3.98 (3.56-4.36)	4.40 (3.91-4.82)	4.98 (4.40-5.46)	5.45 (4.78-5.98)
3-hr	1.67 (1.51-1.86)	2.02 (1.83-2.24)	2.51 (2.27-2.79)	2.91 (2.62-3.22)	3.46 (3.11-3.82)	3.91 (3.50-4.31)	4.38 (3.90-4.82)	4.87 (4.31-5.36)	5.57 (4.89-6.12)	6.13 (5.34-6.74)
-hr	2.03 (1.84-2.26)	2.44 (2.22-2.72)	3.03 (2.75-3.37)	3.50 (3.17-3.89)	4.16 (3.75-4.62)	4.71 (4.22-5.21)	5.28 (4.71-5.84)	5.88 (5.22-6.50)	6.73 (5.92-7.43)	7.42 (6.47-8.19)
12-hr	2.42 (2.19-2.70)	2.91 (2.64-3.24)	3.59 (3.25-3.99)	4.14 (3.74-4.60)	4.90 (4.41-5.43)	5.53 (4.95-6.11)	6.17 (5.50-6.82)	6.85 (6.08-7.57)	7.81 (6.86-8.63)	8.57 (7.48-9.48)
24-hr	2.89 (2.67-3.16)	3.48 (3.21-3.81)	4.32 (3.98-4.72)	5.00 (4.59-5.46)	5.94 (5.44-6.48)	6.70 (6.12-7.31)	7.50 (6.82-8.18)	8.34 (7.54-9.09)	9.50 (8.53-10.4)	10.4 (9.30-11.4)
2-day	3.38 (3.12-3.67)	4.06 (3.76-4.41)	5.04 (4.66-5.48)	5.85 (5.40-6.35)	6.99 (6.42-7.59)	7.93 (7.26-8.62)	8.93 (8.12-9.70)	10.0 (9.04-10.9)	11.5 (10.3-12.5)	12.7 (11.3-13.9)
3-day	3.59 (3.33-3.88)	4.30 (3.99-4.66)	5.33 (4.94-5.77)	6.18 (5.72-6.68)	7.39 (6.81-7.99)	8.40 (7.70-9.08)	9.47 (8.63-10.2)	10.6 (9.62-11.5)	12.3 (11.0-13.3)	13.6 (12.1-14.8)
4-day	3.79 (3.53-4.09)	4.54 (4.23-4.90)	5.61 (5.22-6.05)	6.50 (6.04-7.01)	7.79 (7.19-8.39)	8.86 (8.15-9.54)	10.0 (9.14-10.8)	11.2 (10.2-12.1)	13.0 (11.7-14.1)	14.5 (12.9-15.7)
7-day	4.38 (4.10-4.71)	5.25 (4.91-5.64)	6.47 (6.04-6.95)	7.48 (6.97-8.03)	8.92 (8.28-9.57)	10.1 (9.35-10.9)	11.4 (10.5-12.2)	12.7 (11.6-13.7)	14.7 (13.3-15.8)	16.3 (14.6-17.6)
10-day	4.93 (4.61-5.28)	5.90 (5.52-6.32)	7.27 (6.79-7.78)	8.39 (7.82-8.97)	9.98 (9.27-10.7)	11.3 (10.4-12.1)	12.7 (11.7-13.6)	14.1 (12.9-15.2)	16.2 (14.7-17.5)	17.9 (16.1-19.3)
20-day	6.78 (6.39-7.21)	8.05 (7.59-8.57)	9.64 (9.08-10.3)	10.9 (10.3-11.6)	12.6 (11.8-13.4)	14.0 (13.1-14.9)	15.4 (14.3-16.4)	16.8 (15.6-17.9)	18.7 (17.2-20.0)	20.2 (18.5-21.7)
30-day	8.34 (7.89-8.84)	9.85 (9.33-10.4)	11.6 (11.0-12.3)	13.0 (12.3-13.8)	15.0 (14.1-15.8)	16.5 (15.4-17.4)	17.9 (16.8-19.0)	19.5 (18.1-20.6)	21.5 (19.9-22.8)	23.0 (21.2-24.6)
45-day	10.5 (9.93-11.0)	12.3 (11.7-13.0)	14.4 (13.6-15.2)	16.0 (15.2-16.9)	18.2 (17.2-19.2)	19.9 (18.7-21.0)	21.5 (20.2-22.8)	23.2 (21.7-24.6)	25.4 (23.7-27.0)	27.1 (25.1-28.8)
60-day	12.4 (11.8-13.1)	14.6 (13.8-15.4)	17.0 (16.1-17.9)	18.8 (17.8-19.8)	21.2 (20.0-22.3)	23.0 (21.7-24.3)	24.8 (23.3-26.2)	26.5 (24.9-28.0)	28.8 (26.9-30.5)	30.5 (28.3-32.3)

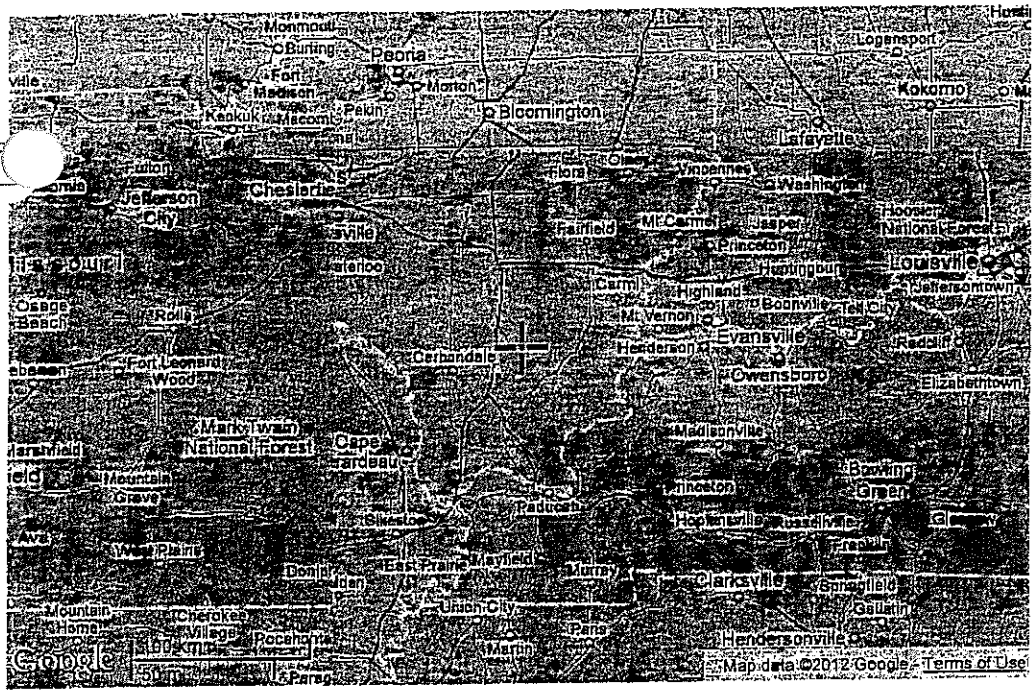
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

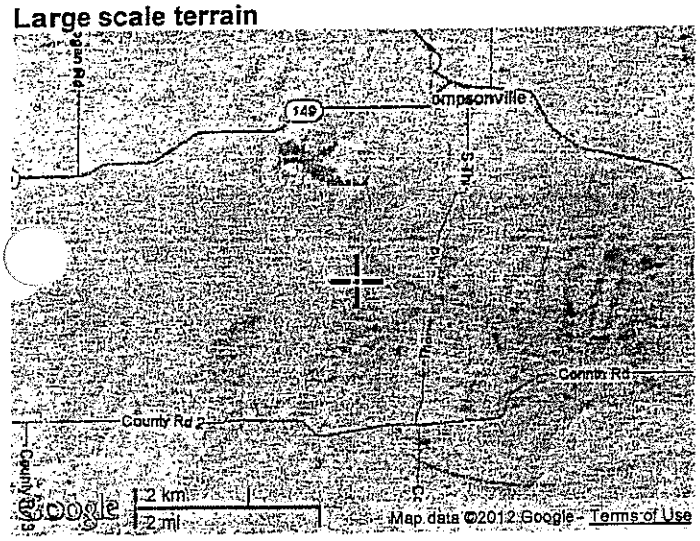
Please refer to NOAA Atlas 14 document for more information.

Back to Top

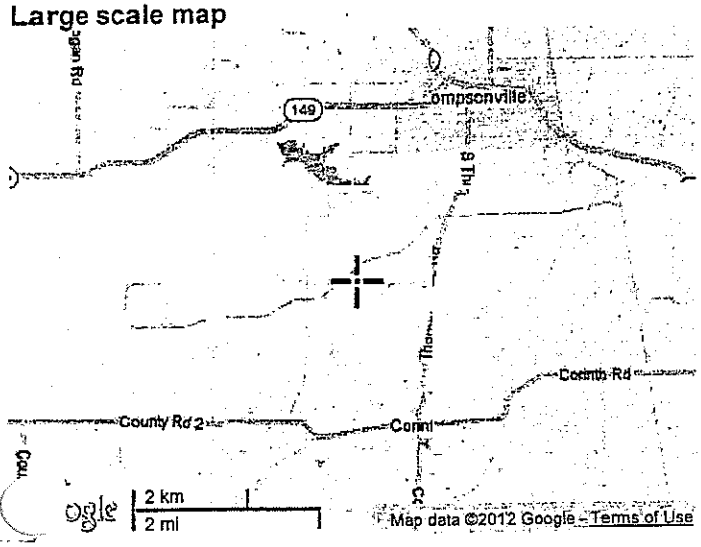
PF graphical



Large scale terrain



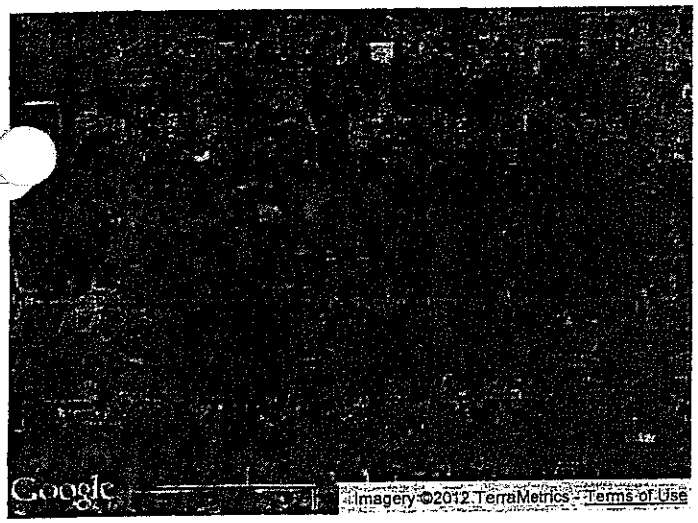
Large scale map



Large scale aerial

R11047

Page No. 7



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Mach No. 1 Mine

Facility Nos. 1, 2, and 3 Expansion Plan

Typical Bench Gutter

100 Yr - 6 Hr Event

RPC

Alliance Consulting, Inc.
124 Philpott Ln.
Beaver, WV 25813

Phone: 304-255-0491

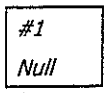
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	5.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	BENCH



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	40.84	3.30

Structure Detail:

Structure #1 (Null)

BENCH

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.331	0.000	0.000	87.000	M	40.84	3.296
	Σ	**12.900**						**40.84**	**3.296**

Subwatershed Time of Concentration Details:

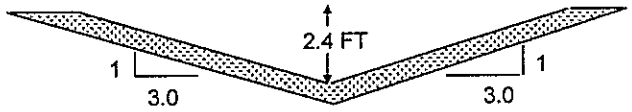
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	27.78	50.00	180.00	15.810	0.003
		8. Large gullies, diversions, and low flowing streams	0.50	12.53	2,506.00	2.120	0.328
#1	**1**	**Time of Concentration:**					**0.331**

CALCULATED BY: RPC 2/22/2012
CHECKED BY: _____

DITCH SIZING UTILITY FOR TRIANGULAR AND TRAPEZOIDAL CONFIGURATIONS USING MANNING'S EQUATION:

TYPICAL BENCH GUTTER

PEAK FLOW =	40.8	CFS
BOTTOM WIDTH =	0	FT
SIDE SLOPE 1 =	3.00:1	
SIDE SLOPE 2 =	3.00:1	
CHANNEL SLOPE =	0.005	FT/FT
MANNING'S N =	0.033	FT^(1/6)



OUTPUT:

TRIANGULAR DITCH

WETTED PERIMETER =	13.13	FT	DEPTH OF FLOW =	2.08	FT
AREA OF FLOW =	12.94	SQ.FT.	MEAN DEPTH =	1.04	FT
HYDRAULIC RADIUS, Rh =	0.99	FT	FROUDE NO. =	0.55	SUBCRITICAL
CALC. VELOCITY =	3.15	FPS			

FREEBOARD REQUIRED =	0.30	FT	(0+0.025vd^1/3)
TOTAL DEPTH =	**2.4**	**FT**	**ADDITIONAL FREEBOARD AVAILABLE BY SLOPE OF BENCH**

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/13/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: **Mach No. 1 Mine, Facility No. 2**

PROJECT NO.: **B13-055-1413** SHEET 1 OF 1

DESCRIPTION: **Phreatic Line - Pool to Underdrain**
Phase 2-3 Connector - Section D-D

Ref: SM Note No. 7, Case V

Transformation Factor = $f_T = (k_y/k_x)^{1/2}$ = 0.3333

k_x = 0.0018 cm/sec
k_y = 0.0002 cm/sec
z_u = 3.00
z_d = 3.50

k_y/k_x = 0.1111

$y_o = (h^2 + d^2)^{1/2} - d$
$a = a_o = y_o/2$

$x_T = (y^2 - y_o^2)/(2y_o)$

$x_T = (f_T)(x_A)$
x_A = x distance on actual section
x_T = x distance on transformed section
y = y distance on both sections

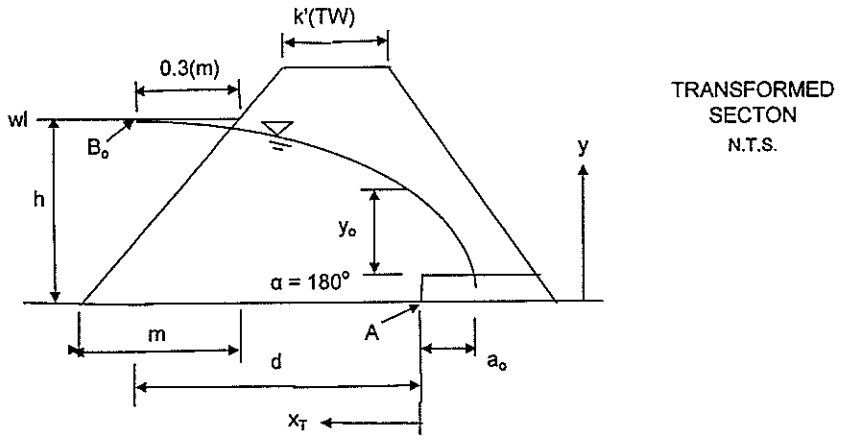
h (ft.)	d (ft.)	m (ft.)	0.3m (ft.)	y_o (ft.)	a_o (ft.)
61.6	98.05	61.60	18.48	17.74	8.87

Phreatic Line Coordinates

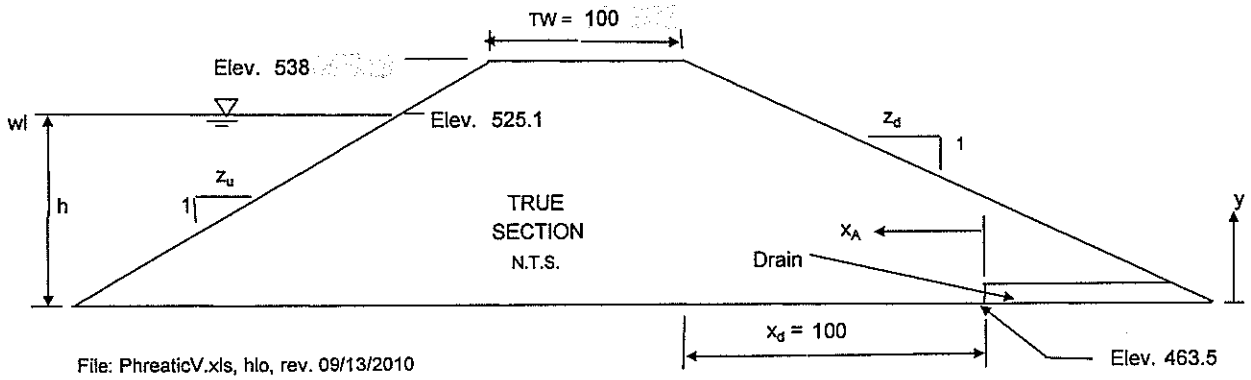
y (ft.)	x_T (ft.)	x_A (ft.)	Elev. (ft)
0.00	-8.87	-26.62	463.50
5.00	-8.17	-24.50	468.50
10.00	-6.05	-18.16	473.50
15.00	-2.53	-7.60	478.50
20.00	2.40	7.19	483.50
25.00	8.74	26.21	488.50
30.00	16.49	49.46	493.50
35.00	25.64	76.93	498.50
40.00	36.21	108.63	503.50
45.00	48.19	144.56	508.50
50.00	61.57	184.71	513.50
61.6	98.05	294.14	525.10

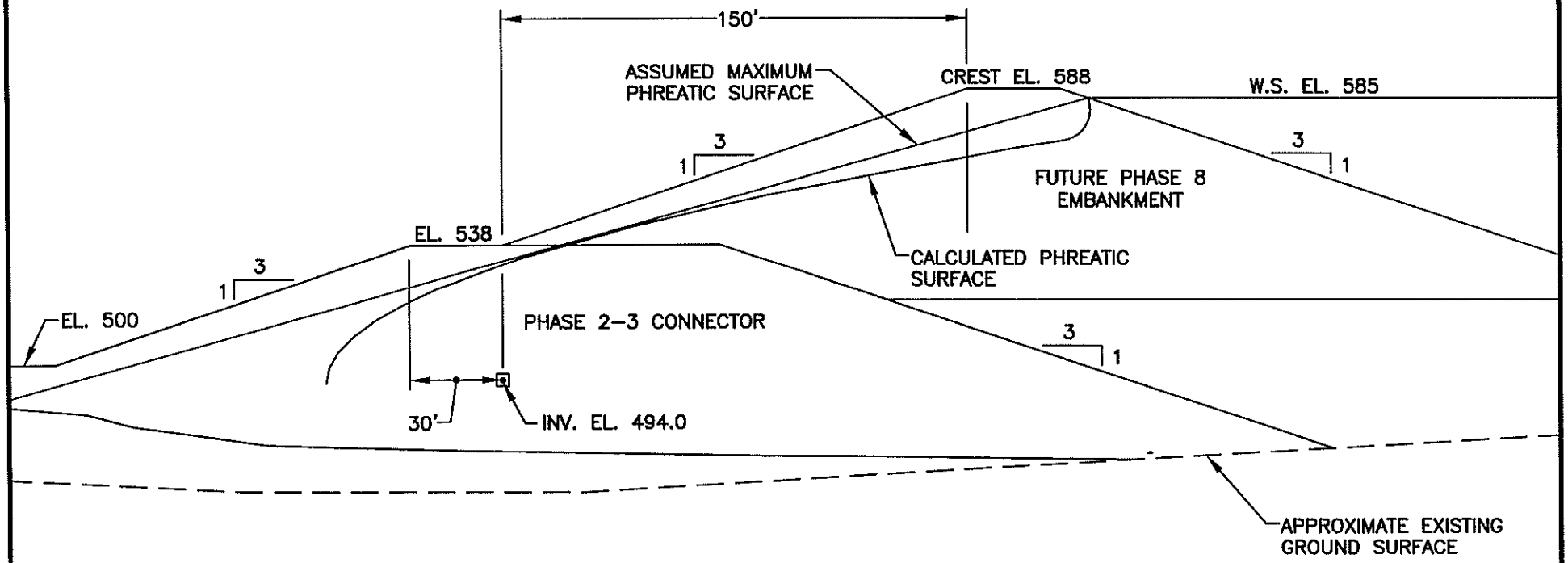
$k' = (k_v k_h)^{1/2}$ = 0.00060 cm/sec = 1.7008 ft/day
$q = k'y_o$ = 30.1805 ft^3/day/ft = **0.1568** *gpm/ft*

Note: $q = k'(h^2)/(2d)$ when $d < h$; $q = k'y_o$ when $d > h$ and $\alpha > 60°$, SM Note No. 7



TRANSFORMED SECTON
N.T.S.





PHASE 2-3 CONNECTOR SECTION E-E

1"=50'

Alliance Consulting, Inc.

Engineers • Constructors • Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2380 | CANONSBURG, PA (724) 745-3630

INTERNAL DRAIN DESIGN

ENGINEERING DESIGN PLAN AND PLAN MODIFICATION
DTE IMPOUNDMENT PLAN

PREPARED FOR

MACH MINING, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	RPC	03/10/12
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		
B13-055-A1		

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/13/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: **Mach No. 1 Mine, Facility No. 2**

PROJECT NO.: **B13-055-1413** SHEET 1 OF 1

DESCRIPTION: **Phreatic Line - Pool to Underdrain**
Phase 2-3 Connector - Section E-E

Ref: SM Note No. 7, Case V

k_x = 0.0018 cm/sec
k_y = 0.0002 cm/sec
z_u = 3.00
z_d = 3.50

k_y/k_x = 0.1111

$y_o = (h^2 + d^2)^{1/2} - d$
$a = a_o = y_o/2$

$x_T = (y^2 - y_o^2)/(2y_o)$

$x_T = (f_T)(x_A)$
x_A = x distance on actual section
x_T = x distance on transformed section
y = y distance on both sections

Transformation Factor = $f_T = (k_y/k_x)^{1/2}$ = 0.3333

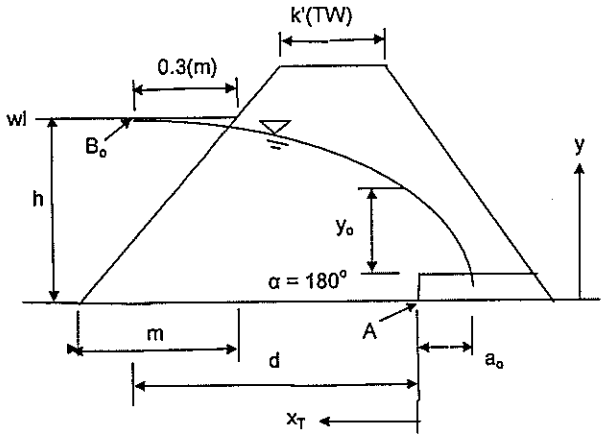
h (ft.)	d (ft.)	m (ft.)	0.3m (ft.)	y_o (ft.)	a_o (ft.)
91.0	90.30	91.00	27.3	37.90	18.95

Phreatic Line Coordinates

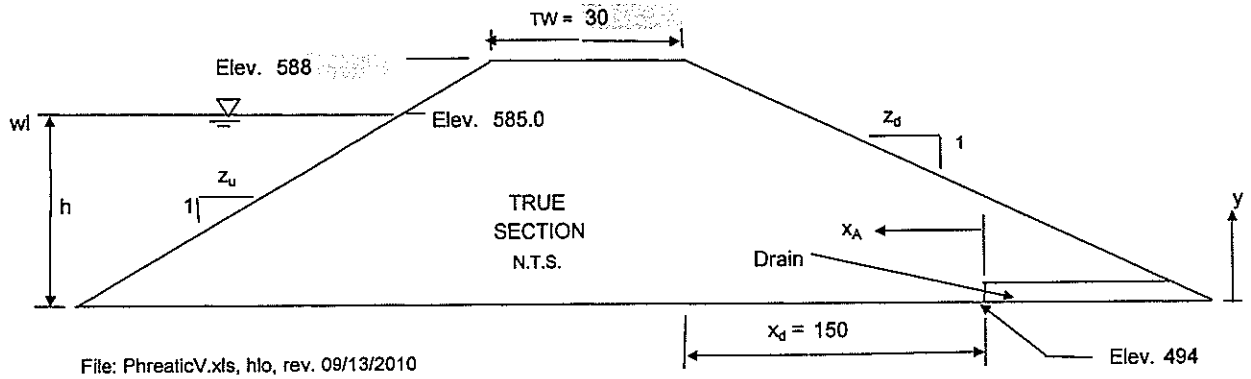
y (ft.)	x_T (ft.)	x_A (ft.)	Elev. (ft)
0.00	-18.95	-56.85	494.00
5.00	-18.62	-55.86	499.00
10.00	-17.63	-52.89	504.00
15.00	-15.98	-47.94	509.00
20.00	-13.67	-41.02	514.00
25.00	-10.70	-32.11	519.00
30.00	-7.08	-21.23	524.00
40.00	2.16	6.48	534.00
50.00	14.03	42.10	544.00
60.00	28.54	85.63	554.00
75.00	55.26	165.78	569.00
91.0	90.30	270.90	585.00

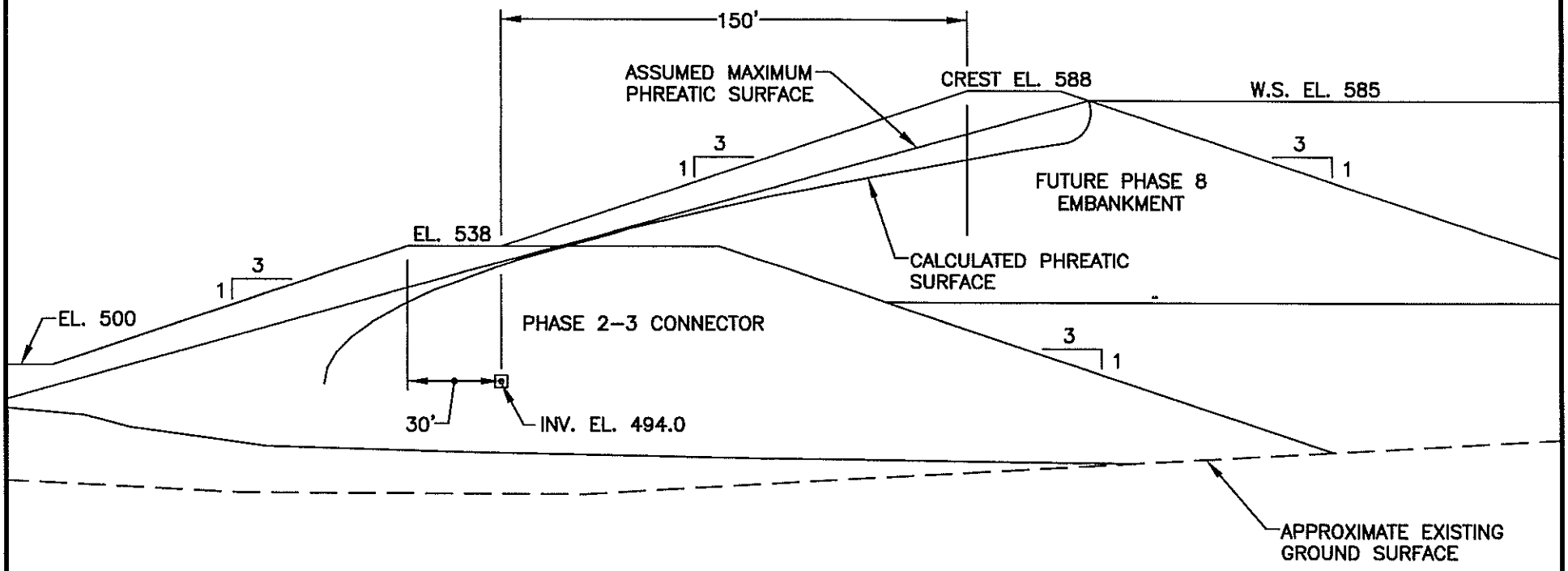
$k' = (k_v k_h)^{1/2}$ = 0.00060 cm/sec = 1.7008 ft/day
$q = k'(h^2)/(2d)$ = 77.9857 ft^3/day/ft = **0.4051** *gpm/ft*

Note: $q = k'(h^2)/(2d)$ when $d < h$; $q = k'y_o$ when $d > h$ and $\alpha > 60°$, SM Note No. 7



TRANSFORMED SECTON
N.T.S.





PHASE 2-3 CONNECTOR SECTION E-E

1"=50'

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2380 | CANONSBURG, PA (724) 745-3630

INTERNAL DRAIN DESIGN

ENGINEERING DESIGN PLAN AND PLAN MODIFICATION
DTE IMPOUNDMENT PLAN

PREPARED FOR

MACH MINING, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	RPC	03/10/12
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		
B13-055-A1		

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

BY: RPC DATE: 2/13/2012 CHKD BY: _____ DATE: _____

PROJECT NAME: **Mach No. 1 Mine, Facility No. 2**

PROJECT NO.: **B13-055-1413** SHEET 1 OF 1

DESCRIPTION: **Phreatic Line - Pool to Underdrain**
Phase 2-3 Connector - Section F-F

Ref: SM Note No. 7, Case V

k_x = 0.0018 cm/sec
k_y = 0.0002 cm/sec
z_u = 3.00
z_d = 3.30

k_y/k_x = 0.1111

$y_o = (h^2 + d^2)^{1/2} - d$
$a = a_o = y_o/2$

$x_T = (y^2 - y_o^2)/(2y_o)$

$x_T = (f_T)(x_A)$
x_A = x distance on actual section
x_T = x distance on transformed section
y = y distance on both sections

Transformation Factor = $f_T = (k_y/k_x)^{1/2}$ = 0.3333

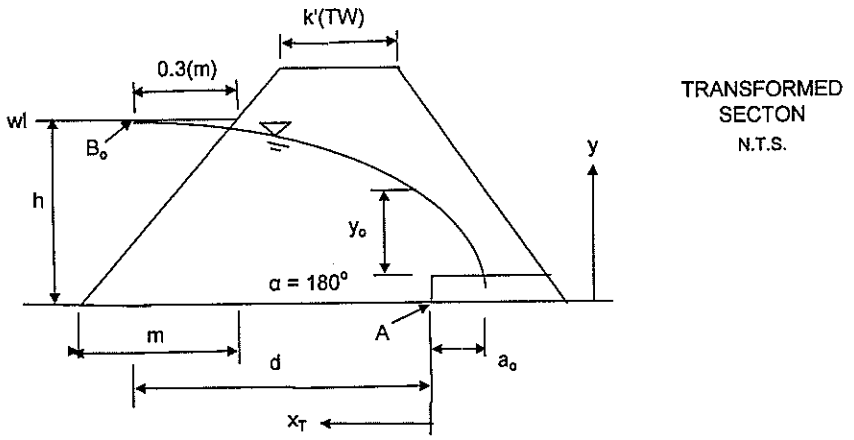
h (ft.)	d (ft.)	m (ft.)	0.3m (ft.)	y_o (ft.)	a_o (ft.)
79.0	70.03	79.00	23.7	35.54	17.77

Phreatic Line Coordinates

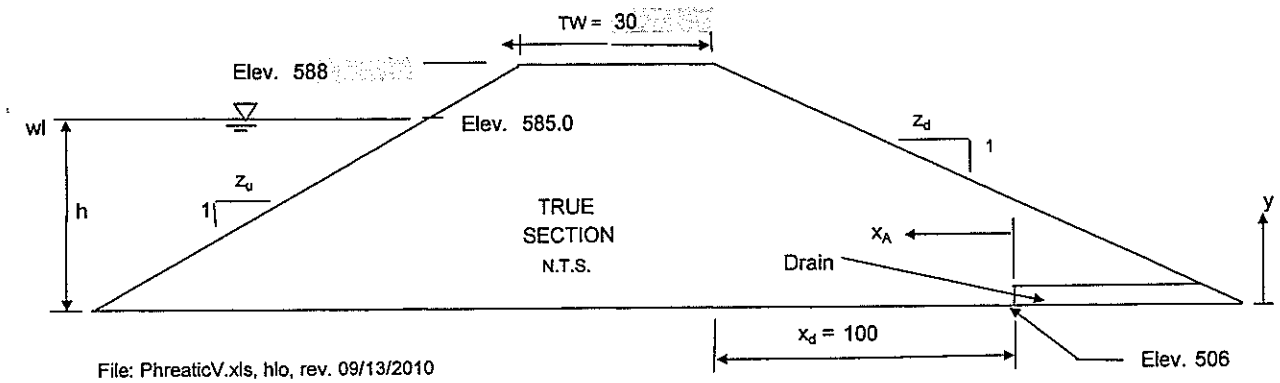
y (ft.)	x_T (ft.)	x_A (ft.)	Elev. (ft)
0.00	-17.77	-53.31	506.00
5.00	-17.42	-52.25	511.00
10.00	-16.36	-49.09	516.00
15.00	-14.60	-43.81	521.00
20.00	-12.14	-36.43	526.00
25.00	-8.98	-26.93	531.00
30.00	-5.11	-15.32	536.00
35.00	-0.54	-1.61	541.00
40.00	4.74	14.22	546.00
50.00	17.40	52.21	556.00
60.00	32.88	98.63	566.00
79.0	70.03	210.10	585.00

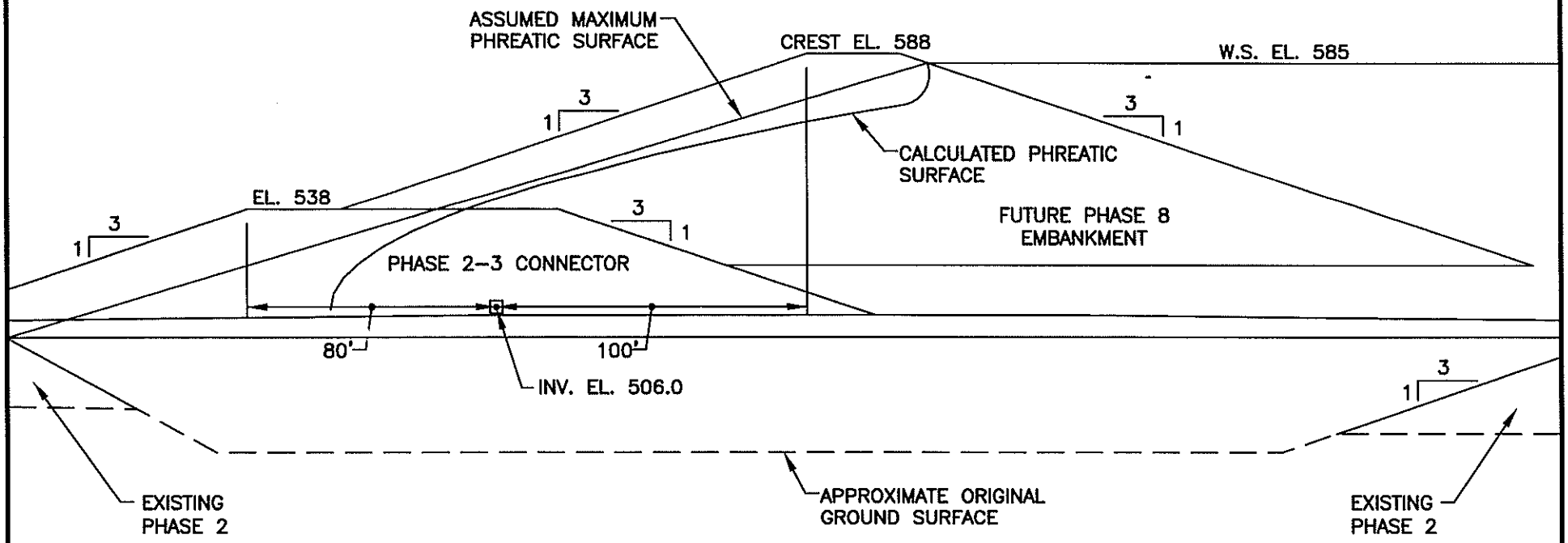
$k' = (k_v k_h)^{1/2}$ = 0.00060 cm/sec = 1.7008 ft/day
$q = k'(h^2)/(2d)$ 75.7826 $ft^3/day/ft$ = **0.3936** *gpm/ft*

Note: $q = k'(h^2)/(2d)$ when $d < h$; $q = k'y_o$ when $d > h$ and $\alpha > 60°$, SM Note No. 7



TRANSFORMED SECTON
N.T.S.





PHASE 2-3 CONNECTOR SECTION F-F

1"=50'

Alliance Consulting, Inc.

Engineers · Constructors · Scientists

BECKLEY, WV (304) 255-0491 | SUMMERSVILLE, WV (304) 883-2360 | CANONSBURG, PA (724) 745-3630

INTERNAL DRAIN DESIGN

ENGINEERING DESIGN PLAN AND PLAN MODIFICATION
DTE IMPOUNDMENT PLAN

PREPARED FOR

MACH MINING, LLC
P.O. BOX 300, JOHNSTON CITY, ILLINOIS 62951

DRAWN BY	RPC	03/10/12
CHECKED BY		
APPROVED BY		
DRAWING NUMBER		
B13-055-A2		

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B13-055-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL DRAIN COLLECTION LINES PIPE SIZE AND CAPACITY

For Factor of Safety = 10, Q_{DRAIN} has been multiplied by 10 and the pipe sized according to this flow.

$$Q_{PIPE} = \frac{1.486}{n}(AR^{2/3}S_o^{1/2}) \qquad n = 0.015 \text{ (aged HDPE)}$$

Ref. : Hydrology and Hydraulic Systems, Table 10.1 Geometric Elements for Circular Section

* Min. Diameter based on Q_{REQ} flowing full. Pipe I.D. based on DR-17 HDPE pipe

Collection lines shall be perforated according to the calculations in Appendix B, and detail drawings in this application.

COLLECTION LINES

Outlet	q (ft^3/d/ft)	Length of pipe/dam, L (ft)	Q_{DRAIN} (ft^3/d) (qxL)	Q_{REQ} (10xQ_{DRAIN})	Q_{REQ} (cfs)	Design Slope (ft/ft)	Pipe Dia.* (inches)	Pipe O.D. (actual)	Pipe I.D. (actual)	Q_{FULL} (cfs)
1	77.9857	171.3	13,358.95	133,589.50	1.55	0.005	10.543	12	11.160	1.80
2	75.7826	178.3	13,512.04	135,120.38	1.56	0.005	10.588	12	11.160	1.80
3	75.7826	504.5	38,232.32	382,323.22	4.43	0.005	15.639	18	15.755	4.51
4	75.7826	504.5	38,232.32	382,323.22	4.43	0.005	15.639	18	15.755	4.51
5	30.1805	189.0	5,705.32	57,053.22	0.66	0.005	7.663	12	11.160	1.80

Note: Outlet drain lines convey flow from two collection lines (L is doubled).

Drain lines are to be non-perforated. Outlet drains will daylight on a bench or drainage structure to convey flow and minimize erosion of the embankment slopes.

OUTLET DRAIN LINES

Outlet	q (ft^3/d/ft)	Length of pipe/dam, L (ft)	Q_{DRAIN} (ft^3/d) (qxL)	Q_{REQ} (10xQ_{DRAIN})	Q_{REQ} (cfs)	Design Slope (ft/ft)	Pipe Dia.* (inches)	Pipe O.D. (actual)	Pipe I.D. (actual)	Q_{FULL} (cfs)
1	77.9857	342.6	26,717.90	267,179.01	3.09	0.020	12.006	12	11.160	3.60
2	75.7826	356.6	27,024.08	270,240.75	3.13	0.020	12.058	12	11.160	3.60
3	75.7826	1,009.0	76,464.64	764,646.43	8.85	0.020	17.810	18	15.755	9.03
4	75.7826	1,009.0	76,464.64	764,646.43	8.85	0.020	17.810	18	15.755	9.03
5*	30.1805	189.0	5,705.32	57,053.22	0.66	0.020	6.729	12	11.16	3.60

* Outlet 5 only carries flow from one collection line (L is not doubled).

PE 3608/3408 IPS HDPE PIPE SIZES

Pressure Rating		DR 17 (100psi)			DR 19 (89psi)			DR 21 (80psi)			DR 26 (65psi)			DR 32.5 (50psi)		
Nominal Size	Actual O.D.	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf
3/4"	1.050"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1"	1.315"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1 1/4"	1.660"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1 1/2"	1.900"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2"	2.375"	0.140"	2.079"	0.429	---	---	---	---	---	---	---	---	---	---	---	---
3"	3.500"	0.206"	3.064"	0.932	---	---	---	---	---	---	---	---	---	---	---	---
4"	4.500"	0.265"	3.939"	1.540	0.237"	3.998"	1.387	0.214"	4.046"	1.262	0.173"	4.133"	1.030	0.138"	4.206"	0.831
5"	5.375"	0.316"	4.705"	2.197	0.283"	4.775"	1.980	0.256"	4.832"	1.801	0.207"	4.937"	1.470	0.165"	5.024"	1.186
5"	5.563"	0.327"	4.869"	2.353	0.293"	4.942"	2.120	0.265"	5.001"	1.929	0.214"	5.109"	1.574	0.171"	5.200"	1.270
6"	6.625"	0.390"	5.799"	3.338	0.349"	5.886"	3.007	0.315"	5.956"	2.736	0.255"	6.085"	2.233	0.204"	6.193"	1.801
7"	7.125"	0.419"	6.236"	3.860	0.375"	6.330"	3.478	0.339"	6.406"	3.165	0.274"	6.544"	2.582	0.219"	6.660"	2.083
8"	8.625"	0.507"	7.549"	5.657	0.454"	7.663"	5.097	0.411"	7.754"	4.637	0.332"	7.922"	3.784	0.265"	8.062"	3.053
10"	10.750"	0.632"	9.409"	8.788	0.566"	9.551"	7.918	0.512"	9.665"	7.204	0.413"	9.873"	5.878	0.331"	10.049"	4.742
12"	12.750"	0.750"	11.160"	12.362	0.671"	11.327"	11.138	0.607"	11.463"	10.134	0.490"	11.710"	8.269	0.392"	11.918"	6.671
14"	14.000"	0.824"	12.254"	14.905	0.737"	12.438"	13.429	0.667"	12.587"	12.218	0.538"	12.858"	9.970	0.431"	13.087"	8.044
16"	16.00"	0.941"	14.005"	19.467	0.842"	14.215"	17.540	0.762"	14.385"	15.959	0.615"	14.695"	13.022	0.492"	14.956"	10.506
18"	18.00"	1.059"	15.755"	24.638	0.947"	15.992"	22.199	0.857"	16.183"	20.198	0.692"	16.532"	16.480	0.554"	16.826"	13.296
20"	20.00"	1.176"	17.506"	30.418	1.053"	17.768"	27.406	0.952"	17.981"	24.936	0.769"	18.369"	20.346	0.615"	18.695"	16.415
22"	22.00"	1.294"	19.256"	36.805	1.158"	19.545"	33.162	1.048"	19.779"	30.172	0.846"	20.206"	24.619	0.677"	20.565"	19.863
24"	24.00"	1.412"	21.007"	43.801	1.263"	21.322"	39.465	1.143"	21.577"	35.907	0.923"	22.043"	29.299	0.738"	22.434"	23.638
26"	26.00"	1.529"	22.758"	51.406	1.368"	23.099"	46.316	1.238"	23.375"	42.141	1.000"	23.880"	34.385	0.800"	24.304"	27.742
28"	28.00"	1.647"	24.508"	59.618	1.474"	24.876"	53.716	1.333"	25.173"	48.874	1.077"	25.717"	39.879	0.862"	26.174"	32.174
30"	30.00"	1.765"	26.259"	68.439	1.579"	26.653"	61.664	1.429"	26.971"	56.105	1.154"	27.554"	45.779	0.923"	28.043"	36.934
32"	32.00"	1.882"	28.009"	77.869	1.684"	28.429"	70.160	1.524"	28.770"	63.835	1.231"	29.391"	52.086	0.985"	29.913"	42.023
34"	34.00"	2.000"	29.760"	87.907	1.789"	30.206"	79.204	1.619"	30.568"	72.064	1.308"	31.228"	58.814	1.046"	31.782"	47.440
36"	36.00"	2.118"	31.511"	98.553	1.895"	31.983"	88.796	1.714"	32.366"	80.791	1.385"	33.065"	65.922	1.108"	33.652"	53.186
42"	42.00"	2.471"	36.762"	134.141	2.211"	37.314"	120.861	2.000"	37.760"	109.966	1.615"	38.575"	89.727	1.292"	39.260"	72.392
48"	48.00"	2.824"	42.014"	175.205	2.526"	42.644"	157.857	2.286"	43.154"	143.629	1.846"	44.086"	117.194	1.477"	44.869"	94.552
54"	54.00"	3.176"	47.266"	222.547	2.842"	47.975"	199.791	2.571"	48.549"	182.298	2.077"	49.597"	148.324	1.662"	50.478"	119.668
63"	62.99"	---	---	---	---	---	---	3.000"	56.631"	247.800	2.423"	57.854"	202.010	1.938"	58.881"	162.980

NOTE:

- Items highlighted in Blue indicates standard stocking items that are more readily available.
- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Service factors should be utilized to compensate for the effect of liquids other than water, and for other temperatures.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths: 40' for 2"-24" / 50' for 26" and larger / Coils available for 3/4"-6"(8" by special order)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B13-055-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL DRAIN COLLECTION LINE PERFORATION SPACING

Calculation to determine number of perforations required for internal drains.

Ref: Soil Mechanics Note No. 3, Soil Mechanics Considerations for Embankment Drains, SCS, USDA, 1971

Aggregate $C_U = D_{60} / D_{10} = 23$ mm / 13 mm = 1.8 <3.0 **OK**
Use 70% perforation flow area reduction

Previous design selected 3/8" dia. holes to prevent aggregate from entering pipe.

For 3/8-inch perforations:

$$A = \frac{\pi(0.03125\ ft)^2}{4} = 0.000767\ ft^2 / hole$$

Design flowrate = Largest flowrate = q = 77.9857 $ft^3/d/ft$
For F.S. = 10, q = 779.857 $ft^3/d/ft$ = 0.0090261 $ft^3/s/ft$

$q = CAe(2gh)^{1/2}$
$q = 0.6(0.3A)(2x32.2x2)^{1/2}$
$q = 2.0428A$
$A =$ 0.0044185 ft^2

Number of holes required:

$$\frac{0.0044185}{0.000767} = 5.76 \text{ Holes / ft}$$

or 6 Holes / ft

Design: Use 2 rows of 3/8" dia. holes with 3 holes/row at 4" C-C spacing.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B12-495-1413 SHEET 1 OF 2
DESCRIPTION: INTERNAL DRAIN AND DECANT PIPE STRUCTURAL DESIGN

Calculation to show the DR-17 HDPE Internal Drain Pipe and decant pipe is capable of sustaining the proposed cover loading.

Reference: Performance Pipe Design Manual, Ch. 7 - Buried Piped Design

Max proposed cover = 69 ft (Section H-H under separate cover)

Unit Wt. of Material = 130 pcf

Pipe wall compressive stress:

$$S = \frac{P_T D_O}{288t}$$

Where:
S = Pipe wall compressive stress, lb/in^2
P_T = Vertical load applied to pipe, lb/ft^2
D_O = Pipe outside diameter, inches
t = Pipe wall thickness, inches

$P_T = 85 \times 130 =$ 8,970 psf = 62.29 psi

D_O	t	S
10	0.632	492.81
12	0.750	498.33
14	0.824	529.18
16	0.941	529.58
18	1.059	529.39
20	1.176	529.69
22	1.294	529.53
24	1.412	529.39
26	1.529	529.62

Highest compressive stress (S) = 529.69 psi, which is less than 800 psi (allowable according to manufacturer), therefore the DR-17 HDPE pipe will be resist the compressive stress of the backfill.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B13-055-1413 SHEET 2 OF 2
DESCRIPTION: INTERNAL DRAIN AND DECANT PIPE STRUCTURAL DESIGN

Calculation to check constrained pipe wall buckling for DR-17 HPDE.

$P_{WC} = 5.65[RB'E'(E/(12(DR-1)^3)]^{1/2}$

Where:

P_{WC} = Allowable constrained buckling pressure, psi
R = Bouyancy reduction factor
H' = groundwater height above pipe, ft
H = Cover above pipe, ft
B' = Elastic support factor
E' = Soil reaction modulus, psi (Table 7-7)
E = Elastic modulus, psi (Table 1, 50 yr @ 73°F)
ΔX = Horizontal Deflection, inches
D_1 = Inside Diameter, inches
P_T = Vertical load applied to pipe, lb/ft²
K = Bedding factor
L = Deflection lag factor

$R = 1 - 0.33(H'/H)$

H' =	27.35	ft		
H =	69	ft		
R =	0.869			

$B' = 1 / (1 + 4e^{(-0.065xH)})$

B' =	0.957			
E' =	3,000	psi		
E =	28,200	psi		
P_T =	8,970	psf =	62.29	psi
DR =	17			

P_{WC} = 213.77 psi

Factor of Safety = $\frac{P_{WC}}{P_T} = \frac{213.77}{62.29}$

F.S. = 3.43

Calculation to check ring deflection.

$$\frac{\Delta X}{D_1} = \frac{P_T}{144} \cdot \frac{KL}{2E/3(1/DR-1)^3+0.061E'}$$

Where:

K = 0.1
L = 1.5

$\frac{\Delta X}{D_1}$ = 5.0% ≤ 5% (Allowable)

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

www.performancepipe.com

The modulus is selected using the same criteria used for determining the stress in the pipe wall due to the thermal change. The applicability of Euler's equation for any specific pipeline calculation must be evaluated. For pipe installed on top of a surface (i.e. the ground, a pipe rack) pipe and fluid weight in the pipe and frictional forces increase the critical thrust force whereas in aerial applications weight and initial curvature due to deflection reduce the critical thrust force.

While the amount of length change experienced by polyethylene pipe during thermal changes is greater than many other materials, the amount of force required to restrain the movement is less because of its lower modulus of elasticity.

Table 1 Typical Elastic Modulus for DriscoPlex® PE 3608

Load Duration	*Elastic Modulus†, 1000 psi (MPa), at Temperature, °F (°C)*							
	-20 (-29)	*0 (-18)*	*40 (4)*	*60 (16)*	*73 (23)*	*100 (38)*	*120 (49)*	*140 (60)*
Short-Term	300.0 (2069)	260.0 (1793)	170.0 (1172)	130.0 (896)	110.0 (758)	100.0 (690)	65.0 (448)	50.0 (345)
10 h	140.8 (971)	122.0 (841)	79.8 (550)	61.0 (421)	57.5 (396)	46.9 (323)	30.5 (210)	23.5 (162)
100 h	125.4 (865)	108.7 (749)	71.0 (490)	54.3 (374)	51.2 (353)	41.8 (288)	27.2 (188)	20.9 (144)
1000 h	107.0 (738)	92.8 (640)	60.7 (419)	46.4 (320)	43.7 (301)	35.7 (246)	23.2 (160)	17.8 (123)
1 y	93.0 (641)	80.6 (556)	52.7 (363)	40.3† (278)	38.0 (262)	31.0 (214)	20.2 (139)	15.5 (107)
10 y	77.4 (534)	67.1 (463)	43.9 (303)	33.5 (231)	31.6 (218)	25.8 (178)	16.8 (116)	12.9 (89)
50 y	69.1 (476)	59.9 (413)	39.1 (270)	29.9 (206)	28.2 (194)	23.0 (159)	15.0 (103)	11.5 (79)

† Typical values based on ASTM D 638 testing of molded plaque material specimens.
Modulus values for PE4710 are under development.

Controlling Expansion and Contraction

Black polyethylene pipe on the surface or above grade and exposed to the sun can absorb solar energy. The resulting pipe temperatures can be greater than the air temperature. To help reduce temperature changes resulting solar heating of a piping system, the pipe may be shaded or placed in a location that receives less direct sunlight.

The effects of thermal expansion and contraction on a piping system can be controlled in several ways, including

- Lateral-deflection expansion loops (snaking the pipe)
- Anchor and guide the pipe
- Conventional Expansion loops
- Expansion joints (non-pressures systems only)
- Burying pipes

March 2007 Supersedes all previous publications
© 2007 Chevron Phillips Chemical Company LP

Performance Pipe, a division of
Chevron Phillips Chemical Company LP
PO Box 269006
Plano, TX 75026-9066
Phone: 800-527-0662
Fax: 972-599-7348

Table 7-7 Bureau of Reclamation Average E' Values for Iowa Formula (Initial Deflection)

Soil type – pipe bedding material (Unified Classification)†	E' for Degree of Bedding Compaction, lb/in²			
	Dumped	Slight (<85% Proctor <40% relative density)	Moderate (48%-95% Proctor 40%-70% relative density)	High (>95% Proctor >70% relative density)
Fine-grained soils (LL>50)‡ Soils with medium to high plasticity CH, MH, CH-MH	No data available; consult a competent soils engineer; otherwise, use E' = 0.			
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with <25% coarse grained particles	50	200	400	1000
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with >25% coarse grained particles Coarse-grained soils with fines GM, GC, SM, SC◊ contains >12% fines	100	400	1000	2000
Coarse-grained soils with little or no fines GW, GP, SW, SP◊ contains <12% fines	200	1000	2000	3000
Crushed rock	1000	3000	3000	3000
Accuracy in terms of percentage deflection▼	±2%	±2%	±1%	±0.5%

† ASTM D 2487; USBR Designation E-3. ‡ LL = Liquid limit. ◊ Or any borderline soil beginning with one of these symbols, i.e., GM-GC, GC-SC. ▼ For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note – Values applicable only for fills less than 50 ft (15 m). No safety factor included in table values. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If bedding falls on the borderline between two compaction categories, select the lower E' value or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/ft³ (598,000 J/m²) (ASTM D 698, AASHTO T-99, USBR Designation E-11). 1 lb/in² = 6.895 kPa.

Table 7-8 Duncan-Hartley Soil Reaction Modulus

Type of Soil	Depth of Cover, ft	E' for Standard AASHTO Relative Compaction, lb.in²			
		85%	90%	95%	100%
Fine-grained soils with <25% sand content (CL, ML, CL-ML)	0-5	500	700	1000	1500
	5-10	600	1000	1400	2000
	10-15	700	1200	1600	2300
	15-20	800	1300	1800	2600
Coarse-grained soils with fines (SM, SC)	0-5	600	1000	1200	1900
	5-10	900	1400	1800	2700
	10-15	1000	1500	2100	3200
	15-20	1100	1600	1400	3700
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	0-5	700	1000	1600	2500
	5-10	1000	1500	2200	3300
	10-15	1050	1500	2400	3600
	15-20	1100	1700	2500	3800

©2003 Chevron Phillips Chemical Company LP

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B13-055-1413 SHEET 1 OF 1
DESCRIPTION: INTERNAL GRAVEL DRAIN CAPACITY

Calculation to check capacity of internal gravel drain.

Use same aggregate as previous underdrain stages.
Aggregate supplied by Freedom Materials, washed river gravel.

3/8" to 1-1/2"
66.7% is 3/8" to 1" 0% < 3/8"
33.3% is 1" to 1-1/2" 0% > 1-1/2"

Underdrain is on a 0.005 ft/ft slope
Aggregate underdrain area = 15.4 ft^2
Aggregate should have a permeability > Gradation No. 15 (See Figure No. 1 and Figure No. C-15)

For hydraulic gradient (i) =0.005

$q/A = 0.38 \times 10^3$ ft/d
$Q =$ 5852 ft^3/d

Check ability of aggregate to admit flow to perforated pipe

Smallest calculated head in Phase8, Section D-D (Future expansion under separate cover)
Calculated phreatic level above drain = 18.22 ft
To center of underdrain h = 17.72 ft
i = 17.72 / 2 = 8.86
For i = 8.86, $(q/A)x10^3 > 4.0$
A = 4 ft x 4(1 ft width) = 16 ft^2 / ft
$Q > (16)(4x10^3) = 64x10^3$ ft^3/d-ft

Max calculated groundflow = 146.43 ft^3/d-ft
$Q = 64x10^3$ ft^3/d-ft > 146.43 ft^3/d-ft

F.S. = $64x10^3$ / 146.43 = 437 > 10 **OK**

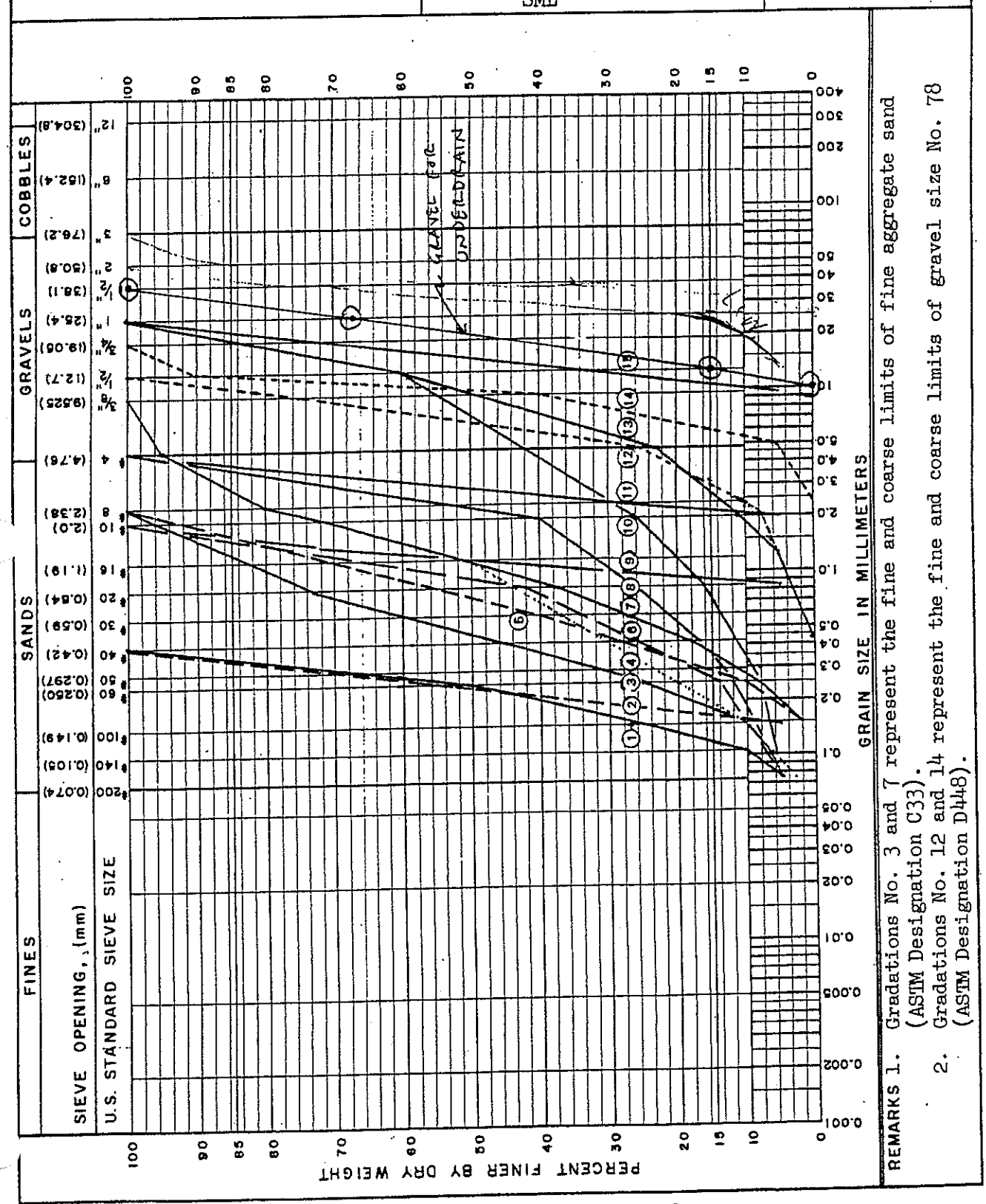
Form SCS 130
5-65

4

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

PROJECT and STATE: Project Study No. 101

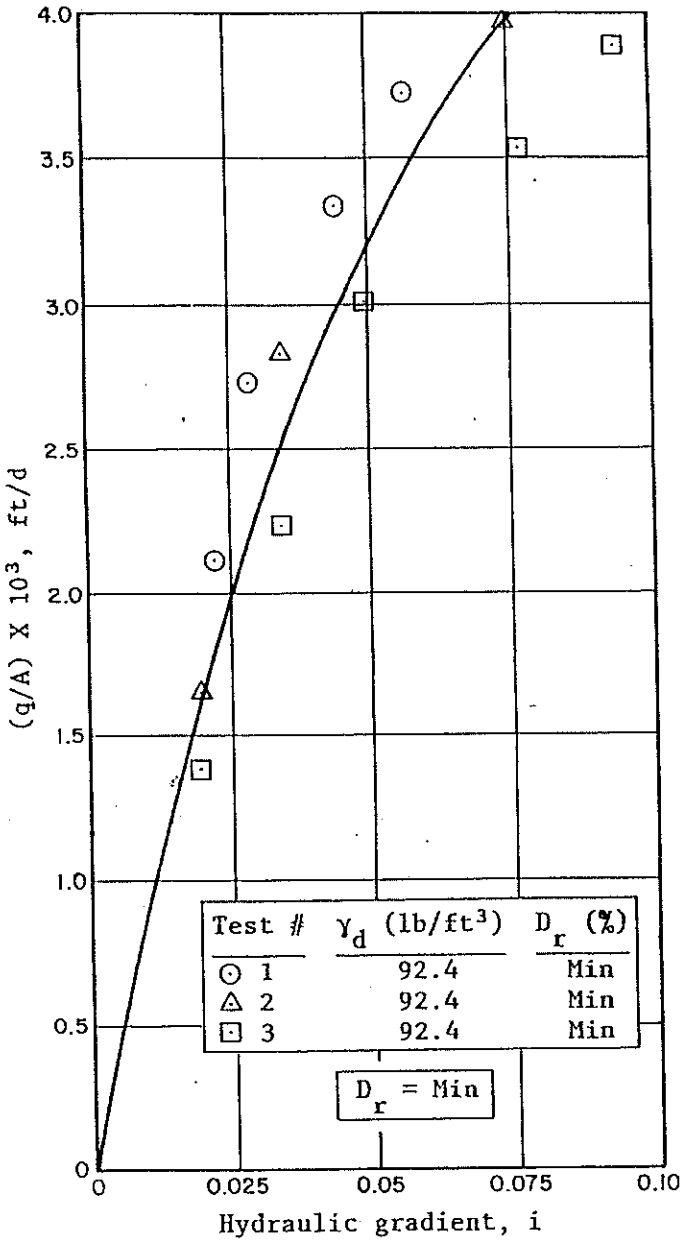
DESIGNED AT | BY: SML | DATE

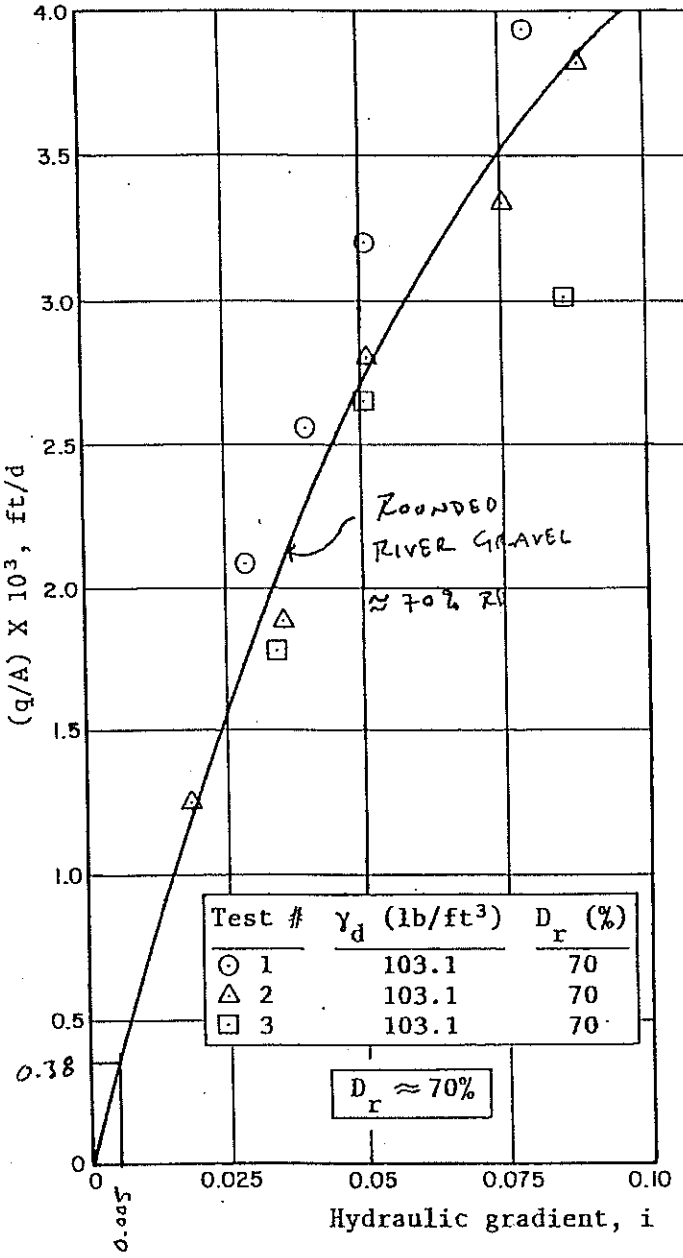


REMARKS 1. Gradations No. 3 and 7 represent the fine and coarse limits of fine aggregate sand (ASTM Designation C33).

2. Gradations No. 12 and 14 represent the fine and coarse limits of gravel size No. 78 (ASTM Designation D448).

Figure 1. Gradations of sands and gravels tested





GRADATION #15	
GP (rounded particles)	
C_u = 1.7; C_z = 1.0	
Sieve #	% Passing
1"	100
1/2"	34
3/8"	5

Relative Density, D_r
Min γ_d = 92.5 lb/ft³
Max γ_d = 108.7 lb/ft³

Figure C-15. Relationship between q/A and i for Gradation No. 15 (GP, rounded)

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-420-951/SCS-628

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/14/2012 CHKD. BY: _____ DATE: _____
PROJECT NAME: MACH NO. 1 MINE, FACILITY NO.1, 2, AND 3 EXPANSION PLAN
PROJECT NUMBER: B13-055-1413 SHEET 1 OF 1
DESCRIPTION: FILTER FABRIC PERMITTIVITY AND CLOGGING POTENTIAL

Check ability of fabric to admit flow into the underdrain.

Use GEOTEX 501 (See Manufacturers Data Sheet for Specs)

Required permittivity:

$q = KiA = K(\Delta h/t)A$
$t =$ Thickness of fabric
$\Delta h =$ 17.72 ft
$q =$ 31.0485 $ft^3/d\text{-}ft =$ 0.0003594 $ft^3/s\text{-}ft$
$K/t = \psi =$ Permittivity of fabric
$K/t = \psi = q/(\Delta hA)$

For F.S. = 10 use 10xq = 0.003097 $ft^3/s\text{-}ft$

Required $\psi = \frac{0.003594}{(17.72)(16)} =$ 0.00000127 sec^{-1}

ψ Fabric = 1.4 sec^{-1} > 1.27x10^{-6} sec^{-1} **OK**

Check geotextile clogging potential.

From previous gradation tests on placed CCR:
Smallest d_{85} = 7 mm

Criteria - AOS ≤ d_{85} soil
EOS ≈ AOS = # 70 sieve = 0.210 mm < 7 mm **OK**

NRCS Criteria - For a nonwoven geotextile:
AOS ≤ # 40 sieve (# 70 Provided)
$\psi > 0.7$ sec^{-1} (1.4 sec^{-1} Provided)

Geotextile meets both criteria

GEOTEX®
BY PROPEX

Product Data
GEOTEX® 501

GEOTEX® 501 is a polypropylene, staple fiber, needlepunched nonwoven geotextile produced by Propex, and will meet the following Minimum Average Roll Values (MARV) when tested in accordance with the methods listed below. The fibers are needled to form a stable network that retains dimensional stability relative to each other. The geotextile is resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.

GEOTEX 501 conforms to the property values listed below[1]. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). This product is NTPEP approved for AASHTO standards.

		MARV[2]	
PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
MECHANICAL			
Tensile Strength (Grab)	ASTM D-4632	150 lbs	667 N
Elongation	ASTM D-4632	50%	50%
CBR Puncture	ASTM D-6241	360 lbs	1602 N
Trapezoidal Tear	ASTM D-4533	60 lbs	267 N
ENDURANCE			
UV Resistance % Retained at 500 hrs	ASTM D-4355	70%	70%
HYDRAULIC			
Apparent Opening Size (AOS)[3]	ASTM D-4751	70 US Std. Sieve	0.212 mm
Permittivity	ASTM D-4491	1.4 sec^{-1}	1.4 sec^{-1}
Water Flow Rate	ASTM D-4491	115 gpm/ft^2	4686 $l/min/m^2$
ROLL SIZES		15 ft x 360 ft	4.57 m x 109.8 m

NOTES:
1. The property values listed above are effective 04/2011 and are subject to change without notice.
2. Values shown are in weaker principal direction. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum average roll value.

Propex™ Geotextile Systems

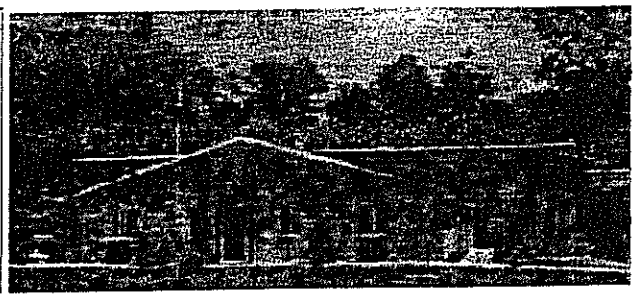
TESTED. PROVEN. TRUSTED
www.geotextile.com

Propex Operating Company, LLC · 6025 Lee Highway, Suite 425 · PO Box 22788 · Chattanooga, TN 37422
ph 423 899 0444 · ph 800 621 1273 · fax 423 899 7619

Geotex®, Landlok®, Pyramat®, X3®, SuperGro®, Petromat® and Petrotac® are registered trademarks of Propex Operating Company, LLC.
This publication should not be construed as engineering advice. While information contained in this publication is accurate to the best of our knowledge, Propex does not warrant its accuracy or completeness. The ultimate customer and user of the products should assume sole responsibility for the final determination of the suitability of the information and the products for the contemplated and actual use. The only warranty made by Propex for its products is set forth in our product data sheets for the product, or such other written warranty as may be agreed by Propex and individual customers. Propex specifically disclaims all other warranties, express or implied, including without limitation, warranties of merchantability or fitness for a particular purpose, or arising from provision of samples, a course of dealing or usage of trade.

© 2011 Propex Operating Company, LLC

DRAINAGE SOLUTIONS, INC
SUPPLIER / DISTRIBUTOR



(317) 346-4110

View Cart | Checkout

Amount in Cart: $0.00

Search

Advanced Search

Categories

Animal Guards
Bar Guard Intake
Drains & Grates
- Mitered Drains
- Emitters
- Grates - Brass
- Grates - Chrome
- Grates - Metal
- Grates & Covers - Plastic
- 6" Catch Basins & Grates
- 9" Catch Basins & Grates
- ?" Catch Basins & rates
- 18" Catch Basins & Grates
- 24" Catch Basins & Grates

Trench Drain
- NDS Dura Slope
- Channel Drain 6"
- NDS Micro Channel Drain 1 1/4"
- NDS Mini Channel Drain 3"
- NDS Spee-D Channel Drain 4"
- NDS Pro Series Channel Drain 3"
- NDS Pro Series Channel Drain 5"
- NDS Pro Series Channel Drain 8"
- NDS Pro Series Channel Drain 12"

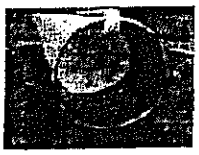
Anti-Seep Collars
Biobarrier
Duckbill Earth Anchors
Fittings-Brass
Fittings-Corrugated-Singlewall
- 2" Singlewall
- 3" Singlewall
- 4" Singlewall
- " Singlewall
- Singlewall
- o" Singlewall

Fittings-Downspout Adapters
Fittings-Flexible

Search Results

Found 29 product(s) for **Animal Guards** (1-25 of 29)

Animal Guards



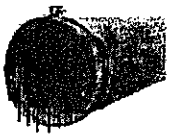
Animal Guard 4" (Polypropylene)
Price: $5.88
Add to Cart | Buy it Now!



Animal Guard 4" (Stainless Steel)
Price: $10.93
Add to Cart | Buy it Now!



Animal Guard 4" (Zinc Coated)
Price: $7.79
Add to Cart | Buy it Now!



Animal Guard 6" (Band Type)
Price: $21.26
Add to Cart | Buy it Now!



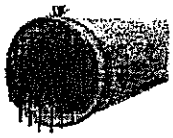
Animal Guard 6" (Polypropylene)
Price: $6.83
Add to Cart | Buy it Now!



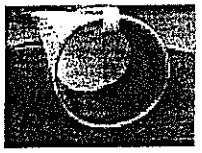
Animal Guard 6" (Stainless Steel)
Price: $12.98
Add to Cart | Buy it Now!



Animal Guard 6" (Zinc Coated)
Price: $8.47
Add to Cart | Buy it Now!

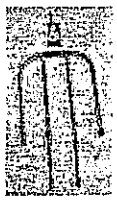


Animal Guard 8" (Band Type)
Price: $27.15
Add to Cart | Buy it Now!



Animal Guard 8" (Polypropylene)
Price: $8.90
Add to Cart | Buy it Now!

Fittings-Hickenbottom Intakes
Fittings-PVC DWV
1 1/2" DWV
2" DWV
1/2" DWV
3" DWV
4" DWV
6" DWV
8" DWV
10" DWV
12" DWV
Fittings-PVC Repair
1/2" S/40 Repair
3/4" S/40 Repair
1" S/40 Repair
1 1/4" S/40 Repair
1 1/2" S/40 Repair
2" S/40 Repair
2 1/2" S/40 Repair
3" S/40 Repair
4" S/40 Repair
6" S/40 Repair
8" S/40 Repair
Fittings-PVC Schedule 40
1/8"
1/4"
3/8"
1/2"
3/4"
1"
1 1/4"
1 1/2"
2"
2 1/2"
3"
6"
8"
Fittings-PVC Schedule 80
1/4" Pressure
3/8" Pressure
1/2" Pressure
1" Pressure
1 1/4" Pressure
3/4" Pressure
1 1/2" Pressure
2" Pressure
2 1/2" Pressure
3" Pressure
4" Pressure
5" Pressure
6" Pressure
8" Pressure
Fittings-PVC SDR35
3" Solvent Weld
4" Solvent Weld
6" Solvent Weld
8" Solvent Weld
10" Solvent Weld
12" Solvent Weld
15" Solvent Weld
Fittings-Quick Connect
1/2" Cam & Groove
3/4" Cam & Groove
1" Cam & Groove
1 1/4" Cam & Groove
1 1/2" Cam & Groove
2" Cam & Groove
2 1/2" Cam & Groove
3" Cam & Groove



Animal Guard 8" (Stainless Steel)

Price: **$16.33**

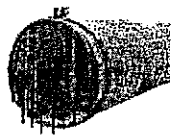
Add to Cart | Buy it Now!



Animal Guard 8" (Zinc Coated)

Price: **$10.27**

Add to Cart | Buy it Now!



Animal Guard 10" (Band Type)

Price: **$30.47**

Add to Cart | Buy it Now!



Animal Guard 10" (Zinc Coated)

Price: **$13.51**

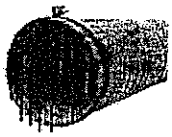
Add to Cart | Buy it Now!



Animal Guard 10"(Stainless Steel)

Price: **$25.16**

Add to Cart | Buy it Now!



Animal Guard 12" (Band Type)

Price: **$37.74**

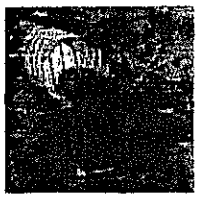
Add to Cart | Buy it Now!



Animal Guard 12" (Stainless Steel)

Price: **$38.83**

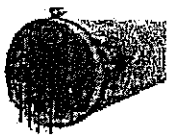
Add to Cart | Buy it Now!



Animal Guard 12" (Zinc Coated)

Price: **$20.28**

Add to Cart | Buy it Now!



Animal Guard 15" (Band Type)

Price: **$53.27**

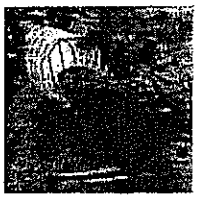
Add to Cart | Buy it Now!



Animal Guard 15" (Stainless Steel)

Price: **$70.42**

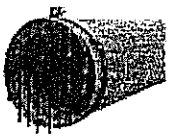
Add to Cart | Buy it Now!



Animal Guard 15" (Zinc Coated)

Price: **$37.58**

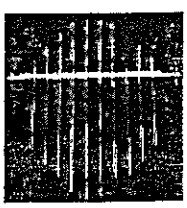
Add to Cart | Buy it Now!

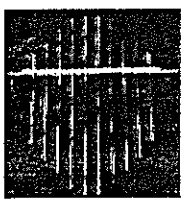


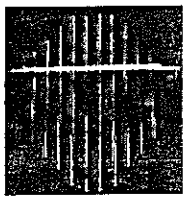
Animal Guard 18" (Band Type)

Price: **$84.60**

Add to Cart | Buy it Now!







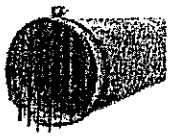
4" Cam & Groove
5" Cam & Groove
6" Cam & Groove
8" Cam & Groove
10" Cam & Groove
12" Cam & Groove
Fittings-QwikSeal
Flo-Well
Grass & Gravel Pavers
Inlet Protection
Bags
Coir Mats
Dandy Products
Dewatering Bags
Drain Guards
Snout
Landscape Supplies
Staples & Geopins
New
Septic & Sewer Accessories
Covers
Disconnects - Pump
Plugs
Valves
Stealth Products
Tools
Knives & Saws
Marking Products
Pipe Cutters
Ratchets
Shovels
Shrink Wrap
Staplers
Tapes
Valve Box
Round 6"
Round 10"
Rectangular 13" x 20"
Rectangular 13" x 24"
Rectangular 14" x 19"
Valves- Lab
Valves-Backwater
Valves-Ball - Compact
Valves-Ball Valves - Single Entry
Valves-Ball Valves - True Union
Valves-Flap Gates
Valves-Septic
Valves-Sewer
Valves-Swing Check
Valves-Valterra Gate

Items in your cart
Empty

Animal Guard 18" (Stainless Steel)
Price: $90.24
Add to Cart | Buy it Now!

Animal Guard 18" (Zinc Coated)
Price: $69.75
Add to Cart | Buy it Now!

Animal Guard 21" (Zinc Coated)
Price: $73.61
Add to Cart | Buy it Now!



Animal Guard 24" (Band Type)
Price: $150.21
Add to Cart | Buy it Now!

Pages: 1 2

Advanced Search | View Cart | Checkout | About Us | Service | Policies | Home

ProStores

Copyright © 2011 THE DRAINAGE PRODUCTS STORE. All Rights Reserved.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

CALC. BY: RPC DATE: 2/13/2013 CHKD. BY: _____ DATE: _____
PROJECT NAME: DTE IMPOUNDMENT PLAN MODIFICATION
PROJECT NUMBER: B13-055-1413 SHEET 1 OF 1
DESCRIPTION: Hydrologic Design Parameters and Required Pump Capacity

Design Rainfall

The design rainfall is one PMF based on a 72-hour PMP of 41", to be stored and 90% evacuated in 10 days or less by pumps for all phases of construction until the decant pipes are installed and active.
The PMF volume and required pump capacity for each Phase is as follows:

72-hour PMF rainfall = 41"
Runoff Curve Number = 100

PMF Volume = (41")(1 ft/12in)(Drainage Area(Ac.))(43560sf/Ac.)

Phase	Drainage Area (Ac)	PMF Vol. (ft^3)	90% PMF Vol. (ft^3)	90% PMF Vol. (gal)	Req. Pump Rate (gpd)	Pump Rate (gpm)
7	80.29	11,949,561	10,754,604.63	80,444,442.63	8,044,444.26	5,586.42
5A	30.86	4,592,894	4,133,604.42	30,919,361.06	3,091,936.11	2,147.18
2-3 Connector	40.80	6,072,264	5,465,037.60	40,878,481.25	4,087,848.12	2,838.78
Total						10,572.38

Design Pumping Capability

The required pump capacity will be maintained onsite at all times. To assume a worst case pumping capacity rate the assumption was made that Mach will have completed construction of the Phase 5A, 7, and 2-3 Connector embankments and that no fines were pumped into these cells. Also, assuming the pumps will be lowered to 10 feet above the pool the diesel powered pumps designed for storm evacuation requirements are:

The required pump capacity at the critical time for Facility Nos. 1 and 2 is:

Model	Size (in)	Capacity (gpm)	Quantity
Godwin DPC300	12	4,012	1
Godwin CD150M	6	1,915	3
Godwin CD100M	4	716	2

Total Capacity (gpm)	11,189

11,189 gpm > 10,573 gpm required

Note: Number of each type of pump is also based on existing onsite pump capacity. Mach may use any combination of these pumps to achieve the required pump rate.

R11076

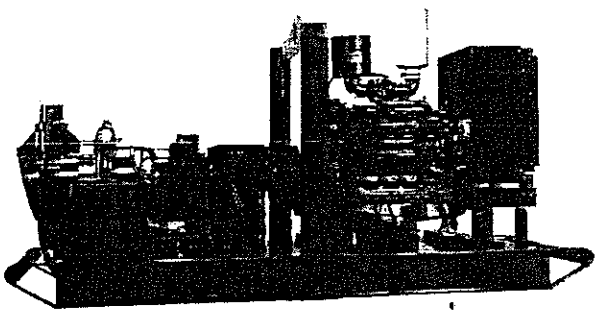
DPC300

DPC300 Dri-Prime Pump

The Godwin Dri-Prime DPC300 pump offers flow rates to 5,062 USGPM and discharge heads to 110' (34m). Also it has the capability of handling solids up to 4" (95mm) in diameter.

The DPC300 is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the DPC300 the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close-coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 4" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine John Deere 6068HF285. Also available with Caterpillar C6.6E.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 1976grbw 4 hardness to 200 hb brinell.

Specifications

Suction connection	12" 125# ANSI B16.1
Delivery connection	12" 125# ANSI B16.1
Max capacity	5062 USGPM
Max head	110' (34m)
Max solids handling	4" (95mm)
Max impeller diameter	17" (430mm)
Max operating temp	176°F (80°C)
Max working pressure	50.8 psi (3.5 bar)
Max suction pressure	29.0 psi (2.0 bar)
Max casing pressure	59.5 psi (4.1 bar)
Max operating speed	1200 rpm

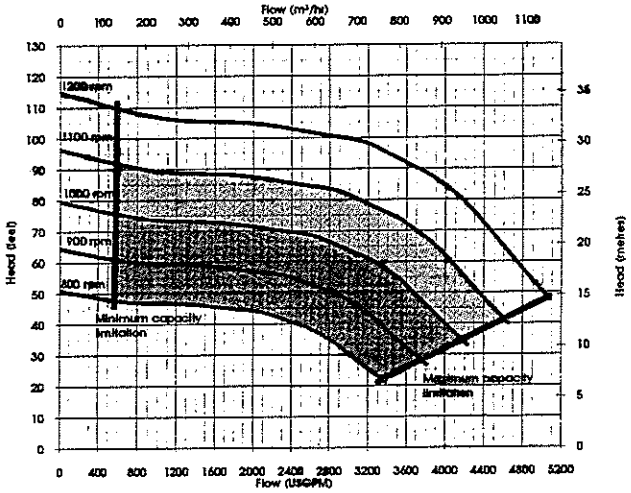
godwin
a xylem brand

Reference number : 95-1017-3000
Date of issue : August 25. 2011
Issue : 1

Please contact Godwin for further details.
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

DPC300

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS1452:1990 grade 220
Wearplates	Cast iron to BS1452 grade 220
Pump shaft	Carbon steel BS970-3:1991 080M40
Impeller	Cast steel BS3100 1976GRBW 4 hardness to 200 HB Brinell
Non-return valve body	Cast iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

John Deere, 6068HF285, 155.4 HP @ 2200 rpm

Impeller diameter 17 " (430 mm)

Pump Speed 1100 rpm

Suction Lift Table

Total Suction Head (')	Total Delivery Head (') 24	36	47	59	70
	Output (USGPM)				
9.8	4606	4321	4012	3609	2849
15.1	4511	4178	3799	3229	950
20.0	4036	3561	2849	1899	712
24.9	2137	1899	1424	950	-

Fuel capacity (Full) 150 US Gal, (Usable) 150 US Gal

Fuel consumption @ 2200 rpm BEP 6.8 US Gal/hr

Weight: (Dry) 5,128 lbs, (Wet) 6,352 lbs

Dimensions: (L) 145" x (W) 53" x (H) 71"

Engine option 2

Caterpillar, C6.6E, 142.1 HP @ 2000 rpm

Impeller diameter 17 " (430 mm)

Pump Speed 1000 rpm

Suction Lift Table

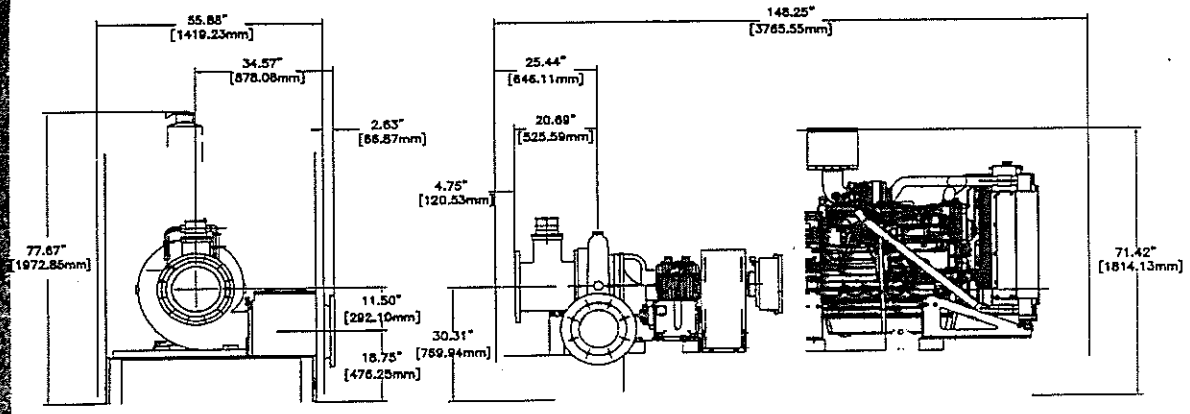
Total Suction Head (')	Total Delivery Head (') 9	19	28	38	47
	Output (USGPM)				
9.8	4187	3928	3647	3281	2590
15.1	4101	3799	3453	2935	863
20.0	3669	3237	2590	1727	647
24.9	1942	1727	1295	863	-

Fuel capacity (Full) 150 US Gal, (Usable) 150 US Gal

Fuel consumption @ 2000 rpm BEP 5.6 US Gal/hr

Weight: (Dry) 4,903 lbs, (Wet) 6,112 lbs

Dimensions: (L) 145" x (W) 53" x (H) 71"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1017-3000

Date of issue : August 25, 2011

Issue : 1

godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwinpumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

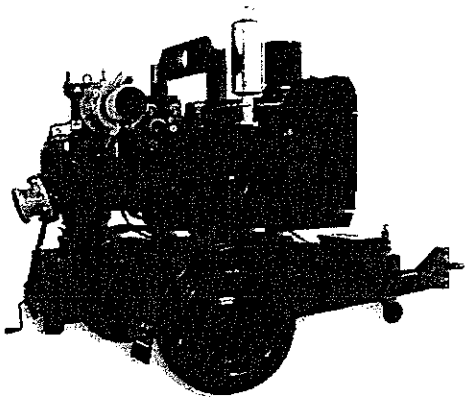
CD150M

CD150M Dri-Prime Pump

The Godwin Dri-Prime CD150M pump offers flow rates to 2,277 USGPM and discharge heads to 154' (47m). Also it has the capability of handling solids up to 3" (75mm) in diameter.

The CD150M is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the CD150M the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close-coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 3" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine John Deere 4045TF280. Also available with Caterpillar C4.4M-T.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 a5 hardness to 200 hb brinell.

Specifications

Suction connection	6" 125# ANSI B16.1
Delivery connection	6" 125# ANSI B16.1
Max capacity	2277 USGPM
Max head	154' (47m)
Max solids handling	3" (75mm)
Max impeller diameter	11" (280mm)
Max operating temp	176°F (80°C)
Max working pressure	69.6 psi (4.8 bar)
Max suction pressure	58.0 psi (4.0 bar)
Max casing pressure	104.4 psi (7.2 bar)
Max operating speed	2200 rpm

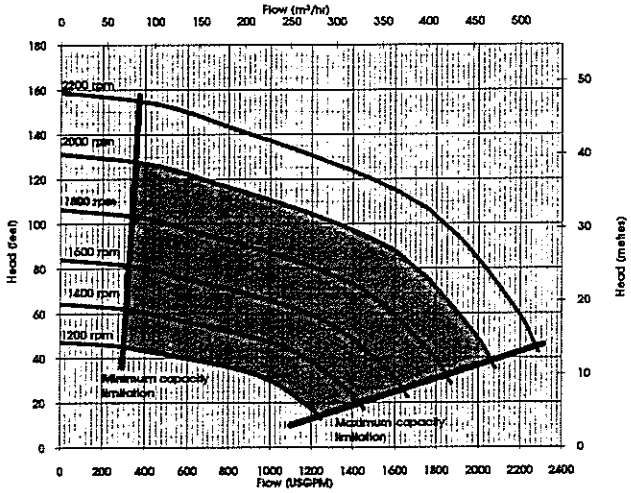
godwin
a xylem brand

Reference number : 95-1011-3000
Date of issue : August 25. 2011
Issue : 1

Please contact Godwin for further details.
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

CD150M

Performance Curve



Materials

Pump casing & suction cover	Cast Iron BS1452:1990 grade 220
Wearplates	Cast Iron to BS1452 grade 220
Pump shaft	Carbon steel BS970 080M40
Impeller	Cast steel BS3100 A5 hardness to 200 HB Brinell
Non-return valve body	Cast iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

John Deere, 4045TF280, 68.3 HP @ 2000 rpm

Impeller diameter 11 " (280 mm)

Suction Lift Table

Total Suction Head (')	Total Delivery Head (')				
	23	36	49	66	112
	Output (USGPM)				
9.8	2083	2008	1915	1739	550
15.1	2008	1964	1876	1655	440
20.0	1893	1849	1805	1611	374
24.9	1761	1717	1651	1567	-

Fuel capacity (Full) 60 US Gal, (Usable) 60 US Gal

Fuel consumption @ 2000 rpm BEP 3.4 US Gal/hr

Weight: (Dry) 2,840 lbs, (Wet) 3,340 lbs

Dimensions: (L) 118" x (W) 66" x (H) 72"

Engine option 2

Caterpillar, C4.4M-T, 69.7 HP @ 2000 rpm

Impeller diameter 11 " (280 mm)

Suction Lift Table

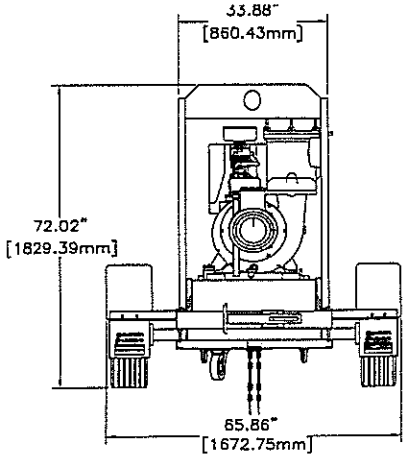
Total Suction Head (')	Total Delivery Head (')				
	23	36	49	66	112
	Output (USGPM)				
9.8	2083	2008	1915	1739	550
15.1	2008	1964	1876	1655	440
20.0	1893	1849	1805	1611	374
24.9	1761	1717	1651	1567	-

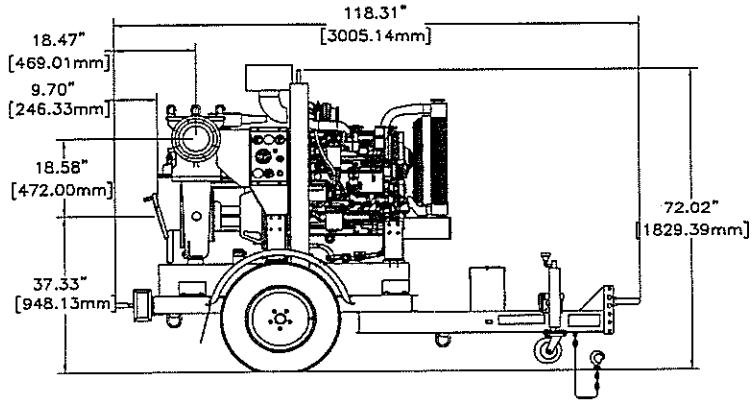
Fuel capacity (Full) 60 US Gal, (Usable) 60 US Gal

Fuel consumption @ 2000 rpm BEP 3.4 US Gal/hr

Weight: (Dry) 3,148 lbs, (Wet) 3,614 lbs

Dimensions: (L) 118" x (W) 66" x (H) 72"





Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1011-3000

Date of issue : August 25, 2011

Issue : 1

godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwindumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

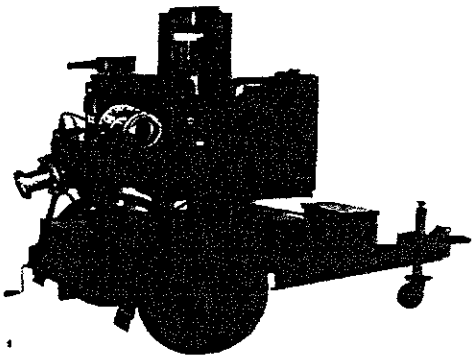
CD100M

CD100M Dri-Prime Pump

The Godwin Dri-Prime CD100M pump offers flow rates to 1,013 USGPM and discharge heads to 124' (38m). Also it has the capability of handling solids up to 2" (45mm) in diameter.

The CD100M is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the CD100M the perfect choice for small dewatering and bypass applications. The standard model is mounted on a highway trailer, with a skid-mounted option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 2" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion-resistant interfaces.
- Also available in a Critically Silenced unit which drastically reduce noise levels of the pump.
- Standard engine Yanmar 3TNV88. Also available with Caterpillar C1.5T.
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 a5 hardness to 200 hb brinell.

Specifications

Suction connection	4" 125# ANSI B16.1
Delivery connection	4" 125# ANSI B16.1
Max capacity	1013 USGPM
Max head	124' (38m)
Max solids handling	2" (45mm)
Max impeller diameter	9" (230mm)
Max operating temp	176°F (80°C)
Max working pressure	55.1 psi (3.8 bar)
Max suction pressure	39.9 psi (2.8 bar)
Max casing pressure	82.7 psi (5.7 bar)
Max operating speed	2200 rpm

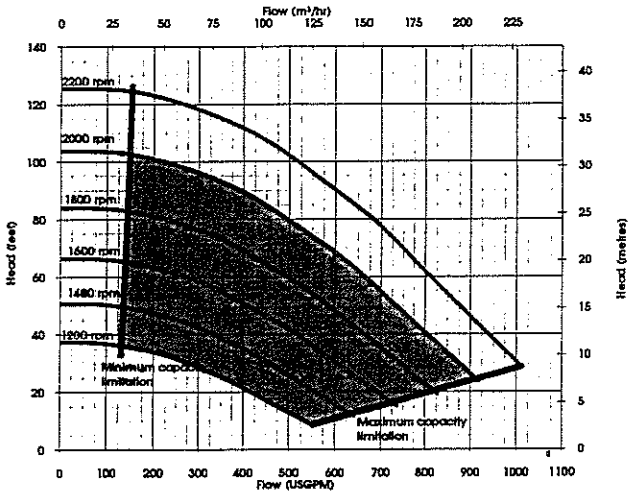
godwin
a xylem brand

Reference number : 95-1007-3000
Date of issue : August 25, 2011
Issue : 1

Please contact Godwin for further details
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

CD100M

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS1452:1990 grade 220
Wearplates	Cast iron to BS1452 Gr220
Pump shaft	Carbon steel BS970 080M40
Impeller	Cast steel BS3100 A5 hardness to 200 HB Brinell
Non-return valve body	Cast iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

Yanmar, 3TNV88, 23.8 HP @ 2000 rpm

Impeller diameter 9 " (230 mm)

Suction Lift Table

Total Suction Head (')	Total Delivery Head (') 12	34	45	59	70
	Output (USGPM)				
9.8	921	793	716	614	496
15.1	869	742	665	563	409
20.0	639	604	563	486	358
24.9	409	384	358	307	205

Fuel capacity (Full) 30 US Gal, (Usable) 30 US Gal

Fuel consumption @ 2000 rpm BEP 1.1 US Gal/hr

Weight: (Dry) 1,936 lbs, (Wet) 2,189 lbs

Dimensions: (L) 102" x (W) 54" x (H) 70"

Engine option 2

Caterpillar, C1.5T, 26.8 HP @ 2000 rpm

Impeller diameter 9 " (230 mm)

Suction Lift Table

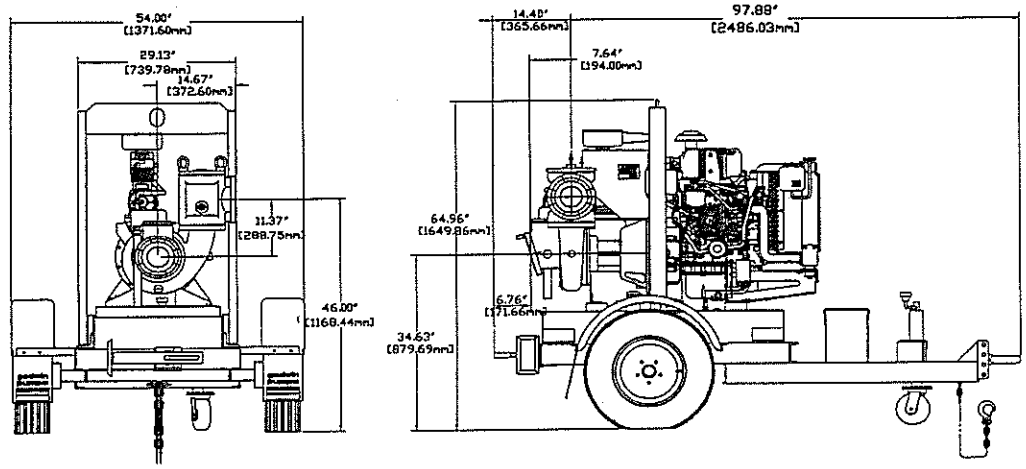
Total Suction Head (')	Total Delivery Head (') 12	34	45	59	70
	Output (USGPM)				
9.8	921	793	716	614	496
15.1	869	742	665	563	409
20.0	639	604	563	486	358
24.9	409	384	358	307	205

Fuel capacity (Full) 30 US Gal, (Usable) 30 US Gal

Fuel consumption @ 2000 rpm BEP 1.2 US Gal/hr

Weight: (Dry) 1,786 lbs, (Wet) 2,032 lbs

Dimensions: (L) 102" x (W) 54" x (H) 70"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1007-3000

Date of Issue : August 25, 2011

Issue : 1

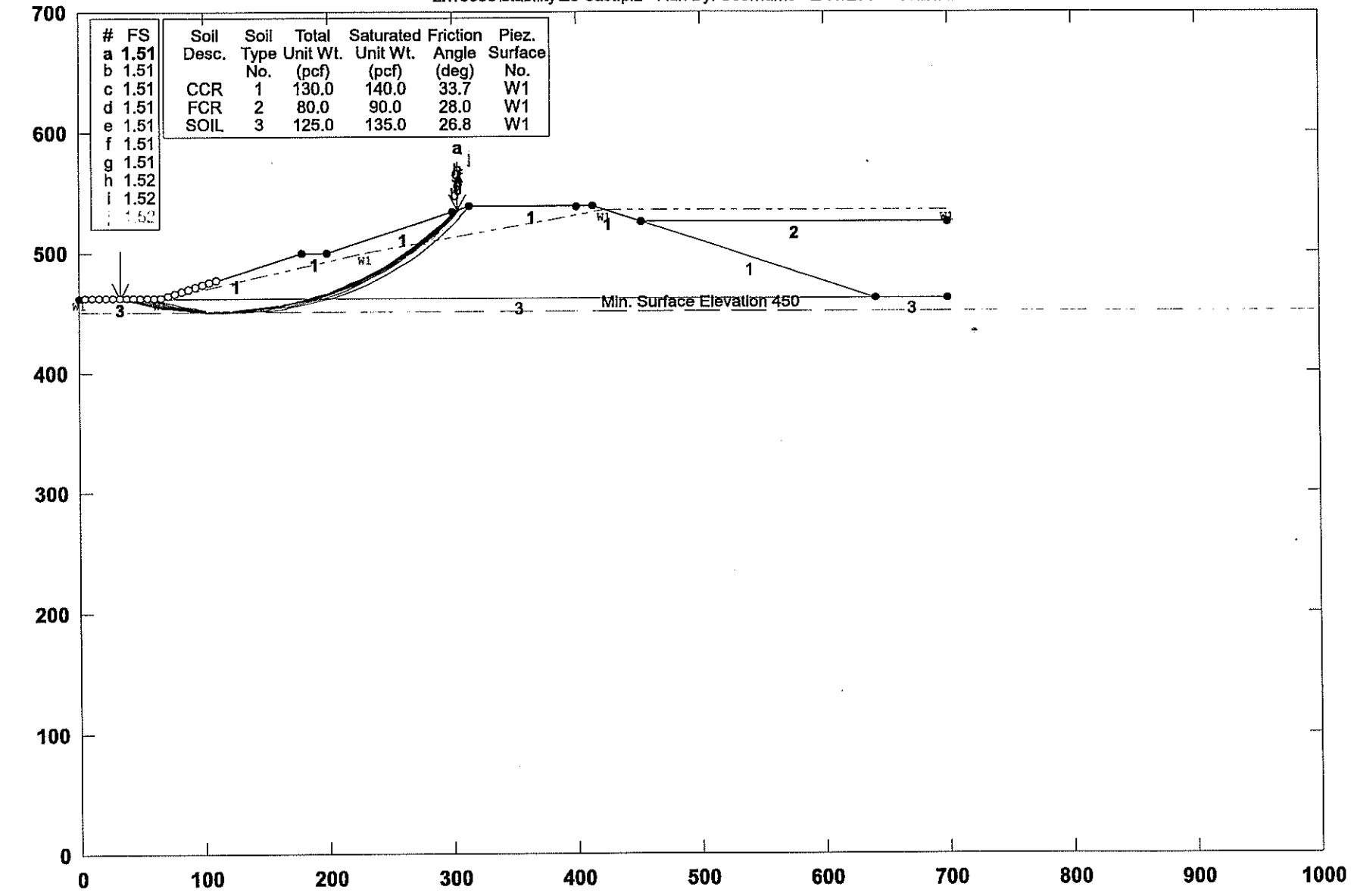
godwin
a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014 USA
P:(856) 467-3636 |F:(856) 467-4841
Sales@godwinpumps.com| godwinpumps.com

Godwinpumps, Dri-Prime® and the color orange for pumps are registered trademarks of Godwin Pumps
Specifications and illustrations are subject to revision without notice. Godwin Pumps is not liable for any incompleteness or inaccuracies.
Godwin Pumps is not liable for any consequential, incidental or indirect damages relating to these specifications or their use.
Godwin is a direct wholly owned subsidiary of ITT Corporation.

Section D-D Phase 2-3 Connector Downstream Static Deep Circle

z:\13055\stability\23-east.pl2 Run By: Username 2/19/2013 10:21AM



#	FS
a	1.51
b	1.51
c	1.51
d	1.51
e	1.51
f	1.51
g	1.51
h	1.52
i	1.52
j	1.52

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	135.0	26.8	W1

PCSTABL5M/si FSmin=1.51

Safety Factors Are Calculated By The Modified Bishop Method

STED

```
                    ** PCSTABL5M **
                          by
                    Purdue University
               --Slope Stability Analysis--
            Simplified Janbu, Simplified Bishop
               or Spencer`s Method of Slices
Run Date:                   2/19/2013
Time of Run:                10:21AM
Run By:                     Username
Input Data Filename:        Z:23-east.in
Output Filename:            Z:23-east.OUT
Unit:                       ENGLISH
Plotted Output Filename:    Z:23-east.PLT
PROBLEM DESCRIPTION   Section D-D Phase 2-3 Connector
                      Downstream Static Deep Circle
BOUNDARY COORDINATES
    7 Top   Boundaries
   10 Total Boundaries
Boundary     X-Left      Y-Left     X-Right     Y-Right     Soil Type
   No.         (ft)        (ft)       (ft)        (ft)     Below Bnd
    1          0.00      462.00       65.20     462.00         3
    2         65.20      462.00      179.10     500.00         1
    3        179.10      500.00      199.10     500.00         1
    4        199.10      500.00      313.10     538.00         1
    5        313.10      538.00      413.10     538.00         1
    6        413.10      538.00      451.80     525.10         1
    7        451.80      525.10      700.00     525.10         2
    8        451.80      525.10      641.10     462.00         1
    9         65.20      462.00      641.10     462.00         3
   10        641.10      462.00      700.00     462.00         3
ISOTROPIC SOIL PARAMETERS
  3 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)   Param.    (psf)     No.
   1   130.0    140.0       0.0      33.7    0.00      0.0       1
   2    80.0     90.0       0.0      28.0    0.00      0.0       1
   3   125.0    135.0       0.0      26.8    0.00      0.0       1
 1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
 Unit Weight of Water =  62.40
 Piezometric Surface No.  1 Specified by  5 Coordinate Points
   Point      X-Water     Y-Water
    No.         (ft)        (ft)
     1          0.00      462.00
     2         65.20      462.00
     3        230.00      500.00
     4        422.10      535.00
     5        700.00      535.00
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 400 Trial Surfaces Have Been Generated.
  20 Surfaces Initiate From Each Of 20 Points Equally Spaced
 Along The Ground Surface Between  X =   5.00 ft.
                                and  X = 110.00 ft.
 Each Surface Terminates Between   X = 300.00 ft.
                                and  X = 400.00 ft.
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =450.00 ft.
 10.00 ft. Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Examined.  They Are Ordered - Most Critical
       First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Failure Surface Specified By 31 Coordinate Points
         Point      X-Surf      Y-Surf
          No.         (ft)        (ft)
           1         32.63      462.00
           2         42.23      459.20
           3         51.93      456.77
```

4	61.72	454.71
5	71.58	453.03
6	81.49	451.72
7	91.45	450.80
8	101.43	450.25
9	111.43	450.08
10	121.43	450.30
11	131.41	450.89
12	141.36	451.87
13	151.27	453.22
14	161.12	454.95
15	170.90	457.06
16	180.58	459.53
17	190.17	462.38
18	199.64	465.58
19	208.99	469.15
20	218.19	473.07
21	227.23	477.34
22	236.10	481.95
23	244.80	486.89
24	253.29	492.16
25	261.59	497.75
26	269.66	503.66
27	277.50	509.86
28	285.10	516.36
29	292.44	523.15
30	299.52	530.21
31	303.91	534.94

Circle Center At X = 110.8 ; Y = 712.4 and Radius, 262.3

*** 1.507 ***

Individual data on the 36 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.6	1813.1	0.0	872.9	0.0	0.0	0.0	0.0	0.0
2	9.7	5254.7	0.0	2503.9	0.0	0.0	0.0	0.0	0.0
3	9.8	8265.6	0.0	3904.1	0.0	0.0	0.0	0.0	0.0
4	3.5	3563.6	0.0	1671.0	0.0	0.0	0.0	0.0	0.0
5	6.4	8165.8	0.0	3604.0	0.0	0.0	0.0	0.0	0.0
6	9.9	17981.1	0.0	7442.6	0.0	0.0	0.0	0.0	0.0
7	10.0	24070.4	0.0	9515.6	0.0	0.0	0.0	0.0	0.0
8	10.0	29672.9	0.0	11362.8	0.0	0.0	0.0	0.0	0.0
9	10.0	34752.0	0.0	12981.4	0.0	0.0	0.0	0.0	0.0
10	10.0	39276.6	0.0	14369.1	0.0	0.0	0.0	0.0	0.0
11	10.0	43220.3	0.0	15523.9	0.0	0.0	0.0	0.0	0.0
12	10.0	46562.5	0.0	16444.0	0.0	0.0	0.0	0.0	0.0
13	9.9	49287.7	0.0	17128.1	0.0	0.0	0.0	0.0	0.0
14	9.8	51386.3	0.0	17575.3	0.0	0.0	0.0	0.0	0.0
15	9.8	52854.1	0.0	17784.9	0.0	0.0	0.0	0.0	0.0
16	8.2	45397.5	0.0	15045.3	0.0	0.0	0.0	0.0	0.0
17	1.5	8247.6	0.0	2711.3	0.0	0.0	0.0	0.0	0.0
18	8.3	44687.8	0.0	15190.4	0.0	0.0	0.0	0.0	0.0
19	1.3	6610.2	0.0	2300.0	0.0	0.0	0.0	0.0	0.0
20	8.9	44346.1	0.0	16028.8	0.0	0.0	0.0	0.0	0.0
21	0.5	2589.9	0.0	957.9	0.0	0.0	0.0	0.0	0.0
22	9.3	44177.1	0.0	16246.2	0.0	0.0	0.0	0.0	0.0
23	9.2	42578.3	0.0	15270.1	0.0	0.0	0.0	0.0	0.0
24	9.0	40442.9	0.0	14059.7	0.0	0.0	0.0	0.0	0.0
25	2.8	12029.0	0.0	4105.5	0.0	0.0	0.0	0.0	0.0
26	6.1	25779.7	0.0	8529.1	0.0	0.0	0.0	0.0	0.0
27	8.7	34679.5	0.0	10736.2	0.0	0.0	0.0	0.0	0.0
28	8.5	31129.0	0.0	8561.7	0.0	0.0	0.0	0.0	0.0
29	8.3	27213.6	0.0	6165.8	0.0	0.0	0.0	0.0	0.0
30	8.1	22986.7	0.0	3552.1	0.0	0.0	0.0	0.0	0.0
31	5.9	14202.4	0.0	818.3	0.0	0.0	0.0	0.0	0.0
32	2.0	4314.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	7.6	14110.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	7.3	9674.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	7.1	5166.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

36 4.4 930.8 0.0 0.0 0.0 0.0 0.0 0.0 0.0

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.63	462.00
2	42.23	459.20
3	51.93	456.76
4	61.72	454.71
5	71.58	453.03
6	81.49	451.73
7	91.45	450.82
8	101.43	450.28
9	111.43	450.14
10	121.43	450.37
11	131.41	451.00
12	141.36	452.00
13	151.26	453.39
14	161.11	455.16
15	170.87	457.31
16	180.55	459.83
17	190.12	462.72
18	199.58	465.97
19	208.90	469.59
20	218.08	473.56
21	227.09	477.89
22	235.94	482.56
23	244.60	487.56
24	253.05	492.90
25	261.30	498.55
26	269.32	504.52
27	277.11	510.79
28	284.65	517.36
29	291.93	524.22
30	298.95	531.34
31	301.48	534.13

Circle Center At X = 110.3 ; Y = 710.0 and Radius, 259.8

*** 1.508 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.16	462.00
2	47.77	459.24
3	57.48	456.86
4	67.28	454.85
5	77.15	453.23
6	87.07	451.99
7	97.03	451.14
8	107.02	450.68
9	117.02	450.60
10	127.02	450.91
11	136.99	451.61
12	146.93	452.70
13	156.82	454.17
14	166.65	456.03
15	176.40	458.27
16	186.05	460.88
17	195.59	463.86
18	205.02	467.22
19	214.30	470.94
20	223.43	475.01
21	232.40	479.44
22	241.19	484.21
23	249.78	489.32
24	258.17	494.76
25	266.35	500.52
26	274.29	506.59
27	281.99	512.97
28	289.44	519.64
29	296.63	526.60
30	303.53	533.83

31	304.76	535.22

Circle Center At X = 114.0 ; Y = 708.0 and Radius, 257.4

*** 1.509 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	49.21	462.00
2	58.77	459.08
3	68.45	456.56
4	78.23	454.46
5	88.09	452.77
6	98.01	451.51
7	107.97	450.66
8	117.96	450.23
9	127.96	450.23
10	137.95	450.65
11	147.92	451.49
12	157.84	452.76
13	167.69	454.44
14	177.47	456.54
15	187.15	459.05
16	196.72	461.97
17	206.15	465.29
18	215.43	469.00
19	224.55	473.11
20	233.49	477.59
21	242.23	482.46
22	250.75	487.68
23	259.05	493.26
24	267.10	499.19
25	274.90	505.46
26	282.42	512.05
27	289.66	518.95
28	296.60	526.15
29	303.22	533.63
30	304.42	535.11

Circle Center At X = 123.0 ; Y = 686.4 and Radius, 236.2

*** 1.509 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	43.68	462.00
2	53.29	459.21
3	63.00	456.81
4	72.79	454.80
5	82.66	453.18
6	92.59	451.97
7	102.55	451.15
8	112.54	450.73
9	122.54	450.72
10	132.54	451.10
11	142.50	451.89
12	152.43	453.08
13	162.31	454.66
14	172.11	456.64
15	181.82	459.02
16	191.44	461.78
17	200.93	464.92
18	210.29	468.44
19	219.50	472.34
20	228.54	476.60
21	237.41	481.23
22	246.09	486.20
23	254.55	491.52
24	262.80	497.18
25	270.81	503.16
26	278.58	509.46
27	286.09	516.06
28	293.33	522.96
29	300.28	530.15

30	304.83	535.24

Circle Center At X = 117.9 ; Y = 699.5 and Radius, 248.8

*** 1.510 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	43.68	462.00
2	53.29	459.22
3	63.00	456.83
4	72.80	454.82
5	82.67	453.21
6	92.59	451.99
7	102.56	451.17
8	112.55	450.74
9	122.55	450.72
10	132.54	451.09
11	142.51	451.85
12	152.44	453.02
13	162.32	454.58
14	172.13	456.53
15	181.85	458.87
16	191.47	461.60
17	200.98	464.70
18	210.35	468.19
19	219.58	472.04
20	228.65	476.26
21	237.54	480.83
22	246.24	485.76
23	254.74	491.03
24	263.02	496.63
25	271.08	502.56
26	278.89	508.80
27	286.44	515.35
28	293.73	522.20
29	300.74	529.33
30	306.67	535.86

Circle Center At X = 118.2 ; Y = 701.7 and Radius, 251.0

*** 1.510 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.63	462.00
2	42.26	459.31
3	51.99	456.99
4	61.80	455.03
5	71.67	453.44
6	81.60	452.23
7	91.56	451.38
8	101.55	450.92
9	111.55	450.83
10	121.54	451.11
11	131.52	451.77
12	141.47	452.81
13	151.37	454.22
14	161.21	456.00
15	170.98	458.14
16	180.66	460.66
17	190.23	463.53
18	199.70	466.77
19	209.03	470.36
20	218.22	474.29
21	227.26	478.57
22	236.13	483.18
23	244.82	488.13
24	253.32	493.40
25	261.62	498.98
26	269.70	504.87
27	277.55	511.06
28	285.17	517.55
29	292.53	524.31

30	299.64	531.35
31	302.59	534.50

Circle Center At X = 109.0 ; Y = 716.8 and Radius, 266.0

*** 1.514 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.63	462.00
2	42.27	459.34
3	52.00	457.03
4	61.81	455.09
5	71.69	453.52
6	81.61	452.32
7	91.58	451.48
8	101.57	451.02
9	111.57	450.92
10	121.56	451.20
11	131.54	451.86
12	141.49	452.88
13	151.39	454.27
14	161.24	456.03
15	171.01	458.15
16	180.70	460.64
17	190.28	463.48
18	199.76	466.68
19	209.11	470.23
20	218.32	474.12
21	227.38	478.36
22	236.27	482.93
23	244.99	487.82
24	253.52	493.04
25	261.86	498.57
26	269.98	504.40
27	277.87	510.54
28	285.54	516.96
29	292.96	523.67
30	300.12	530.64
31	304.36	535.09

Circle Center At X = 109.0 ; Y = 719.8 and Radius, 268.8

*** 1.515 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.74	462.00
2	64.30	459.08
3	73.98	456.57
4	83.76	454.46
5	93.61	452.77
6	103.53	451.49
7	113.49	450.63
8	123.48	450.19
9	133.48	450.16
10	143.47	450.56
11	153.44	451.38
12	163.36	452.61
13	173.23	454.27
14	183.01	456.33
15	192.70	458.80
16	202.28	461.68
17	211.73	464.95
18	221.03	468.63
19	230.17	472.68
20	239.13	477.12
21	247.90	481.93
22	256.45	487.11
23	264.79	492.63
24	272.88	498.51
25	280.72	504.72
26	288.29	511.25
27	295.58	518.09

28	302.58	525.24
29	309.27	532.67
30	313.68	538.00

Circle Center At X = 129.0 ; Y = 688.1 and Radius, 238.0

*** 1.517 ***

Failure Surface Specified By 33 Coordinate Points

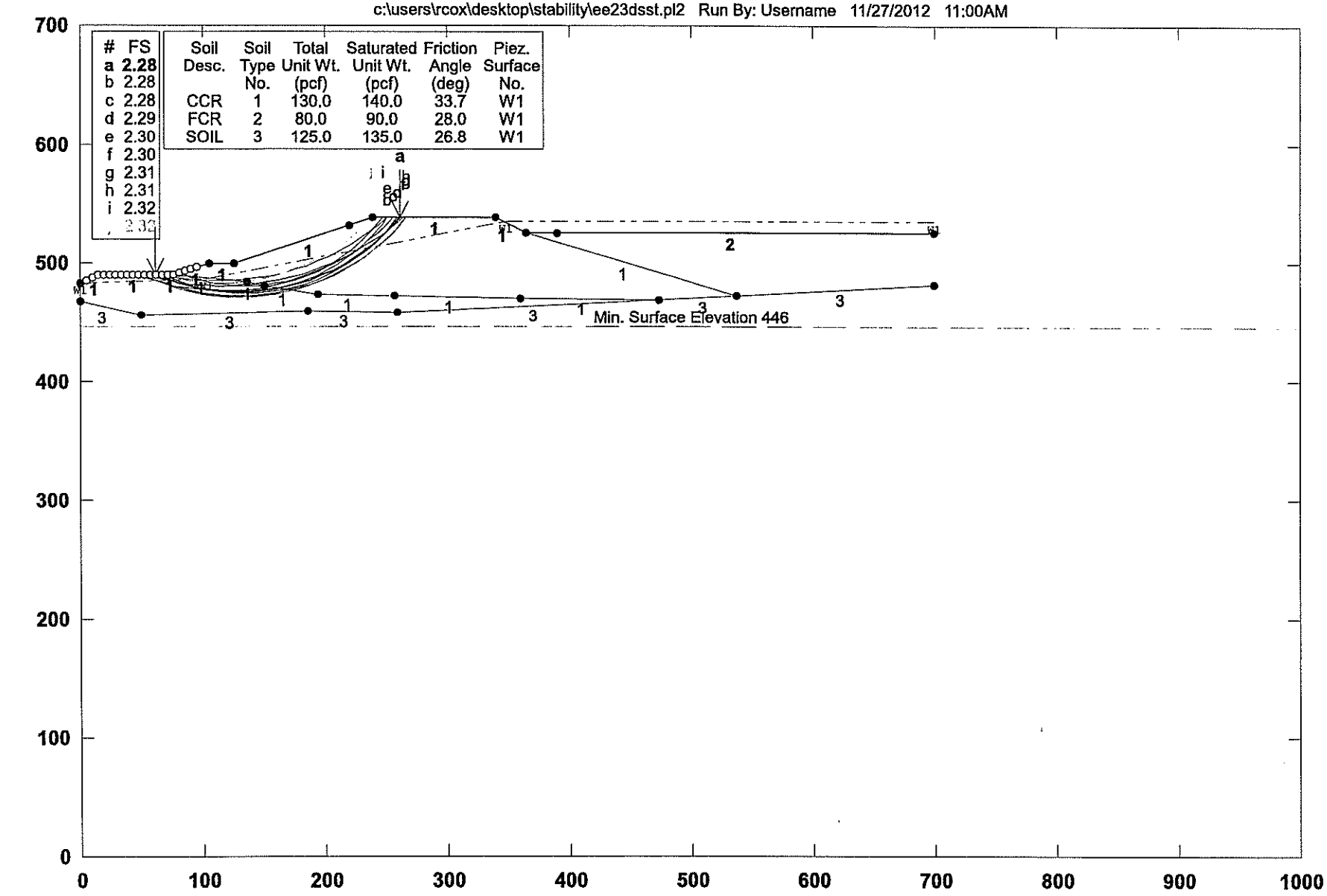
Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.11	462.00
2	36.75	459.37
3	46.49	457.09
4	56.30	455.14
5	66.17	453.53
6	76.09	452.27
7	86.05	451.36
8	96.03	450.80
9	106.03	450.58
10	116.03	450.72
11	126.02	451.20
12	135.98	452.03
13	145.91	453.20
14	155.80	454.73
15	165.62	456.59
16	175.37	458.80
17	185.04	461.35
18	194.62	464.23
19	204.09	467.45
20	213.44	470.99
21	222.66	474.86
22	231.74	479.04
23	240.67	483.54
24	249.44	488.35
25	258.03	493.46
26	266.45	498.87
27	274.66	504.57
28	282.68	510.56
29	290.48	516.81
30	298.05	523.34
31	305.40	530.13
32	312.50	537.16
33	313.29	538.00

Circle Center At X = 107.2 ; Y = 737.2 and Radius, 286.7

*** 1.517 ***

Section E-E Phase 2-3 Connector Downstream Static Deep Circle

c:\users\rcox\desktop\stability\ee23dsst.pl2 Run By: Username 11/27/2012 11:00AM



PCSTABL5M/si FSmin=2.28

Safety Factors Are Calculated By The Modified Bishop Method

STED



```
                    ** PCSTABL5M **
                          by
                    Purdue University
               --Slope Stability Analysis--
            Simplified Janbu, Simplified Bishop
               or Spencer`s Method of Slices
Run Date:                   11/27/2012
Time of Run:                11:00AM
Run By:                     Username
Input Data Filename:        C:ee23dsst.
Output Filename:            C:ee23dsst.OUT
Unit:                       ENGLISH
Plotted Output Filename:    C:ee23dsst.PLT
PROBLEM DESCRIPTION   Section E-E Phase 2-3 Connector
                      Downstream Static Deep Circle
BOUNDARY COORDINATES
    9 Top   Boundaries
   22 Total Boundaries
Boundary     X-Left      Y-Left     X-Right     Y-Right     Soil Type
   No.        (ft)        (ft)       (ft)        (ft)      Below Bnd
    1          0.00      482.36      13.84      490.00         1
    2         13.84      490.00      70.86      490.00         1
    3         70.86      490.00      74.43      489.67         1
    4         74.43      489.67     105.43      500.00         1
    5        105.43      500.00     125.43      500.00         1
    6        125.43      500.00     239.43      538.00         1
    7        239.43      538.00     339.43      538.00         1
    8        339.43      538.00     364.33      525.10         1
    9        364.33      525.10     700.00      525.10         2
   10        364.33      525.10     537.27      472.05         1
   11         74.43      489.67     135.53      484.00         1
   12        135.53      484.00     150.49      480.00         1
   13        150.49      480.00     193.71      474.00         1
   14        193.71      474.00     256.92      472.00         1
   15        256.92      472.00     359.52      470.00         1
   16        359.52      470.00     473.30      468.47         1
   17          0.00      468.10      49.87      456.25         3
   18         49.87      456.25     185.57      459.07         3
   19        185.57      459.07     259.26      458.50         3
   20        259.26      458.50     473.20      468.47         3
   21        473.30      468.47     537.27      472.05         3
   22        537.27      472.05     700.00      481.17         3
ISOTROPIC SOIL PARAMETERS
  3 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)   Param.    (psf)    No.
  1   130.0    140.0       0.0      33.7    0.00      0.0      1
  2    80.0     90.0       0.0      28.0    0.00      0.0      1
  3   125.0    135.0       0.0      26.8    0.00      0.0      1
1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water =  62.40
Piezometric Surface No.  1 Specified by  4 Coordinate Points
  Point      X-Water     Y-Water
   No.         (ft)        (ft)
    1          0.00      482.36
    2        103.19      487.00
    3        348.43      535.00
    4        700.00      535.00
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
 20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between  X =   5.00 ft.
                              and  X =  95.00 ft.
Each Surface Terminates Between   X = 220.00 ft.
                              and   X = 390.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =446.00 ft.
```

10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	61.84	490.00
2	71.09	486.20
3	80.55	482.95
4	90.19	480.28
5	99.96	478.18
6	109.85	476.66
7	119.80	475.74
8	129.80	475.41
9	139.80	475.67
10	149.76	476.53
11	159.65	477.98
12	169.44	480.01
13	179.10	482.62
14	188.58	485.81
15	197.85	489.55
16	206.89	493.83
17	215.65	498.64
18	224.12	503.97
19	232.25	509.79
20	240.02	516.08
21	247.40	522.83
22	254.37	530.00
23	260.91	537.57
24	261.24	538.00

Circle Center At X = 130.4 ; Y = 643.5 and Radius, 168.1
*** 2.278 ***
Individual data on the 35 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.0	2172.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	112.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.7	857.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.7	969.8	0.0	36.2	0.0	0.0	0.0	0.0	0.0
5	6.1	5432.8	0.0	742.5	0.0	0.0	0.0	0.0	0.0
6	9.6	15095.6	0.0	2857.1	0.0	0.0	0.0	0.0	0.0
7	9.8	22740.4	0.0	4617.9	0.0	0.0	0.0	0.0	0.0
8	3.2	9009.8	0.0	1831.0	0.0	0.0	0.0	0.0	0.0
9	0.0	11.2	0.0	2.2	0.0	0.0	0.0	0.0	0.0
10	2.2	6642.2	0.0	1345.2	0.0	0.0	0.0	0.0	0.0
11	4.4	13679.3	0.0	2975.3	0.0	0.0	0.0	0.0	0.0
12	10.0	32084.6	0.0	8009.4	0.0	0.0	0.0	0.0	0.0
13	5.6	18646.6	0.0	5224.9	0.0	0.0	0.0	0.0	0.0
14	4.4	15040.4	0.0	4364.7	0.0	0.0	0.0	0.0	0.0
15	5.7	21033.2	0.0	6069.2	0.0	0.0	0.0	0.0	0.0
16	4.3	16543.3	0.0	4739.1	0.0	0.0	0.0	0.0	0.0
17	10.0	41169.6	0.0	11661.3	0.0	0.0	0.0	0.0	0.0
18	0.7	3148.0	0.0	887.0	0.0	0.0	0.0	0.0	0.0
19	9.2	40588.9	0.0	11258.3	0.0	0.0	0.0	0.0	0.0
20	2.2	9870.1	0.0	2716.0	0.0	0.0	0.0	0.0	0.0
21	7.6	35386.6	0.0	9542.9	0.0	0.0	0.0	0.0	0.0
22	9.7	45729.3	0.0	12001.4	0.0	0.0	0.0	0.0	0.0
23	9.5	45177.2	0.0	11373.9	0.0	0.0	0.0	0.0	0.0
24	9.3	43644.7	0.0	10378.6	0.0	0.0	0.0	0.0	0.0
25	9.0	41196.9	0.0	9018.9	0.0	0.0	0.0	0.0	0.0
26	8.8	37918.8	0.0	7299.8	0.0	0.0	0.0	0.0	0.0
27	8.5	33914.0	0.0	5227.2	0.0	0.0	0.0	0.0	0.0
28	8.1	29302.6	0.0	2808.6	0.0	0.0	0.0	0.0	0.0
29	4.0	13056.3	0.0	392.0	0.0	0.0	0.0	0.0	0.0
30	3.2	9497.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.6	1701.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

32	7.4	17802.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	7.0	10500.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	6.5	3581.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.3	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.58	490.00
2	75.75	486.01
3	85.17	482.65
4	94.79	479.92
5	104.57	477.85
6	114.47	476.44
7	124.44	475.71
8	134.44	475.64
9	144.43	476.25
10	154.34	477.52
11	164.15	479.46
12	173.81	482.06
13	183.27	485.30
14	192.49	489.17
15	201.43	493.65
16	210.05	498.72
17	218.31	504.36
18	226.17	510.54
19	233.60	517.24
20	240.56	524.42
21	247.02	532.05
22	251.40	538.00

Circle Center At X = 130.4 ; Y = 624.0 and Radius, 148.5

*** 2.280 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	47.63	490.00
2	57.00	486.50
3	66.54	483.51
4	76.23	481.03
5	86.04	479.08
6	95.94	477.66
7	105.90	476.77
8	115.89	476.42
9	125.89	476.60
10	135.86	477.33
11	145.78	478.59
12	155.62	480.38
13	165.35	482.69
14	174.94	485.53
15	184.36	488.88
16	193.59	492.73
17	202.60	497.07
18	211.36	501.89
19	219.85	507.17
20	228.05	512.90
21	235.92	519.06
22	243.46	525.64
23	250.62	532.61
24	255.60	538.00

Circle Center At X = 117.4 ; Y = 662.2 and Radius, 185.8

*** 2.284 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.58	490.00
2	75.69	485.89
3	85.06	482.37
4	94.63	479.47
5	104.36	477.20
6	114.23	475.56
7	124.18	474.57

8	134.17	474.23
9	144.17	474.53
10	154.12	475.48
11	164.00	477.08
12	173.74	479.31
13	183.33	482.17
14	192.70	485.65
15	201.83	489.73
16	210.68	494.39
17	219.20	499.62
18	227.37	505.39
19	235.15	511.67
20	242.50	518.45
21	249.40	525.69
22	255.81	533.36
23	259.20	538.00

Circle Center At X = 134.5 ; Y = 628.3 and Radius, 154.0

*** 2.293 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.58	490.00
2	76.37	487.97
3	86.25	486.42
4	96.19	485.36
5	106.18	484.78
6	116.18	484.69
7	126.17	485.10
8	136.13	485.99
9	146.03	487.36
10	155.86	489.22
11	165.58	491.55
12	175.18	494.36
13	184.63	497.64
14	193.91	501.37
15	202.99	505.55
16	211.86	510.17
17	220.49	515.22
18	228.87	520.68
19	236.97	526.55
20	244.77	532.80
21	250.64	538.00

Circle Center At X = 113.0 ; Y = 689.2 and Radius, 204.5

*** 2.295 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	52.37	490.00
2	62.02	487.37
3	71.77	485.17
4	81.62	483.42
5	91.53	482.11
6	101.49	481.25
7	111.49	480.84
8	121.49	480.88
9	131.47	481.37
10	141.43	482.31
11	151.33	483.70
12	161.16	485.53
13	170.90	487.80
14	180.53	490.51
15	190.02	493.65
16	199.37	497.21
17	208.54	501.19
18	217.52	505.58
19	226.30	510.37
20	234.86	515.56
21	243.17	521.12
22	251.22	527.05
23	259.00	533.33

24	264.26	538.00

Circle Center At X = 115.6 ; Y = 702.6 and Radius, 221.8

*** 2.302 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	52.37	490.00
2	61.47	485.85
3	70.79	482.23
4	80.30	479.15
5	89.97	476.61
6	99.78	474.62
7	109.67	473.20
8	119.64	472.34
9	129.63	472.05
10	139.63	472.33
11	149.59	473.18
12	159.49	474.59
13	169.30	476.56
14	178.97	479.09
15	188.49	482.16
16	197.81	485.77
17	206.92	489.91
18	215.77	494.56
19	224.35	499.70
20	232.62	505.32
21	240.55	511.41
22	248.13	517.93
23	255.33	524.88
24	262.11	532.22
25	266.87	538.00

Circle Center At X = 129.7 ; Y = 647.8 and Radius, 175.7

*** 2.308 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	52.37	490.00
2	61.40	485.71
3	70.67	481.94
4	80.14	478.73
5	89.78	476.07
6	99.56	473.99
7	109.44	472.47
8	119.40	471.53
9	129.39	471.18
10	139.39	471.41
11	149.35	472.22
12	159.26	473.61
13	169.06	475.58
14	178.73	478.12
15	188.24	481.21
16	197.56	484.86
17	206.64	489.04
18	215.46	493.74
19	224.00	498.95
20	232.22	504.65
21	240.09	510.82
22	247.58	517.44
23	254.68	524.48
24	261.36	531.93
25	266.19	538.00

Circle Center At X = 130.5 ; Y = 642.6 and Radius, 171.4

*** 2.313 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.79	491.79
2	90.09	488.11
3	99.63	485.13
4	109.37	482.85

5	119.25	481.29
6	129.21	480.46
7	139.21	480.36
8	149.19	480.99
9	159.10	482.35
10	168.88	484.44
11	178.48	487.23
12	187.85	490.72
13	196.94	494.89
14	205.70	499.71
15	214.09	505.16
16	222.05	511.21
17	229.55	517.83
18	236.54	524.97
19	242.99	532.61
20	246.90	538.00

Circle Center At X = 135.6 ; Y = 616.6 and Radius, 136.3

*** 2.318 ***

Failure Surface Specified By 20 Coordinate Points

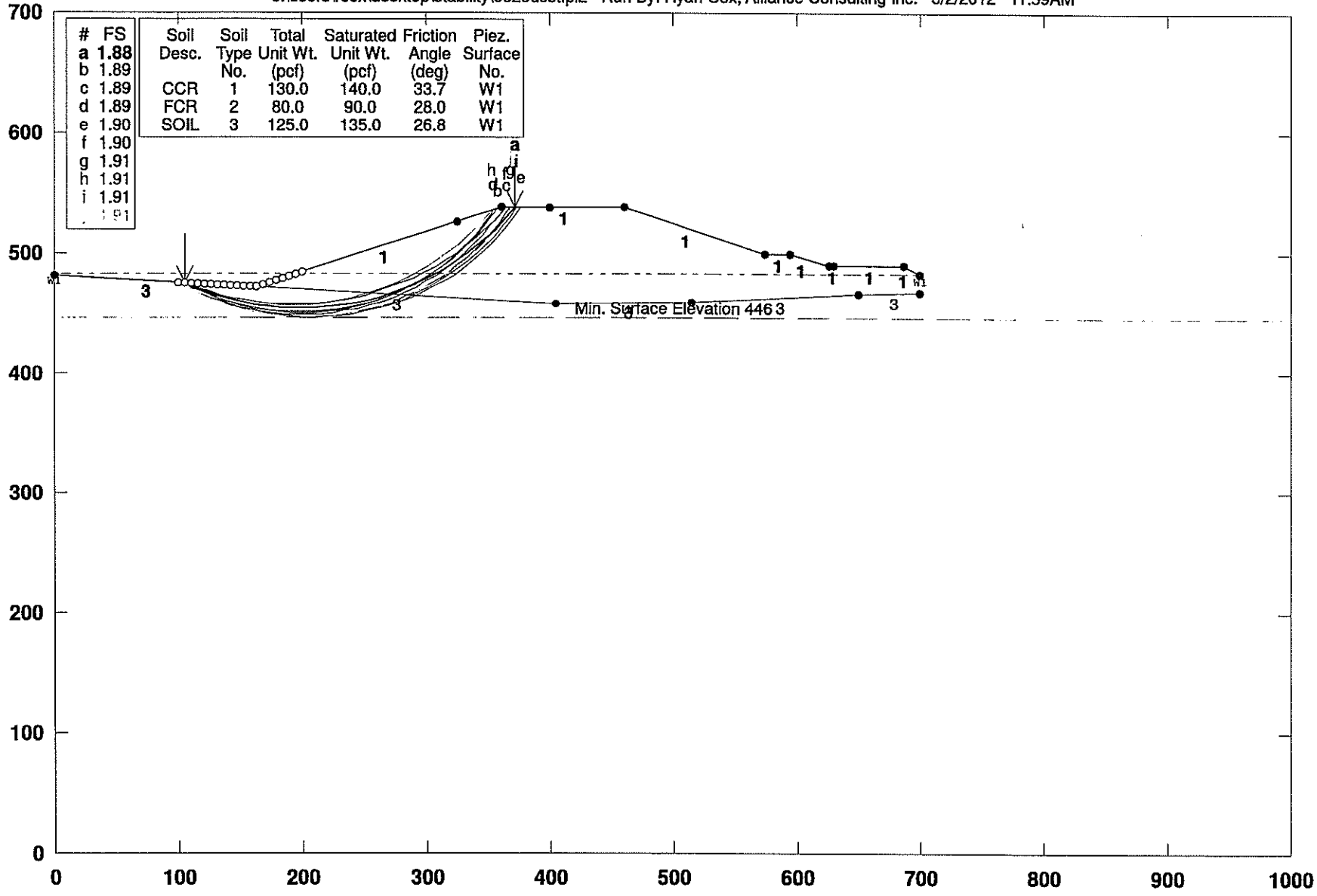
Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.58	490.00
2	76.25	487.45
3	86.05	485.48
4	95.96	484.09
5	105.92	483.30
6	115.92	483.09
7	125.91	483.48
8	135.87	484.46
9	145.74	486.03
10	155.51	488.19
11	165.13	490.91
12	174.57	494.21
13	183.80	498.06
14	192.78	502.45
15	201.49	507.36
16	209.90	512.78
17	217.96	518.70
18	225.66	525.08
19	232.97	531.90
20	238.47	537.68

Circle Center At X = 114.4 ; Y = 651.4 and Radius, 168.4

*** 2.320 ***

Section E-E Phase 2-3 Connector Upstream Static

c:\users\rcox\desktop\stability\ee23usst.pl2 Run By: Ryan Cox, Alliance Consulting Inc. 3/2/2012 11:59AM



PCSTABL5M/si FSmin=1.88

Safety Factors Are Calculated By The Modified Bishop Method

STED



```
                    ** PCSTABL5M **
                           by
                    Purdue University
                --Slope Stability Analysis--
            Simplified Janbu, Simplified Bishop
               or Spencer's Method of Slices
 Run Date:                  3/2/2012
 Time of Run:               11:59AM
 Run By:                    Ryan Cox, Alliance Consulting Inc.
 Input Data Filename:       C:ee23usst.in
 Output Filename:           C:ee23usst.OUT
 Unit:                      ENGLISH
 Plotted Output Filename:   C:ee23usst.PLT
 PROBLEM DESCRIPTION   Section E-E Phase 2-3 Connector
                       Upstream Static
 BOUNDARY COORDINATES
    9 Top   Boundaries
   14 Total Boundaries
 Boundary     X-Left      Y-Left     X-Right     Y-Right     Soil Type
    No.        (ft)        (ft)        (ft)        (ft)     Below Bnd
     1          0.00      481.20      162.70      472.05         3
     2        162.70      472.05      360.60      538.00         1
     3        360.60      538.00      460.60      538.00         1
     4        460.60      538.00      574.60      500.00         1
     5        574.60      500.00      594.60      500.00         1
     6        594.60      500.00      625.60      489.70         1
     7        625.60      489.70      629.10      490.00         1
     8        629.10      490.00      686.20      490.00         1
     9        686.20      490.00      700.00      482.40         1
    10          0.00      481.20      162.70      472.05         3
    11        162.70      472.05      404.70      458.50         3
    12        404.70      458.50      514.40      459.10         3
    13        514.40      459.10      650.10      466.20         3
    14        650.10      466.20      700.00      468.10         3
 ISOTROPIC SOIL PARAMETERS
   3 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)  Param.    (psf)     No.
   1   130.0    140.0       0.0      33.7   0.00       0.0      1
   2    80.0     90.0       0.0      28.0   0.00       0.0      1
   3   125.0    135.0       0.0      26.8   0.00       0.0      1
 1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
 Unit Weight of Water =  62.40
 Piezometric Surface No.  1 Specified by  2 Coordinate Points
   Point      X-Water     Y-Water
    No.         (ft)        (ft)
     1          0.00      482.50
     2        700.00      482.50
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 400 Trial Surfaces Have Been Generated.
  20 Surfaces Initiate From Each Of 20 Points Equally Spaced
 Along The Ground Surface Between  X = 100.00 ft.
                                   and  X = 200.00 ft.
 Each Surface Terminates Between   X = 325.00 ft.
                                   and  X = 400.00 ft.
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =446.00 ft.
 10.00 ft. Line Segments Define Each Trial Failure Surface.
 ****  ERROR - RC11  ****
>>200 attempts to generate failure surface have failed. Revise limitations
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Examined.  They Are Ordered - Most Critical
       First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Failure Surface Specified By 31 Coordinate Points
         Point      X-Surf      Y-Surf
          No.         (ft)        (ft)
           1        105.26      475.28
```

2	114.40	471.21
3	123.71	467.56
4	133.17	464.34
5	142.78	461.55
6	152.50	459.21
7	162.32	457.30
8	172.21	455.85
9	182.16	454.85
10	192.15	454.31
11	202.15	454.22
12	212.14	454.58
13	222.11	455.40
14	232.02	456.68
15	241.87	458.40
16	251.64	460.57
17	261.29	463.19
18	270.81	466.24
19	280.19	469.72
20	289.39	473.62
21	298.41	477.94
22	307.22	482.67
23	315.81	487.79
24	324.16	493.30
25	332.24	499.19
26	340.05	505.43
27	347.57	512.03
28	354.78	518.96
29	361.66	526.21
30	368.21	533.77
31	371.55	538.00

Circle Center At X = 199.1 ; Y = 673.6 and Radius, 219.4

*** 1.883 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.1	2192.7	4268.3	5775.0	0.0	0.0	0.0	0.0	0.0
2	9.3	6434.4	4652.3	8183.6	0.0	0.0	0.0	0.0	0.0
3	9.5	10258.7	5043.0	10327.4	0.0	0.0	0.0	0.0	0.0
4	9.6	13607.1	5437.8	12202.2	0.0	0.0	0.0	0.0	0.0
5	9.7	16428.3	5834.1	13803.9	0.0	0.0	0.0	0.0	0.0
6	9.8	18678.8	6229.4	15129.3	0.0	0.0	0.0	0.0	0.0
7	0.4	764.3	249.8	609.2	0.0	0.0	0.0	0.0	0.0
8	9.5	22025.4	5545.9	15566.4	0.0	0.0	0.0	0.0	0.0
9	9.9	29194.7	3679.6	16940.6	0.0	0.0	0.0	0.0	0.0
10	10.0	35010.9	1511.1	17422.7	0.0	0.0	0.0	0.0	0.0
11	10.0	40077.4	0.0	17621.0	0.0	0.0	0.0	0.0	0.0
12	10.0	44222.1	0.0	17535.0	0.0	0.0	0.0	0.0	0.0
13	10.0	47641.3	0.0	17164.9	0.0	0.0	0.0	0.0	0.0
14	9.9	50310.8	0.0	16511.5	0.0	0.0	0.0	0.0	0.0
15	9.9	52216.2	0.0	15576.2	0.0	0.0	0.0	0.0	0.0
16	9.8	53352.4	0.0	14360.8	0.0	0.0	0.0	0.0	0.0
17	9.7	53724.2	0.0	12867.9	0.0	0.0	0.0	0.0	0.0
18	8.9	49782.2	0.0	10418.6	0.0	0.0	0.0	0.0	0.0
19	0.6	3563.0	0.0	682.0	0.0	0.0	0.0	0.0	0.0
20	9.4	52135.4	0.0	9062.5	0.0	0.0	0.0	0.0	0.0
21	9.2	50144.5	0.0	6758.0	0.0	0.0	0.0	0.0	0.0
22	9.0	47491.1	0.0	4191.8	0.0	0.0	0.0	0.0	0.0
23	8.5	42688.0	0.0	1371.0	0.0	0.0	0.0	0.0	0.0
24	0.3	1540.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	8.6	40651.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	8.3	36798.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	8.1	32543.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	7.8	27962.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	7.5	23136.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	7.2	18149.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	5.8	11359.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	1.1	1706.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	6.5	6819.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

34 3.3 919.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.26	475.28
2	114.09	470.58
3	123.15	466.36
4	132.43	462.62
5	141.89	459.37
6	151.51	456.63
7	161.25	454.41
8	171.11	452.70
9	181.04	451.51
10	191.02	450.85
11	201.01	450.72
12	211.01	451.12
13	220.96	452.05
14	230.86	453.50
15	240.66	455.47
16	250.35	457.96
17	259.89	460.96
18	269.26	464.46
19	278.43	468.45
20	287.37	472.91
21	296.07	477.85
22	304.50	483.23
23	312.62	489.06
24	320.43	495.31
25	327.90	501.96
26	335.01	508.99
27	341.73	516.40
28	348.05	524.14
29	353.96	532.21
30	356.94	536.78

Circle Center At X = 198.5 ; Y = 639.6 and Radius, 188.9

*** 1.886 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.26	475.28
2	114.57	471.61
3	124.02	468.36
4	133.61	465.52
5	143.32	463.12
6	153.12	461.15
7	163.01	459.62
8	172.95	458.53
9	182.92	457.88
10	192.92	457.67
11	202.92	457.91
12	212.90	458.59
13	222.83	459.71
14	232.71	461.27
15	242.51	463.27
16	252.21	465.71
17	261.79	468.57
18	271.24	471.85
19	280.53	475.55
20	289.64	479.65
21	298.57	484.16
22	307.29	489.06
23	315.78	494.34
24	324.03	500.00
25	332.02	506.01
26	339.73	512.37
27	347.16	519.07
28	354.28	526.09
29	361.08	533.42
30	364.97	538.00

Circle Center At X = 192.6 ; Y = 682.8 and Radius, 225.1

*** 1.887 ***
Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.26	475.28
2	114.00	470.41
3	122.98	466.02
4	132.19	462.12
5	141.60	458.74
6	151.18	455.87
7	160.90	453.53
8	170.74	451.73
9	180.66	450.46
10	190.63	449.73
11	200.63	449.56
12	210.62	449.92
13	220.58	450.83
14	230.48	452.28
15	240.28	454.27
16	249.95	456.79
17	259.48	459.84
18	268.82	463.40
19	277.96	467.46
20	286.86	472.02
21	295.50	477.05
22	303.86	482.55
23	311.90	488.50
24	319.60	494.87
25	326.95	501.66
26	333.91	508.83
27	340.47	516.38
28	346.61	524.27
29	352.32	532.49
30	354.45	535.95

Circle Center At X = 198.9 ; Y = 632.7 and Radius, 183.2

*** 1.893 ***
Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.26	475.28
2	113.95	470.33
3	122.88	465.82
4	132.02	461.76
5	141.35	458.16
6	150.85	455.04
7	160.49	452.39
8	170.25	450.22
9	180.11	448.55
10	190.04	447.38
11	200.02	446.70
12	210.02	446.52
13	220.01	446.83
14	229.98	447.65
15	239.89	448.97
16	249.73	450.78
17	259.46	453.08
18	269.06	455.86
19	278.52	459.12
20	287.80	462.85
21	296.88	467.03
22	305.74	471.67
23	314.36	476.74
24	322.71	482.23
25	330.78	488.14
26	338.55	494.44
27	345.98	501.13
28	353.08	508.17
29	359.82	515.56
30	366.17	523.28
31	372.14	531.31

32	376.61	538.00

Circle Center At X = 208.6 ; Y = 646.5 and Radius, 200.0

*** 1.898 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	475.58
2	108.73	470.70
3	117.70	466.28
4	126.89	462.33
5	136.26	458.85
6	145.81	455.86
7	155.49	453.37
8	165.29	451.37
9	175.18	449.89
10	185.13	448.91
11	195.12	448.44
12	205.12	448.49
13	215.10	449.05
14	225.05	450.13
15	234.92	451.71
16	244.70	453.80
17	254.36	456.39
18	263.87	459.47
19	273.21	463.04
20	282.36	467.08
21	291.29	471.59
22	299.97	476.55
23	308.39	481.95
24	316.52	487.77
25	324.34	494.00
26	331.82	500.63
27	338.96	507.63
28	345.73	515.00
29	352.11	522.70
30	358.09	530.71
31	362.96	538.00

Circle Center At X = 199.2 ; Y = 643.0 and Radius, 194.6

*** 1.902 ***

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	475.58
2	108.64	470.53
3	117.52	465.94
4	126.62	461.81
5	135.93	458.15
6	145.41	454.97
7	155.05	452.29
8	164.80	450.10
9	174.66	448.41
10	184.59	447.23
11	194.57	446.57
12	204.57	446.41
13	214.56	446.77
14	224.52	447.65
15	234.43	449.03
16	244.25	450.92
17	253.96	453.30
18	263.53	456.19
19	272.95	459.56
20	282.18	463.41
21	291.20	467.73
22	299.98	472.50
23	308.51	477.72
24	316.76	483.37
25	324.71	489.44
26	332.34	495.91
27	339.63	502.75
28	346.55	509.97

29	353.10	517.53
30	359.25	525.41
31	364.99	533.60
32	367.74	538.00

Circle Center At X = 202.5 ; Y = 641.2 and Radius, 194.8

*** 1.906 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	475.58
2	109.19	471.63
3	118.55	468.12
4	128.07	465.06
5	137.73	462.46
6	147.50	460.31
7	157.35	458.63
8	167.28	457.41
9	177.25	456.66
10	187.25	456.39
11	197.25	456.59
12	207.22	457.26
13	217.16	458.40
14	227.03	460.01
15	236.81	462.09
16	246.48	464.62
17	256.03	467.61
18	265.42	471.05
19	274.63	474.93
20	283.66	479.23
21	292.47	483.96
22	301.05	489.11
23	309.37	494.65
24	317.43	500.57
25	325.19	506.87
26	332.65	513.54
27	339.78	520.54
28	346.58	527.88
29	352.96	535.45

Circle Center At X = 188.0 ; Y = 667.9 and Radius, 211.6

*** 1.906 ***

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	475.58
2	108.68	470.60
3	117.59	466.07
4	126.71	461.98
5	136.03	458.35
6	145.52	455.18
7	155.15	452.50
8	164.90	450.29
9	174.76	448.57
10	184.68	447.35
11	194.65	446.62
12	204.65	446.38
13	214.65	446.64
14	224.62	447.40
15	234.54	448.65
16	244.39	450.40
17	254.13	452.63
18	263.76	455.34
19	273.24	458.53
20	282.55	462.18
21	291.66	466.29
22	300.56	470.85
23	309.22	475.85
24	317.63	481.27
25	325.75	487.10
26	333.57	493.33
27	341.08	499.94

28	348.25	506.91
29	355.06	514.23
30	361.50	521.88
31	367.55	529.84
32	373.13	538.00

Circle Center At X = 204.4 ; Y = 647.6 and Radius, 201.2

*** 1.907 ***

Failure Surface Specified By 32 Coordinate Points

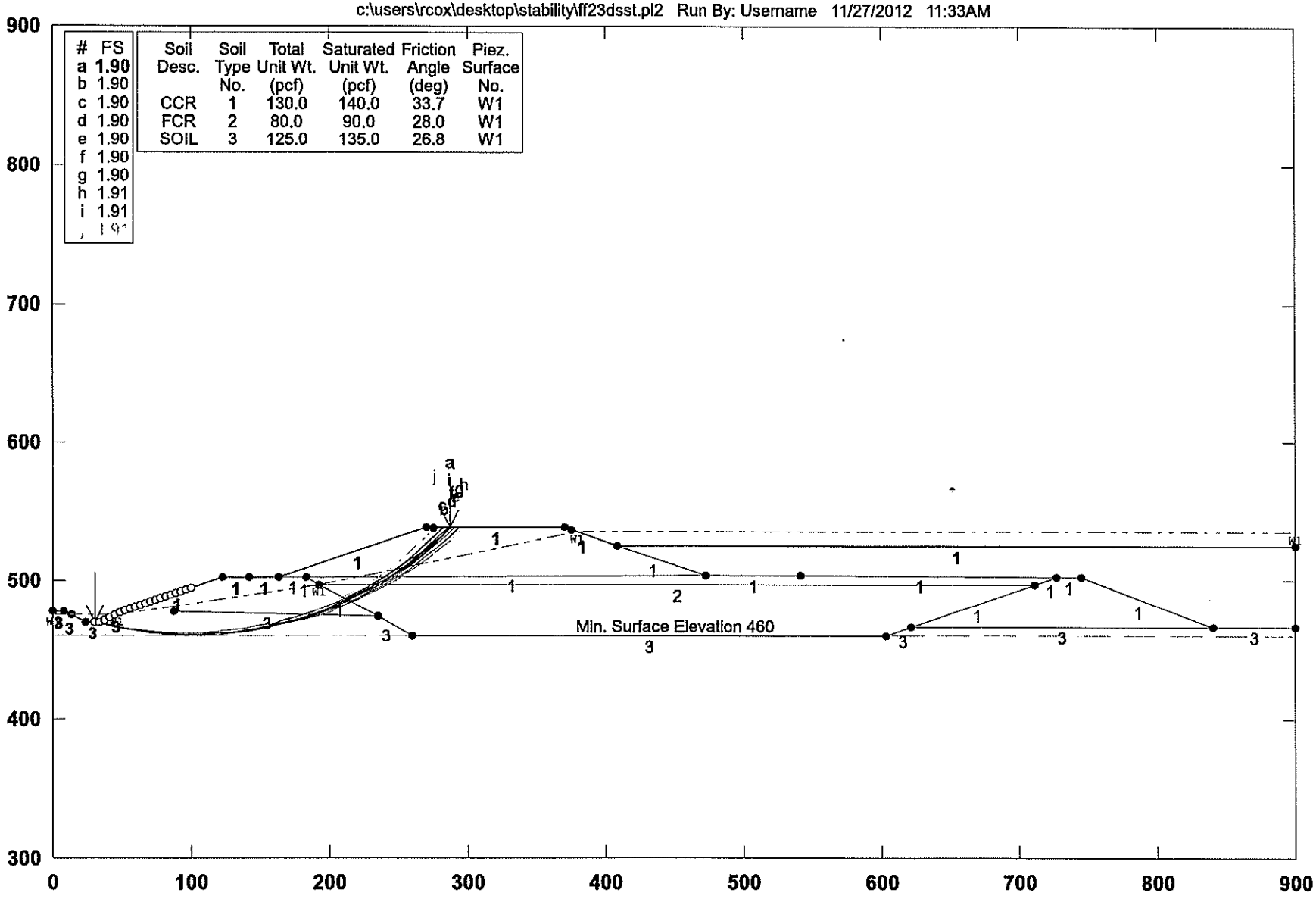
Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	475.58
2	108.62	470.50
3	117.49	465.88
4	126.58	461.72
5	135.87	458.03
6	145.34	454.82
7	154.97	452.10
8	164.72	449.88
9	174.57	448.16
10	184.49	446.94
11	194.47	446.24
12	204.47	446.05
13	214.46	446.38
14	224.43	447.21
15	234.34	448.56
16	244.16	450.41
17	253.88	452.76
18	263.47	455.61
19	272.89	458.95
20	282.14	462.76
21	291.17	467.05
22	299.98	471.79
23	308.53	476.98
24	316.80	482.60
25	324.77	488.63
26	332.43	495.07
27	339.74	501.89
28	346.69	509.08
29	353.27	516.61
30	359.45	524.47
31	365.22	532.64
32	368.61	538.00

Circle Center At X = 203.1 ; Y = 640.9 and Radius, 194.9

*** 1.908 ***

Section F-F Phase 2-3 Connector Downstream Static Deep Circle

c:\users\rcox\desktop\stability\ff23dsst.pl2 Run By: Username 11/27/2012 11:33AM



PCSTABL5M/si FSmin=1.90

Safety Factors Are Calculated By The Modified Bishop Method

STED



** PCSTABL5M **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 11/27/2012
Time of Run: 11:33AM
Run By: Username
Input Data Filename: C:ff23dsst.
Output Filename: C:ff23dsst.OUT
Unit: ENGLISH
Plotted Output Filename: C:ff23dsst.PLT
PROBLEM DESCRIPTION Section F-F Phase 2-3 Connector
Downstream Static Deep Circle

BOUNDARY COORDINATES
Note: User origin value specified.
Add 0.00 to X-values and 300.00 to Y-values listed.

12 Top Boundaries
30 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	178.00	8.12	178.00	3
2	8.12	178.00	13.27	176.00	3
3	13.27	176.00	24.12	170.00	3
4	24.12	170.00	34.12	170.00	3
5	34.12	170.00	50.12	178.00	3
6	50.12	178.00	122.12	202.00	1
7	122.12	202.00	141.24	202.00	1
8	141.24	202.00	162.69	202.21	1
9	162.69	202.21	270.04	238.00	1
10	270.04	238.00	370.04	238.00	1
11	370.04	238.00	408.74	225.10	1
12	408.74	225.10	900.00	225.10	1
13	408.74	225.10	472.04	204.00	1
14	162.69	202.21	182.88	202.42	1
15	182.88	202.42	472.04	204.00	1
16	472.04	204.00	541.06	204.00	1
17	541.06	204.00	726.45	202.18	1
18	726.45	202.18	745.04	202.00	1
19	182.88	202.42	192.74	197.00	1
20	192.74	197.00	711.27	197.00	2
21	711.27	197.00	726.45	202.18	1
22	745.04	202.00	840.50	166.00	1
23	192.74	197.00	234.60	174.00	1
24	87.71	177.67	234.60	174.00	3
25	234.60	174.00	260.08	160.00	3
26	260.08	160.00	602.87	160.00	3
27	602.87	160.00	620.45	166.00	3
28	620.45	166.00	711.27	197.00	1
29	620.45	166.00	840.50	166.00	3
30	840.50	166.00	900.00	166.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	135.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	176.00
2	46.12	176.00
3	192.74	197.00
4	379.04	235.00

5 900.00 235.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 30.00 ft. and X = 100.00 ft.

Each Surface Terminates Between X = 275.00 ft. and X = 375.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =160.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.70	167.56
3	49.48	165.49
4	59.34	163.79
5	69.25	162.46
6	79.20	161.51
7	89.19	160.93
8	99.18	160.73
9	109.18	160.90
10	119.17	161.45
11	129.12	162.38
12	139.04	163.68
13	148.90	165.35
14	158.69	167.39
15	168.39	169.80
16	178.00	172.57
17	187.50	175.71
18	196.87	179.19
19	206.10	183.03
20	215.19	187.21
21	224.11	191.74
22	232.85	196.59
23	241.40	201.77
24	249.76	207.27
25	257.90	213.08
26	265.81	219.19
27	273.49	225.60
28	280.92	232.28
29	286.81	238.00

Circle Center At X = 99.6 ; Y = 426.3 and Radius, 265.6

*** 1.898 ***

Individual data on the 44 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.1	287.8	1542.3	1727.5	0.0	0.0	0.0	0.0	0.0
2	5.6	2358.0	1792.5	2776.9	0.0	0.0	0.0	0.0	0.0
3	6.4	6510.9	719.1	3733.6	0.0	0.0	0.0	0.0	0.0
4	3.4	4965.8	0.0	2206.3	0.0	0.0	0.0	0.0	0.0
5	0.6	1058.6	0.0	443.3	0.0	0.0	0.0	0.0	0.0
6	9.2	19064.8	0.0	7306.0	0.0	0.0	0.0	0.0	0.0
7	9.9	26767.4	0.0	9559.1	0.0	0.0	0.0	0.0	0.0
8	10.0	32897.7	0.0	11143.0	0.0	0.0	0.0	0.0	0.0
9	8.5	32491.9	0.0	10572.8	0.0	0.0	0.0	0.0	0.0
10	1.5	5902.4	0.0	1925.7	0.0	0.0	0.0	0.0	0.0
11	10.0	42756.9	0.0	13623.8	0.0	0.0	0.0	0.0	0.0
12	10.0	47264.8	0.0	14517.3	0.0	0.0	0.0	0.0	0.0
13	10.0	51189.8	0.0	15177.7	0.0	0.0	0.0	0.0	0.0
14	3.0	15832.3	0.0	4595.5	0.0	0.0	0.0	0.0	0.0
15	7.0	37616.5	0.0	11008.6	0.0	0.0	0.0	0.0	0.0

16	9.9	52075.7	0.0	15795.8	0.0	0.0	0.0	0.0	0.0
17	2.2	11330.8	0.0	3530.2	0.0	0.0	0.0	0.0	0.0
18	7.7	38662.4	0.0	12222.5	0.0	0.0	0.0	0.0	0.0
19	9.8	47453.9	0.0	15474.7	0.0	0.0	0.0	0.0	0.0
20	4.0	18659.4	0.0	6246.3	0.0	0.0	0.0	0.0	0.0
21	5.7	26424.9	0.0	8716.0	0.0	0.0	0.0	0.0	0.0
22	9.6	45103.8	0.0	14216.2	0.0	0.0	0.0	0.0	0.0
23	4.9	23047.9	0.0	6937.4	0.0	0.0	0.0	0.0	0.0
24	3.1	14774.0	0.0	4293.6	0.0	0.0	0.0	0.0	0.0
25	1.5	7047.1	0.0	2006.4	0.0	0.0	0.0	0.0	0.0
26	5.2	24664.1	0.0	6890.7	0.0	0.0	0.0	0.0	0.0
27	4.1	19052.7	0.0	5119.0	0.0	0.0	0.0	0.0	0.0
28	9.2	40233.4	0.0	10806.7	0.0	0.0	0.0	0.0	0.0
29	6.6	26361.9	0.0	7001.4	0.0	0.0	0.0	0.0	0.0
30	2.5	9767.9	0.0	2495.1	0.0	0.0	0.0	0.0	0.0
31	5.1	19874.4	0.0	4777.0	0.0	0.0	0.0	0.0	0.0
32	3.8	14690.6	0.0	3180.6	0.0	0.0	0.0	0.0	0.0
33	8.7	33700.7	0.0	6192.1	0.0	0.0	0.0	0.0	0.0
34	0.7	2586.4	0.0	408.0	0.0	0.0	0.0	0.0	0.0
35	7.9	28946.3	0.0	3794.6	0.0	0.0	0.0	0.0	0.0
36	1.5	5168.8	0.0	523.2	0.0	0.0	0.0	0.0	0.0
37	6.9	22596.0	0.0	1468.6	0.0	0.0	0.0	0.0	0.0
38	2.7	8153.9	0.0	136.3	0.0	0.0	0.0	0.0	0.0
39	5.5	15587.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	7.9	19690.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	4.2	8985.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	3.5	6209.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	7.4	8754.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	5.9	2187.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.66	167.42
3	49.42	165.22
4	59.25	163.42
5	69.15	162.00
6	79.10	160.98
7	89.08	160.36
8	99.08	160.13
9	109.08	160.30
10	119.06	160.86
11	129.01	161.82
12	138.92	163.18
13	148.77	164.93
14	158.54	167.06
15	168.21	169.58
16	177.78	172.49
17	187.23	175.77
18	196.54	179.43
19	205.69	183.45
20	214.68	187.83
21	223.49	192.57
22	232.10	197.65
23	240.51	203.06
24	248.69	208.81
25	256.64	214.88
26	264.34	221.26
27	271.78	227.94
28	278.95	234.91
29	281.89	238.00

Circle Center At X = 99.8 ; Y = 412.0 and Radius, 251.9

*** 1.898 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.66	167.40
3	49.41	165.20
4	59.24	163.38

5	69.14	161.95
6	79.09	160.93
7	89.07	160.29
8	99.07	160.06
9	109.07	160.23
10	119.05	160.79
11	129.00	161.75
12	138.91	163.11
13	148.76	164.86
14	158.52	167.00
15	168.20	169.54
16	177.76	172.45
17	187.21	175.74
18	196.51	179.41
19	205.66	183.44
20	214.64	187.84
21	223.44	192.59
22	232.04	197.69
23	240.44	203.12
24	248.61	208.89
25	256.54	214.98
26	264.23	221.38
27	271.65	228.08
28	278.80	235.07
29	281.57	238.00

Circle Center At X = 99.9 ; Y = 410.9 and Radius, 250.8

*** 1.898 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.71	167.60
3	49.50	165.56
4	59.36	163.88
5	69.27	162.58
6	79.23	161.64
7	89.21	161.08
8	99.21	160.88
9	109.21	161.06
10	119.19	161.61
11	129.15	162.53
12	139.07	163.82
13	148.93	165.48
14	158.72	167.51
15	168.43	169.89
16	178.05	172.64
17	187.55	175.74
18	196.94	179.20
19	206.19	183.00
20	215.29	187.14
21	224.23	191.62
22	233.00	196.42
23	241.58	201.55
24	249.97	207.00
25	258.15	212.75
26	266.11	218.81
27	273.84	225.15
28	281.32	231.78
29	287.84	238.00

Circle Center At X = 99.4 ; Y = 429.7 and Radius, 268.8

*** 1.898 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.68	170.00
2	43.38	167.55
3	53.16	165.48
4	63.02	163.77
5	72.93	162.43
6	82.88	161.48

7	92.86	160.89
8	102.86	160.69
9	112.86	160.86
10	122.84	161.41
11	132.80	162.33
12	142.72	163.63
13	152.58	165.31
14	162.36	167.35
15	172.07	169.77
16	181.68	172.54
17	191.17	175.68
18	200.54	179.18
19	209.77	183.02
20	218.85	187.21
21	227.77	191.74
22	236.50	196.61
23	245.05	201.80
24	253.40	207.31
25	261.53	213.13
26	269.43	219.25
27	277.10	225.67
28	284.53	232.37
29	290.31	238.00

Circle Center At X = 103.3 ; Y = 425.6 and Radius, 264.9

*** 1.904 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.68	170.00
2	43.37	167.52
3	53.15	165.41
4	63.00	163.68
5	72.90	162.33
6	82.86	161.36
7	92.84	160.78
8	102.84	160.58
9	112.84	160.77
10	122.82	161.34
11	132.77	162.30
12	142.68	163.64
13	152.54	165.36
14	162.31	167.46
15	172.00	169.93
16	181.59	172.78
17	191.06	175.99
18	200.40	179.57
19	209.59	183.50
20	218.63	187.78
21	227.49	192.41
22	236.17	197.38
23	244.65	202.68
24	252.92	208.30
25	260.97	214.23
26	268.79	220.47
27	276.35	227.01
28	283.66	233.83
29	287.80	238.00

Circle Center At X = 103.0 ; Y = 420.1 and Radius, 259.5

*** 1.904 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.68	170.00
2	43.39	167.59
3	53.18	165.54
4	63.03	163.85
5	72.95	162.53
6	82.90	161.57
7	92.88	160.98
8	102.88	160.76

9	112.88	160.91
10	122.87	161.43
11	132.83	162.32
12	142.75	163.57
13	152.62	165.19
14	162.42	167.17
15	172.14	169.51
16	181.77	172.21
17	191.29	175.27
18	200.69	178.67
19	209.96	182.42
20	219.09	186.50
21	228.06	190.92
22	236.86	195.67
23	245.48	200.74
24	253.91	206.13
25	262.13	211.82
26	270.13	217.81
27	277.91	224.10
28	285.45	230.66
29	292.75	237.50
30	293.24	238.00

Circle Center At X = 103.8 ; Y = 431.6 and Radius, 270.8

*** 1.904 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.68	170.00
2	43.40	167.64
3	53.20	165.64
4	63.06	163.99
5	72.98	162.69
6	82.93	161.74
7	92.92	161.16
8	102.91	160.93
9	112.91	161.06
10	122.90	161.55
11	132.86	162.40
12	142.79	163.60
13	152.67	165.16
14	162.49	167.07
15	172.23	169.33
16	181.88	171.94
17	191.44	174.89
18	200.88	178.18
19	210.20	181.81
20	219.38	185.77
21	228.41	190.06
22	237.29	194.67
23	245.99	199.59
24	254.51	204.82
25	262.84	210.36
26	270.97	216.18
27	278.88	222.30
28	286.57	228.69
29	294.02	235.36
30	296.77	238.00

Circle Center At X = 104.3 ; Y = 439.8 and Radius, 278.9

*** 1.906 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.75	167.77
3	49.57	165.91
4	59.46	164.39
5	69.39	163.24
6	79.36	162.45
7	89.35	162.02
8	99.35	161.96

9	109.35	162.26
10	119.32	162.92
11	129.27	163.94
12	139.18	165.32
13	149.02	167.06
14	158.80	169.16
15	168.50	171.61
16	178.10	174.41
17	187.59	177.56
18	196.96	181.05
19	206.20	184.88
20	215.29	189.05
21	224.22	193.53
22	232.99	198.35
23	241.58	203.47
24	249.97	208.91
25	258.16	214.64
26	266.14	220.67
27	273.90	226.98
28	281.42	233.58
29	286.11	238.00

Circle Center At X = 96.1 ; Y = 437.3 and Radius, 275.4

*** 1.908 ***

Failure Surface Specified By 28 Coordinate Points

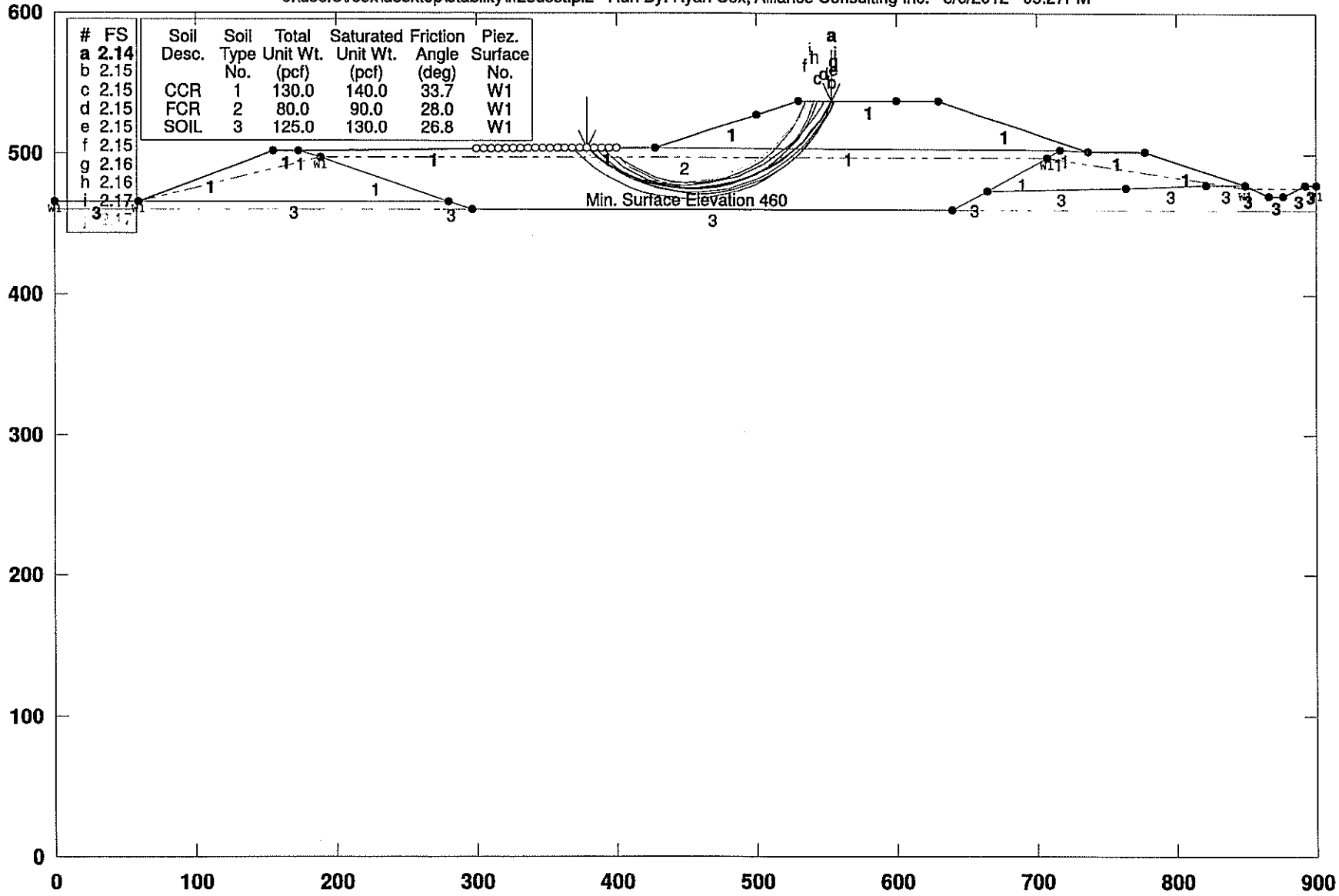
Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	170.00
2	39.65	167.38
3	49.40	165.15
4	59.23	163.34
5	69.13	161.93
6	79.08	160.94
7	89.07	160.35
8	99.07	160.18
9	109.06	160.43
10	119.04	161.09
11	128.98	162.16
12	138.87	163.65
13	148.69	165.54
14	158.43	167.84
15	168.05	170.53
16	177.56	173.63
17	186.94	177.11
18	196.16	180.99
19	205.21	185.24
20	214.08	189.86
21	222.75	194.84
22	231.20	200.18
23	239.43	205.87
24	247.41	211.89
25	255.14	218.23
26	262.60	224.89
27	269.77	231.86
28	275.60	238.00

Circle Center At X = 98.1 ; Y = 401.4 and Radius, 241.3

*** 1.909 ***

Section F-F Phase 2-3 Connector Upstream Static

c:\users\rcox\desktop\stability\ff23usst.pl2 Run By: Ryan Cox, Alliance Consulting Inc. 3/6/2012 05:27PM



#	FS
a	2.14
b	2.15
c	2.15
d	2.15
e	2.15
f	2.15
g	2.16
h	2.16
i	2.17

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CCR	1	130.0	140.0	33.7	W1
FCR	2	80.0	90.0	28.0	W1
SOIL	3	125.0	130.0	26.8	W1

PCSTABL5M/si FSmin=2.14

Safety Factors Are Calculated By The Modified Bishop Method

STED



**** PCSTABL5M ****
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 3/6/2012
Time of Run: 05:27PM
Run By: Ryan Cox, Alliance Consulting Inc.
Input Data Filename: C:ff23usst.in
Output Filename: C:ff23usst.OUT
Unit: ENGLISH
Plotted Output Filename: C:ff23usst.PLT
PROBLEM DESCRIPTION Section F-F Phase 2-3 Connector
Upstream Static

BOUNDARY COORDINATES
14 Top Boundaries
28 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	466.00	59.50	466.00	3
2	59.50	466.00	155.00	502.00	1
3	155.00	502.00	173.60	502.20	1
4	173.60	502.20	358.90	504.00	1
5	358.90	504.00	428.00	504.00	1
6	428.00	504.00	530.00	538.00	1
7	530.00	538.00	630.00	538.00	1
8	630.00	538.00	737.30	502.00	1
9	737.30	502.00	777.90	502.00	1
10	777.90	502.00	849.90	478.00	1
11	849.90	478.00	865.90	470.00	3
12	865.90	470.00	875.90	470.00	3
13	875.90	470.00	891.90	478.00	3
14	891.90	478.00	900.00	478.00	3
15	428.00	504.00	717.10	502.40	1
16	717.10	502.40	737.30	502.20	1
17	173.60	502.20	188.70	497.00	1
18	188.70	497.00	707.30	497.00	2
19	707.30	497.00	717.10	502.40	1
20	188.70	497.00	279.60	466.00	1
21	665.40	474.00	707.30	497.00	1
22	59.50	466.00	279.60	466.00	3
23	279.60	466.00	297.10	460.00	3
24	297.10	460.00	639.90	460.00	3
25	639.90	460.00	665.40	474.00	3
26	665.40	474.00	764.10	476.00	3
27	764.10	476.00	821.70	478.00	3
28	821.70	478.00	849.90	478.00	3

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	140.0	0.0	33.7	0.00	0.0	1
2	80.0	90.0	0.0	28.0	0.00	0.0	1
3	125.0	130.0	0.0	26.8	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	466.00
2	59.50	466.00
3	188.70	497.00
4	707.30	497.00
5	849.90	476.00
6	900.00	476.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 300.00 ft.
and X = 400.00 ft.
Each Surface Terminates Between X = 500.00 ft.
and X = 600.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =460.00 ft.
10.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	378.95	504.00
2	386.64	497.61
3	394.88	491.94
4	403.59	487.03
5	412.71	482.93
6	422.16	479.67
7	431.87	477.27
8	441.76	475.76
9	451.74	475.15
10	461.73	475.43
11	471.66	476.62
12	481.44	478.70
13	491.00	481.65
14	500.25	485.45
15	509.12	490.06
16	517.54	495.46
17	525.43	501.60
18	532.75	508.42
19	539.41	515.87
20	545.38	523.90
21	550.60	532.42
22	553.36	538.00

Circle Center At X = 453.5 ; Y = 585.8 and Radius, 110.7
*** 2.143 ***
Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	7.7	3195.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.9	770.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	7.4	8364.4	0.0	1409.8	0.0	0.0	0.0	0.0	0.0
4	8.7	13823.3	0.0	4689.5	0.0	0.0	0.0	0.0	0.0
5	9.1	18165.2	0.0	7499.7	0.0	0.0	0.0	0.0	0.0
6	9.5	21959.4	0.0	9796.9	0.0	0.0	0.0	0.0	0.0
7	5.8	14795.6	0.0	6772.8	0.0	0.0	0.0	0.0	0.0
8	3.9	10554.4	0.0	4789.7	0.0	0.0	0.0	0.0	0.0
9	9.9	30994.4	0.0	12782.0	0.0	0.0	0.0	0.0	0.0
10	10.0	36547.0	0.0	13445.6	0.0	0.0	0.0	0.0	0.0
11	10.0	41075.2	0.0	13547.8	0.0	0.0	0.0	0.0	0.0
12	9.9	44429.6	0.0	13087.9	0.0	0.0	0.0	0.0	0.0
13	9.8	46511.0	0.0	12069.6	0.0	0.0	0.0	0.0	0.0
14	9.6	47273.1	0.0	10501.1	0.0	0.0	0.0	0.0	0.0
15	9.3	46724.5	0.0	8395.2	0.0	0.0	0.0	0.0	0.0
16	8.9	44927.3	0.0	5769.1	0.0	0.0	0.0	0.0	0.0
17	8.4	41995.6	0.0	2644.1	0.0	0.0	0.0	0.0	0.0
18	2.0	9706.0	0.0	120.3	0.0	0.0	0.0	0.0	0.0
19	5.9	27840.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	2.0	8852.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	2.6	11039.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	2.7	11017.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	6.7	22409.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	6.0	14056.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	5.2	6678.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	2.8	998.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	378.95	504.00
2	386.69	497.68
3	394.97	492.07
4	403.72	487.22
5	412.87	483.18
6	422.34	479.97
7	432.06	477.61
8	441.95	476.14
9	451.93	475.55
10	461.92	475.85
11	471.85	477.05
12	481.63	479.13
13	491.19	482.08
14	500.45	485.86
15	509.33	490.46
16	517.76	495.83
17	525.68	501.93
18	533.03	508.72
19	539.74	516.14
20	545.76	524.12
21	551.04	532.61
22	553.76	538.00

Circle Center At X = 453.5 ; Y = 587.3 and Radius, 111.7

*** 2.145 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	389.47	504.00
2	396.66	497.04
3	404.56	490.91
4	413.08	485.68
5	422.12	481.41
6	431.58	478.16
7	441.33	475.96
8	451.27	474.83
9	461.27	474.80
10	471.21	475.87
11	480.98	478.01
12	490.45	481.21
13	499.52	485.43
14	508.08	490.61
15	516.01	496.69
16	523.23	503.61
17	529.66	511.27
18	535.21	519.59
19	539.81	528.47
20	543.42	537.80
21	543.47	538.00

Circle Center At X = 456.5 ; Y = 566.0 and Radius, 91.4

*** 2.146 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	373.68	504.00
2	381.63	497.93
3	390.08	492.57
4	398.95	487.97
5	408.20	484.16
6	417.74	481.17
7	427.51	479.02
8	437.42	477.72
9	447.41	477.30
10	457.40	477.75
11	467.32	479.06
12	477.08	481.23
13	486.61	484.24
14	495.85	488.07

15	504.72	492.69
16	513.15	498.07
17	521.09	504.16
18	528.46	510.91
19	535.22	518.28
20	541.31	526.21
21	546.69	534.64
22	548.44	538.00

Circle Center At X = 447.3 ; Y = 592.0 and Radius, 114.7

*** 2.147 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	378.95	504.00
2	386.31	497.23
3	394.26	491.17
4	402.75	485.88
5	411.69	481.40
6	421.00	477.77
7	430.62	475.02
8	440.45	473.18
9	450.41	472.26
10	460.41	472.27
11	470.36	473.22
12	480.19	475.08
13	489.80	477.85
14	499.11	481.50
15	508.04	486.00
16	516.51	491.31
17	524.45	497.39
18	531.79	504.18
19	538.47	511.62
20	544.43	519.66
21	549.61	528.21
22	553.98	537.20
23	554.28	538.00

Circle Center At X = 455.3 ; Y = 579.6 and Radius, 107.4

*** 2.148 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	394.74	504.00
2	402.18	497.32
3	410.36	491.57
4	419.16	486.83
5	428.47	483.17
6	438.15	480.64
7	448.05	479.28
8	458.05	479.10
9	468.00	480.11
10	477.76	482.30
11	487.19	485.63
12	496.15	490.05
13	504.53	495.51
14	512.21	501.92
15	519.06	509.20
16	525.00	517.25
17	529.95	525.94
18	533.83	535.15
19	534.65	538.00

Circle Center At X = 454.5 ; Y = 563.1 and Radius, 84.1

*** 2.153 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	384.21	504.00
2	391.38	497.03
3	399.19	490.79
4	407.58	485.34
5	416.46	480.73

6	425.74	477.02
7	435.34	474.22
8	445.17	472.38
9	455.13	471.51
10	465.13	471.61
11	475.07	472.68
12	484.86	474.72
13	494.41	477.71
14	503.61	481.61
15	512.40	486.39
16	520.67	492.01
17	528.36	498.40
18	535.38	505.52
19	541.68	513.28
20	547.20	521.63
21	551.87	530.47
22	554.95	538.00

Circle Center At X = 459.1 ; Y = 573.7 and Radius, 102.3

*** 2.161 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	394.74	504.00
2	401.84	496.96
3	409.72	490.80
4	418.26	485.60
5	427.34	481.42
6	436.85	478.33
7	446.66	476.36
8	456.62	475.54
9	466.62	475.89
10	476.50	477.40
11	486.15	480.05
12	495.42	483.80
13	504.19	488.60
14	512.34	494.39
15	519.77	501.08
16	526.37	508.60
17	532.05	516.83
18	536.73	525.66
19	540.36	534.98
20	541.15	538.00

Circle Center At X = 458.6 ; Y = 561.3 and Radius, 85.8

*** 2.161 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	368.42	504.00
2	375.53	496.97
3	383.24	490.60
4	391.48	484.93
5	400.19	480.02
6	409.30	475.90
7	418.74	472.60
8	428.44	470.15
9	438.31	468.57
10	448.29	467.87
11	458.29	468.06
12	468.23	469.13
13	478.04	471.08
14	487.63	473.89
15	496.94	477.54
16	505.89	482.00
17	514.41	487.24
18	522.44	493.21
19	529.90	499.87
20	536.74	507.16
21	542.91	515.03
22	548.36	523.41
23	553.04	532.25

24	555.47	538.00

Circle Center At X = 451.1 ; Y = 580.5 and Radius, 112.7

*** 2.165 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	373.68	504.00
2	381.61	497.90
3	390.07	492.57
4	399.00	488.06
5	408.31	484.42
6	417.92	481.66
7	427.75	479.82
8	437.71	478.92
9	447.71	478.96
10	457.66	479.94
11	467.48	481.85
12	477.07	484.68
13	486.35	488.40
14	495.24	492.98
15	503.66	498.37
16	511.54	504.53
17	518.80	511.41
18	525.38	518.94
19	531.22	527.05
20	536.27	535.68
21	537.35	538.00

Circle Center At X = 442.3 ; Y = 584.9 and Radius, 106.1

*** 2.166 ***

5378-13 R11121
Part 3

APPENDIX C

SOIL BORINGS AND LABORATORY TEST DATA

SOIL BORINGS AND LABORATORY TESTS POND CREEK MINE #1 REFUSE DISPOSAL AREA WILLIAMSON COUNTY, ILLINOIS

Prepared for:

Foresight Management
208 Public Square, 4th Floor
Benton, Illinois 62812

Prepared by:

HOLCOMB FOUNDATION ENGINEERING CO.
Carbondale, Illinois
618-529-5262

July 11, 2012

HFE File Number: H-08283

TABLE OF CONTENTS

	PAGE
REPORT	1
BORING LOCATION DIAGRAM	2
BORING LOGS (22)	3-26
MONITORING WELL COMPLETION REPORT	27
ATTERBERG LIMIT TEST RESULTS	28
CONSOLIDATION TEST D-1 10'	29-51
TRIAXIAL SHEAR TEST REPORTS (2)	52-65
D-2 (13.5-16.0')	52-58
D-2 (18.5-21.0')	59-65
GENERAL NOTES	66
UNIFIED SOIL CLASSIFICATIONS	67

Holcomb Foundation Engineering Co., Inc.

R11124

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

July 11, 2012

Foresight Management
208 Public Square, 4th Floor
Benton, Illinois 62812

Attention: Mr. Joe Lowry, P.E.

Re: Soil Borings and Laboratory Tests
Pond Creek Mine #1 Refuse Disposal Area
Williamson County, Illinois
HFE File H-08283

Dear Sir:

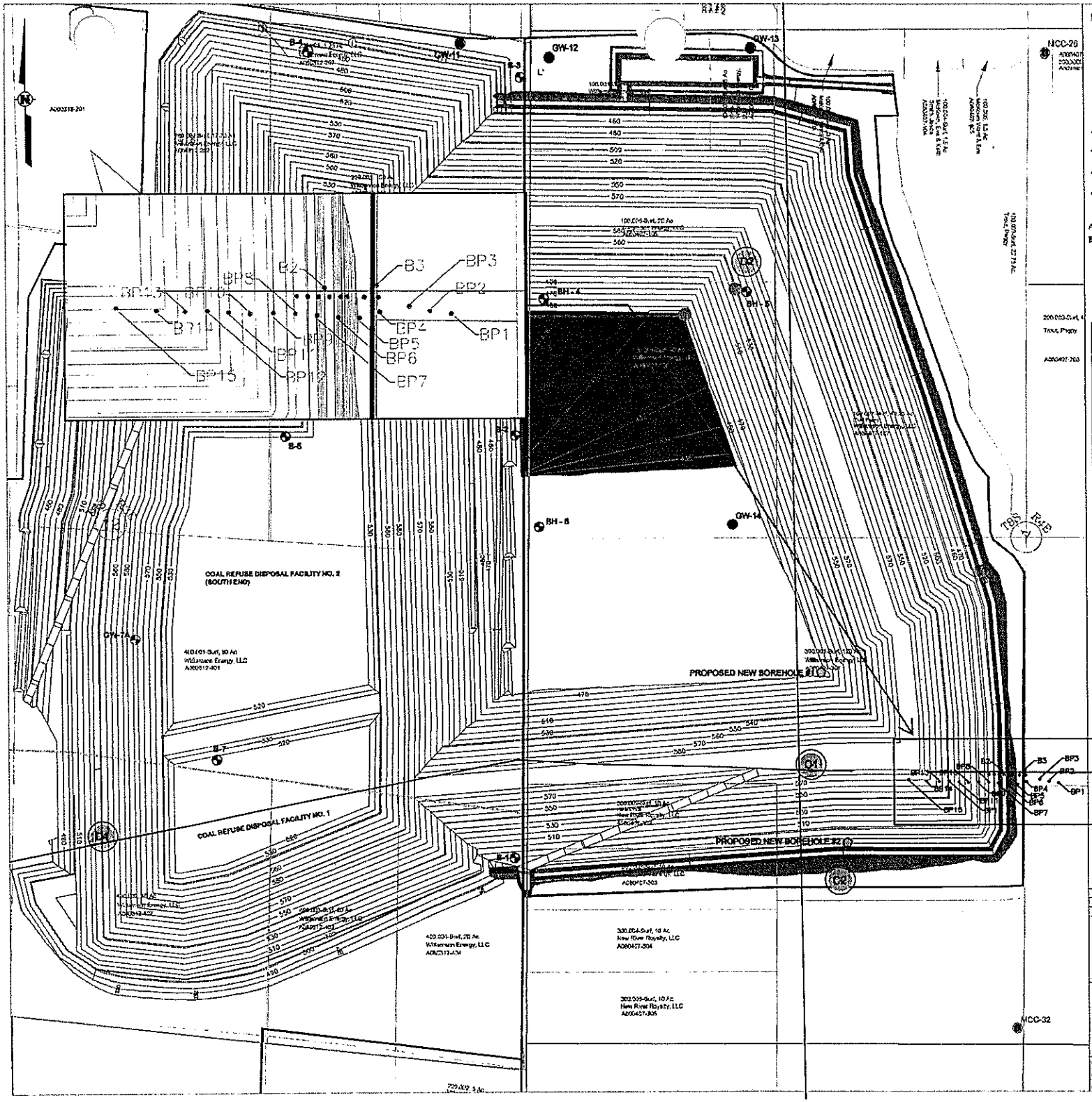
From May 30 until June 8, 2012, we drilled 22 soil borings at this site. The borings are located as indicated on the enclosed Boring Location Diagram. Soils sampled in Borings D-1 and D-2 were subjected to Atterberg limits tests, a consolidation test, and consolidated-undrained triaxial tests.

The Boring Logs, Well Completion Diagram, and Laboratory Test Results are attached. If you should have any questions please feel free to contact us at your convenience.

Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

Timothy J. Holcomb, P.E.



LEGEND

- B-5 — EXPLORATION HOLE DRILLED PRIOR TO MAY 2009
- BH-4 — EXPLORATION HOLE COMPLETED DURING MAY 2009
- GW-7A — EXPLORATION HOLE/GROUND WATER WELL COMPLETED PRIOR TO MAY 2009
- GW-13 — EXPLORATION HOLE/GROUND WATER WELL COMPLETED DURING MAY 2009
- TOWNSHIP/RANGE
- EXISTING 8" METHANE PIPELINE
- PERMIT NO. 375 BOUNDARY
- PERMIT NO. 417 BOUNDARY
- PROPERTY LINE
- A——A' GEOLOGIC CROSS SECTION A-AA' LOCATION
- B——B' GEOLOGIC CROSS SECTION B-BB' LOCATION

SURVEYED BOREHOLE LOCATIONS

BORING NUMBER	NORTHING	EASTING	TOP OF PIPE	GROUND ELEVATION
BH-4	429343	360407	--	436.27
BH-5	429376	361463	--	444.28
BH-6	428164	360375	--	452.07
GW-7A	427587	358275	--	452.0
GW-10	429483	358105	437.68	435.17
GW-11	430660	359981	440.50	437.77
GW-12	430596	360443	438.13	435.25
GW-13	430637	361492	444.57	441.57
GW-14	428172	361383	458.52	455.56
B-1	428451	360239	--	481.6
B-2	428637	360254	--	446.3
B-3	430497	360292	--	435.4
B-4	430625	359192	--	442.2
B-5	428636	359082	--	447.9
B-7	426964	358895	--	459.4

NOTES:

1) FOR GEOLOGIC CROSS SECTION A-AA', SEE DRAWING NO. B12-271-E2

2) FOR GEOLOGIC CROSS SECTION B-BB', SEE DRAWING NO. B12-271-E3

REFERENCES:

1) TOPOGRAPHIC MAPPING PROVIDED BY WILLIAMSON ENERGY, LLC.

2) INFORMATION FOR COAL REFUSE DISPOSAL FACILITY NOS. 1 AND 2 WAS ACQUIRED FROM ALLIANCE CONSULTING INC.'S (ALLIANCE) DRAWING NO. B09-018-MZ.

3) LOCATIONS FOR BORING NOS. B-1, B-2, B-3, B-4, B-5, B-7 AND GW-7A WERE OBTAINED FROM ALLIANCE'S DRAWING NO. B05-330-MZ5.

4) COORDINATE AND ELEVATION DATA FOR BORINGS BH-4, BH-5, BH-6 AND GW-10 THROUGH GW-14 WERE OBTAINED FROM HOLCOMB FOUNDATION ENGINEERING CO., INC.'S MAY 2009 DRILLING LOGS.

SCALE
200 0 200 400 FEET

REV.	DATE	DESCRIPTION	PM

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

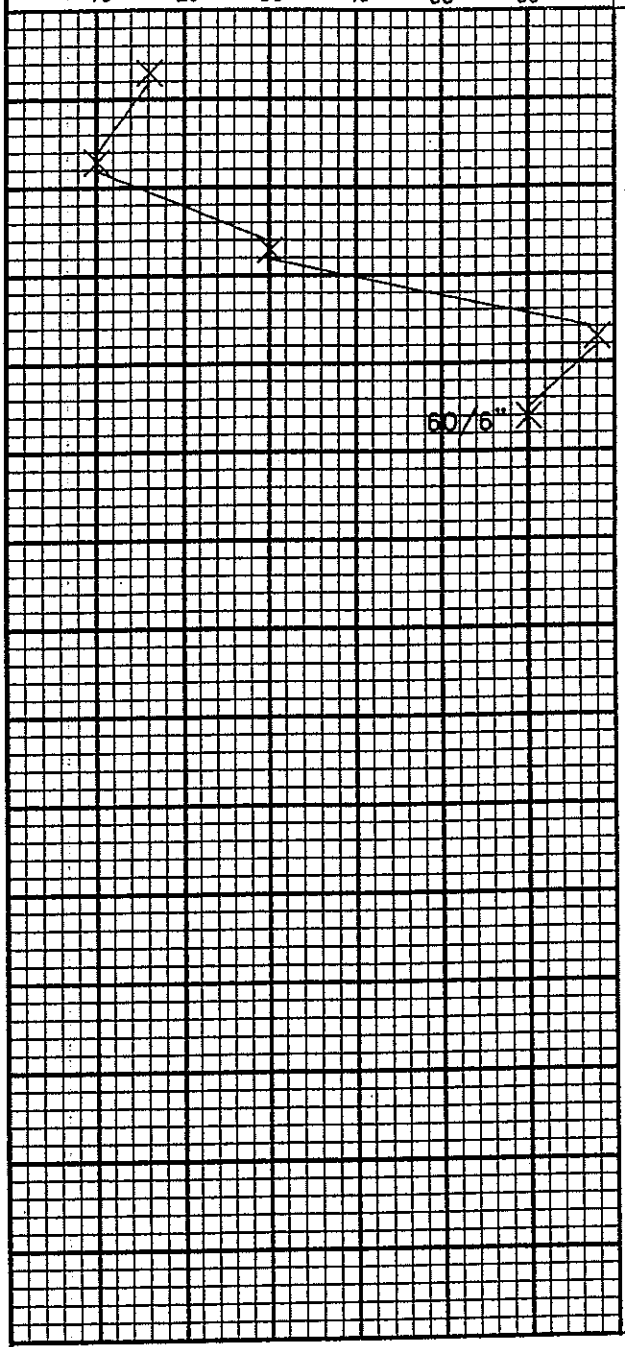
PROPOSED BOREHOLE LOCATION MAP

CAD BY	DSM	06/12/12	PROJECT NO. B12-271-1413
CHECKED BY			
APPROVED BY			DRAWING NO. B12-271-E1

R111125

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-1



Sample No.	Type Sample	Sample Distance	Description of Material
			Surface Elevation
			3" of Topsoil
1	ss		Brown Silty CLAY (CL)
2	ss		
3	ss		
			Brown Sandy CLAY (CL)
4	ss		Brown Weathered Sandstone
5	ss		Brown Sandstone
			End of Boring @ -12.0'

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

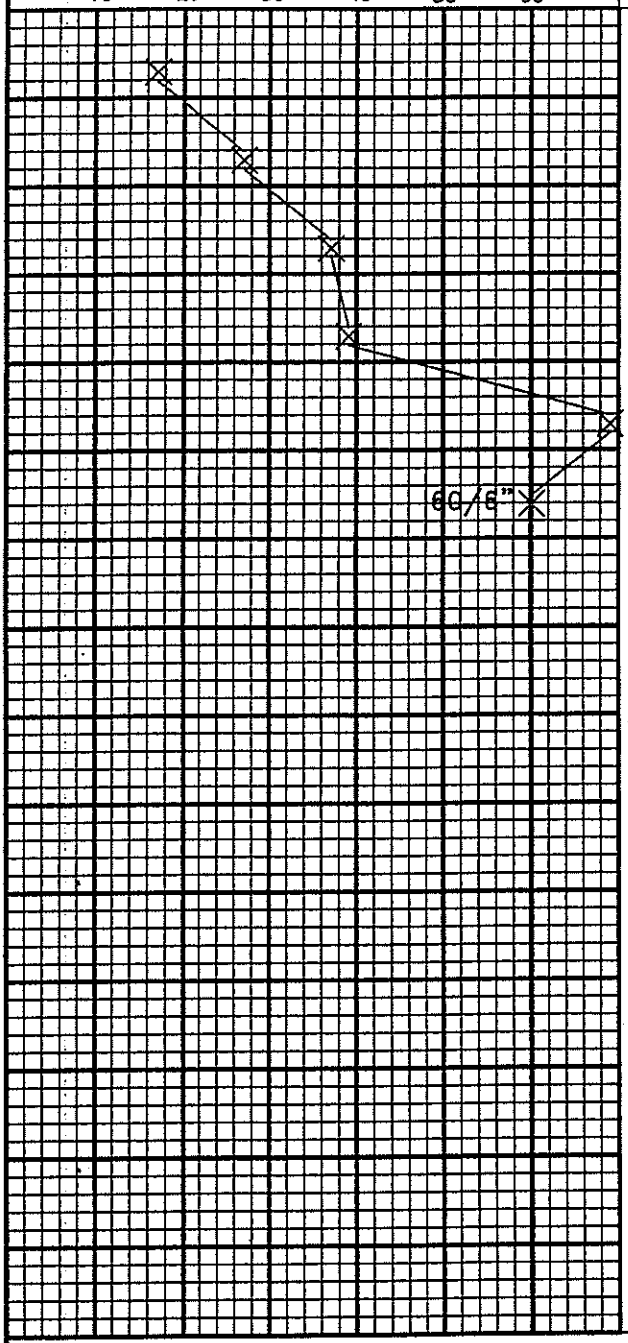
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
5	2	ss		Brown Mott. Gray Weathered Shale
	3	ss		Brown Mott. Gray Shale
10	4	ss		
	5	ss		
	6	ss		Gray Mott. Brown Shale
15				End of Boring @ -14.5'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

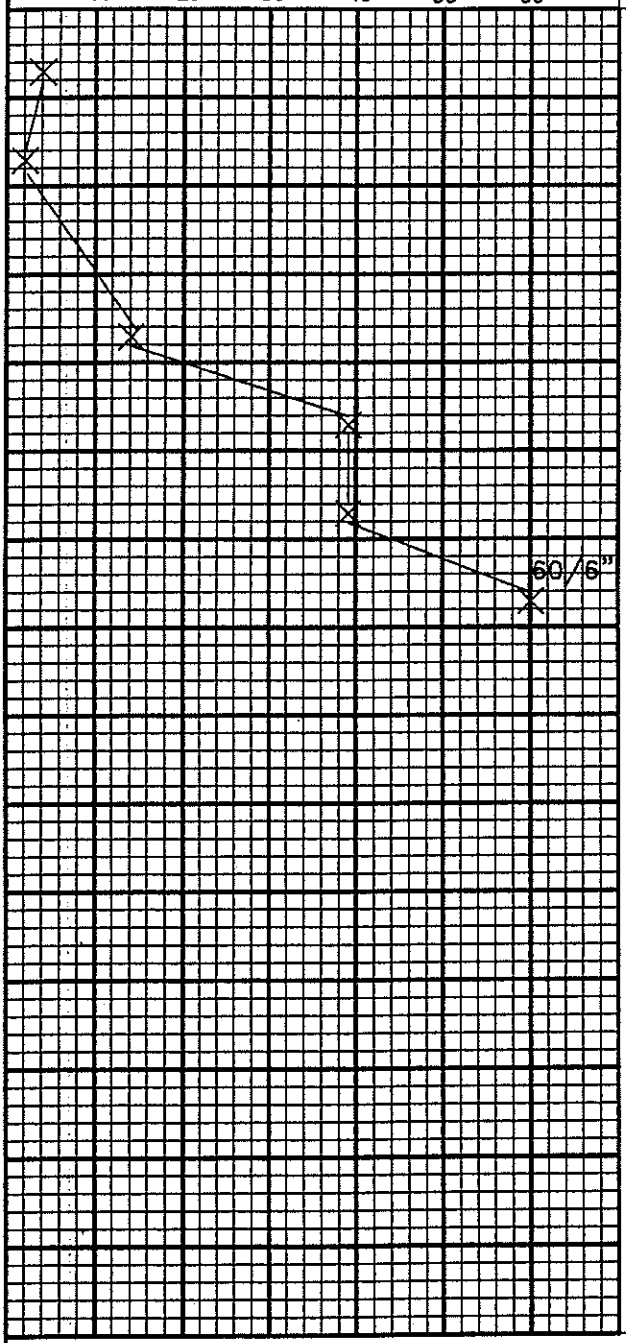
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING B-3

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
5	2	ss		Gray Mott. Brown Silty CLAY (CL)
	3	ss		Brown Mott. Gray Silty CLAY (CL)
10	4	ss		
	5	ss		Gray Mott. Brown Shale
	6	ss		
15	7	ss		
				End of Boring @ -17.5'
20				
25				*Note: Moved Rig 4' up & pushed Shelby Tube 3-5' Deep
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
May 30, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Shale
15				End of Boring @ −15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
				Gray Shale
10				
				End of Boring @ -11.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP3

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Shale
15				End of Boring @ −14.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

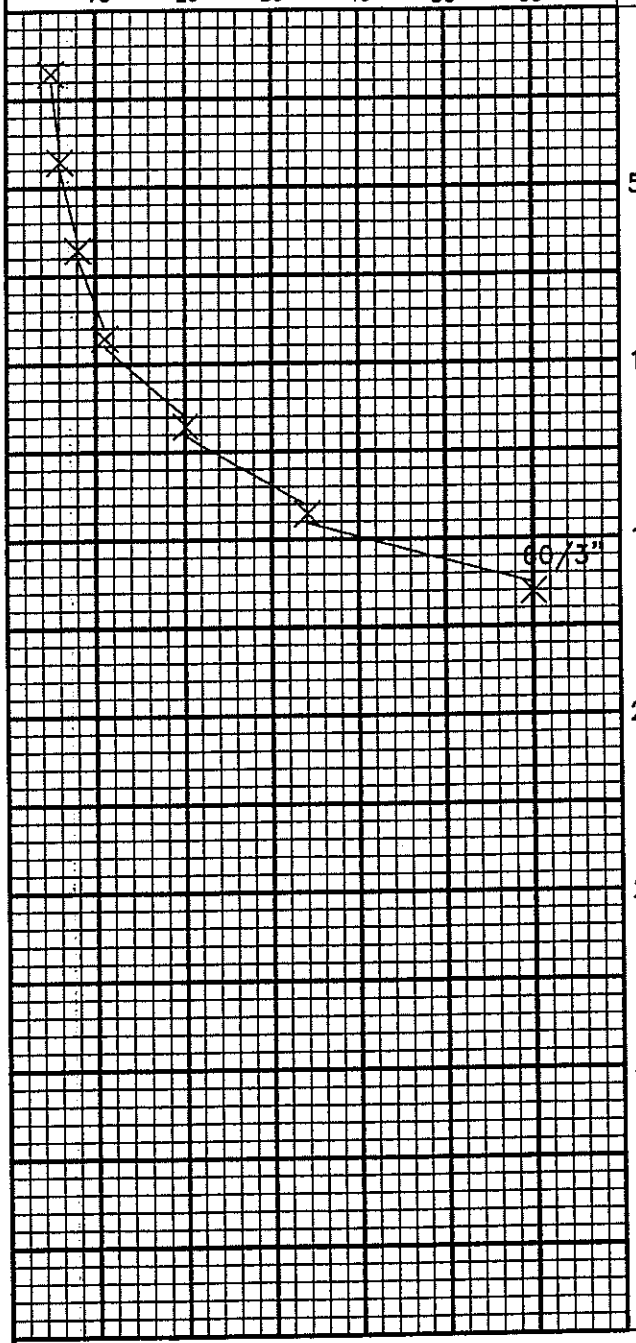
Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP4



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
	1	ss		Brown Mott. Gray Silty CLAY (CL)
	2	ss		
5	3	ss		
	4	ss		Brown Mott. Gray Sandy CLAY (CL)
10	5	ss		
	6	ss		Gray Weathered Shale
15	7	ss		
				End of Boring @ −17.0' Well set @ −16.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP5

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

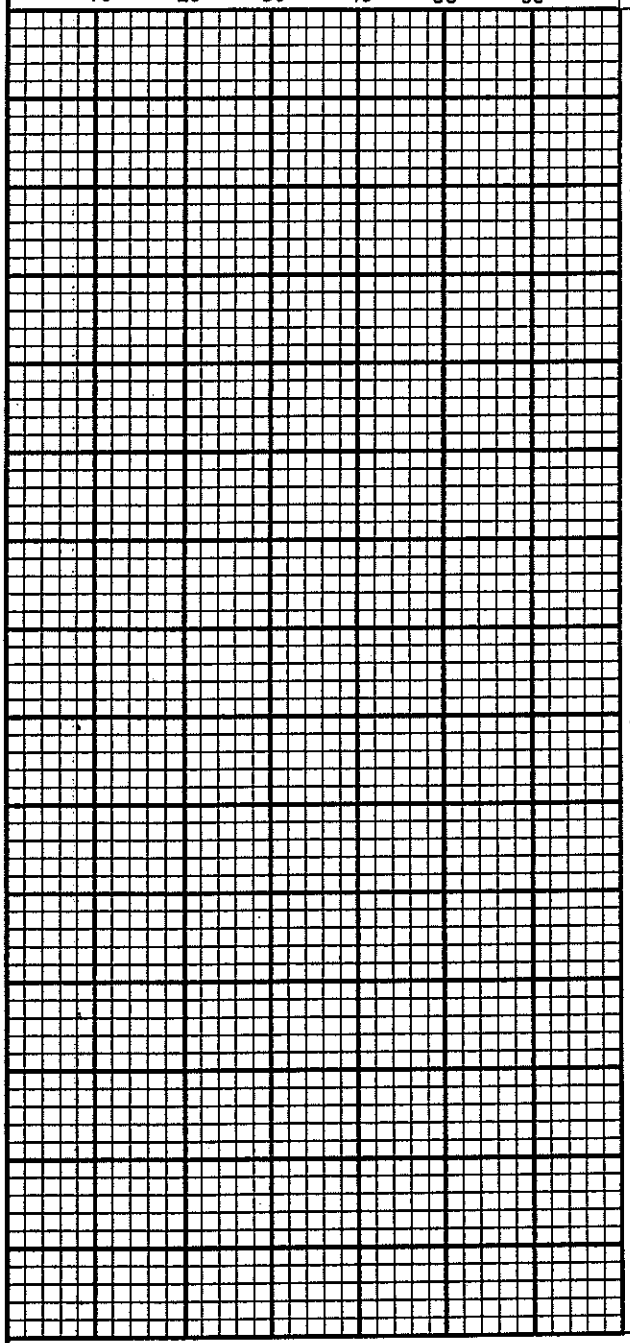
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP6

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Shale
15				End of Boring @ -14.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP7

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP8

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP9

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Weathered Shale
15				End of Boring @ -13.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP10

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5				
10		Au		
15				Gray Weathered Shale
20				End of Boring @ -17.0'
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 4, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP11

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5				
		Au		
10				
				Gray Weathered Shale
15				
				End of Boring @ -17.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP12

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Gray Weathered Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP13

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Gray Weathered Shale
15				End of Boring @ -14.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

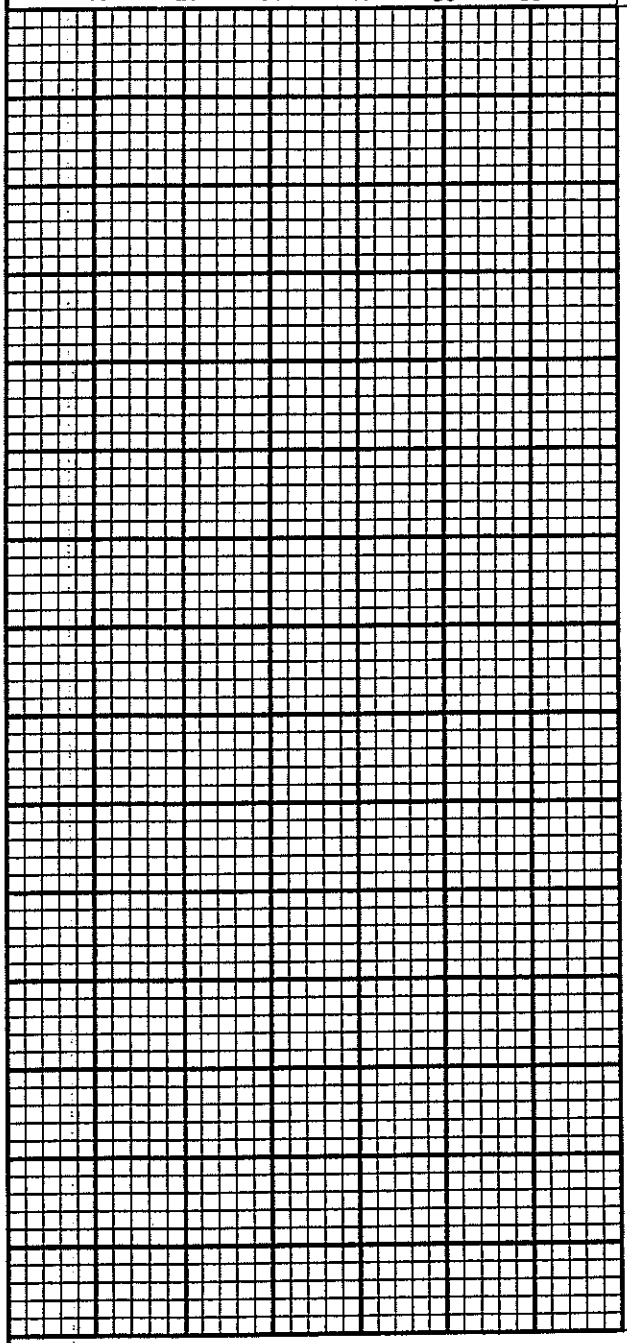
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP14

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth In Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				
				Brown Weathered Shale
15				End of Boring @ −15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H−08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING BP15

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" of Topsoil
				Brown Silty CLAY (CL)
5		Au		
10				Brown Weathered Shale
				End of Boring @ -13.0'
15				
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 5, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

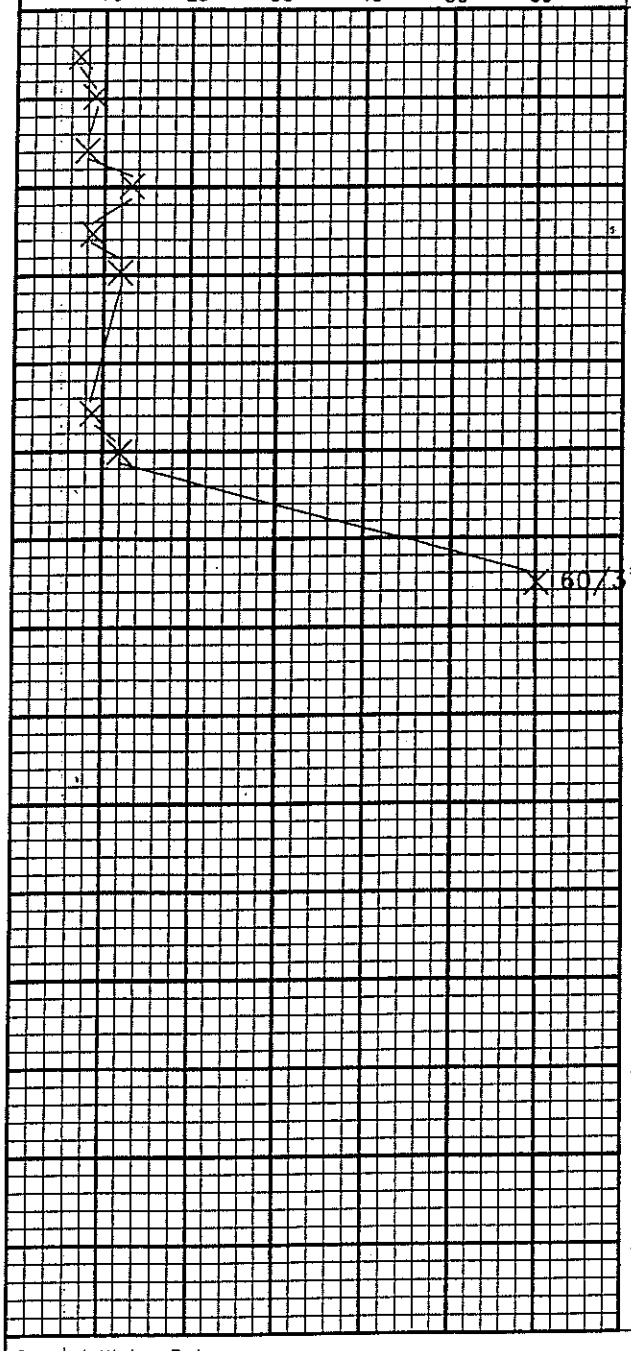
Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
5	2	ss		
	3	ss		
10	4	st		
	5	ss		
15	6	st		
	7	ss		Brown Weathered SHALE
				End of Boring @ -15.5'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

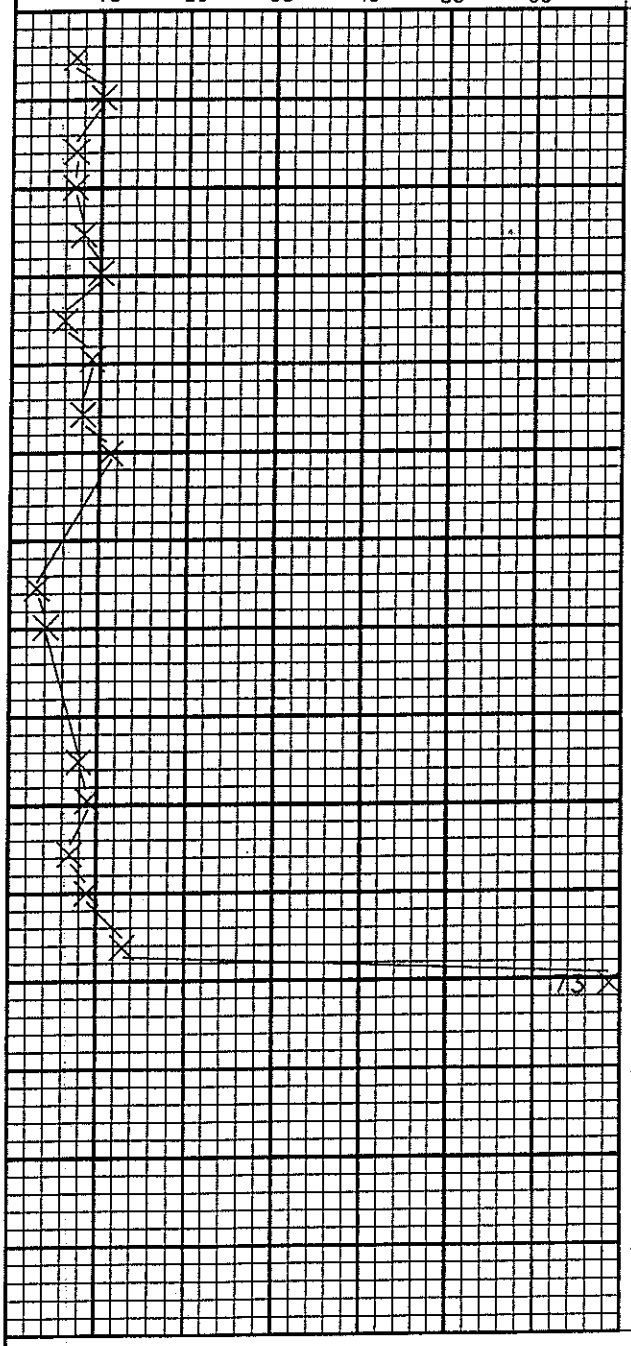
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING D2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
5	2	ss		
	3	ss		
10	4	ss		
	5	ss		
15	6	st		
	7	ss		Brown Mottled Gray Sandy CLAY(CL)
20	8	st		
	9	ss		
25	10	ss		Gray Silty CLAY (CL)
	11	ss		Gray – Brown Weathered SHALE
				Gray SHALE
30				End of Boring @ −28.0'
35				

Ground Water Data
Ground Water Encountered @ −16.0' During Drilling and @ −25.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

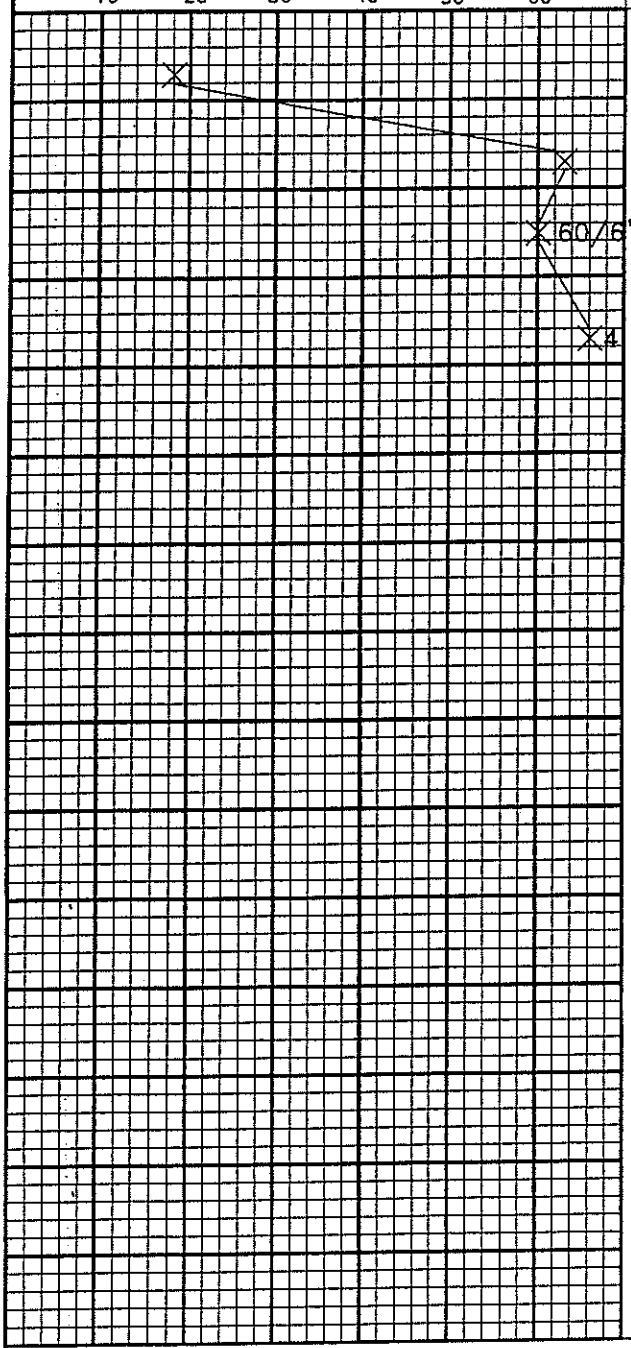
Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				4" Topsoil
	1	ss		Brown Mottled Gray Silty CLAY (CL) with sand
5	2	ss		Brown SANDSTONE
	3	ss		
	4	ss		
10	5	rc		Gray Mottled Brown SHALE
15	6	rc		Gray SHALE
20	7	rc		
25	8	rc		
30	9	rc		
35	10	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ -8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

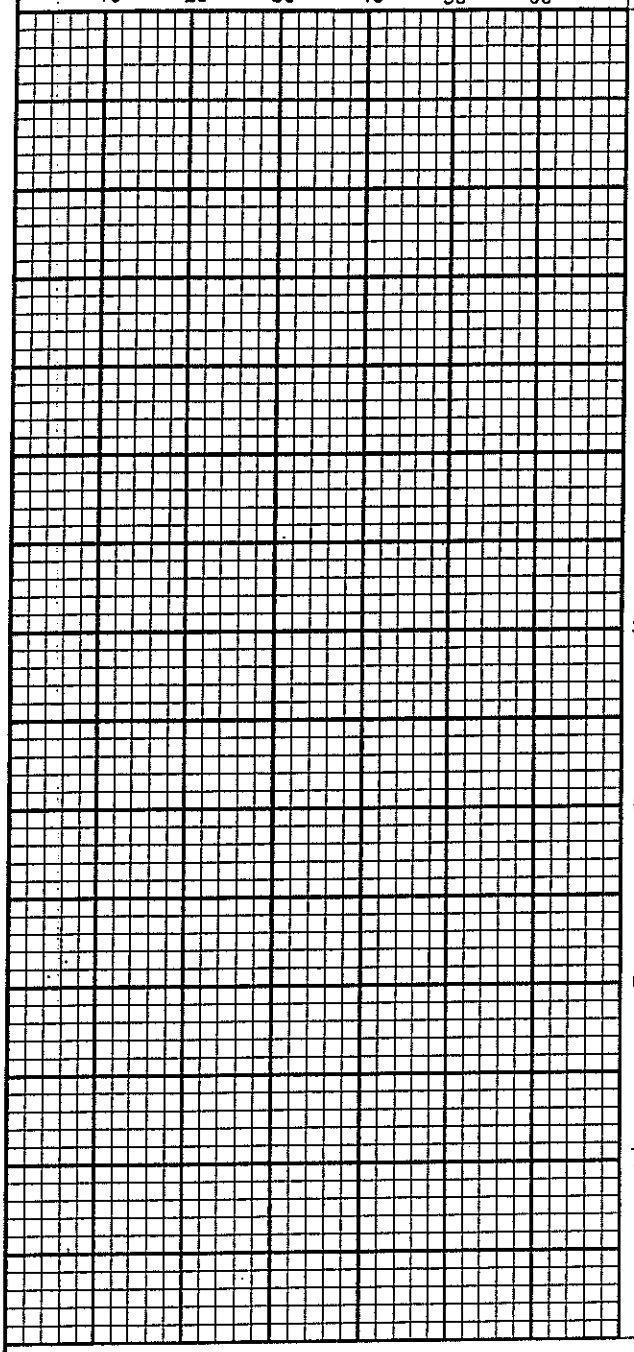
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C1

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6
Water Content (%)
Standard N Penetration, Blows/Ft.
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
40	11	rc		
45	12	rc		
50	13	rc		Black SHALE
55	14	rc		Gray Sandy SHALE
60	15	rc		
65	16	rc		
70				End of Boring @ −70.0'

Ground Water Data
No Ground Water Encountered During Drilling and @ −8.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

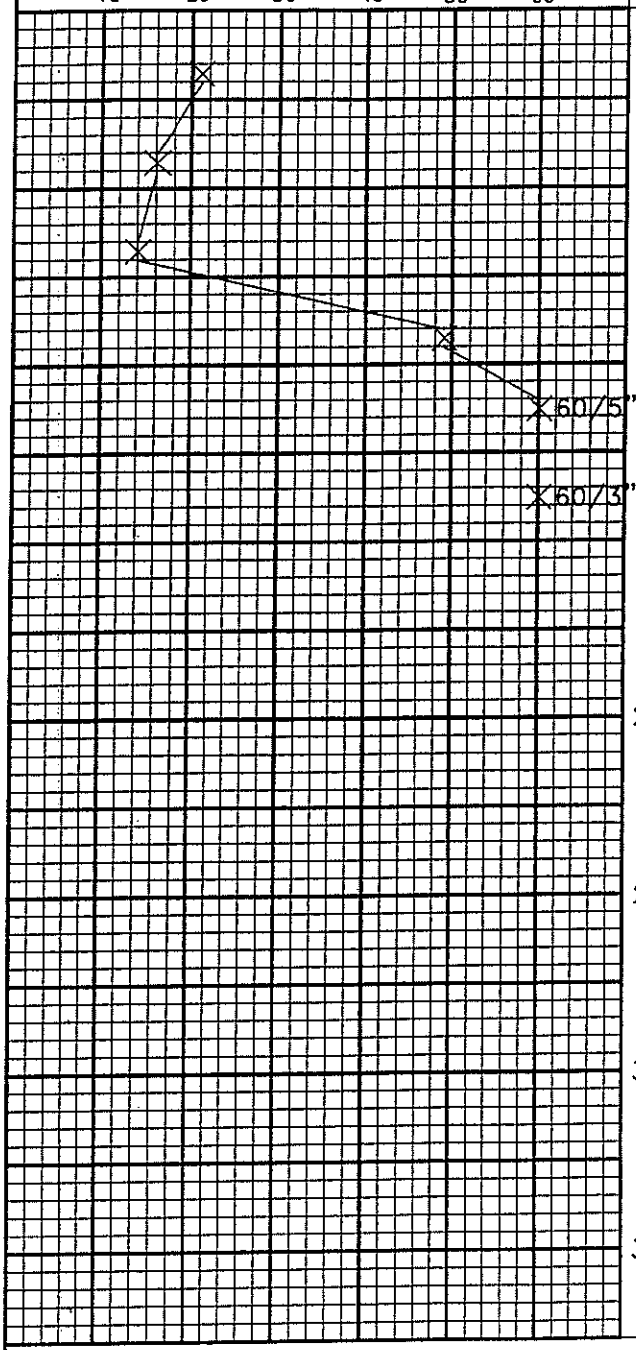
Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R11148

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				Brown Mottled Gray Silty CLAY (CL)
	1	ss		
	2	ss		
5	3	ss		
	4	ss		Brown Mottled Gray SANDSTONE
10	5	ss		
	6	ss		
15	7	rc		
20	8	rc		
25	9	rc		
30	10	rc		Brown-Gray Clayey SHALE
35	11	rc		

Ground Water Data
No Ground Water Encountered During Drilling and @ −10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

Holcomb Foundation Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING C2

Unconfined Compressive Strength (Tons/Sq. Ft.)
1 2 3 4 5 6

Water Content (%)

Standard N Penetration, Blows/Ft.
10 20 30 40 50 60

Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				GRay SHALE
40				
	12	rc		
45				
	13	rc		
50				
	14	rc		
55				
	15	rc		
60				
	16	rc		
65				End of Boring @ -65.0'
70				

Ground Water Data
No Ground Water Encountered During Drilling and @ -10.0' Upon Completion.

Project: Pond Creek Mine No. 1 Refuse Disposal Area
Williamson County, Illinois

Date of Boring
June 8, 2012

Client: Williamson Energy
Marion, Illinois

Project No.
H-08283

R11150

Holcomb Foundation Engineering Company

Monitoring Well Completion Report

Site # H-08283 County Williamson Well # GW28

Site Name Pond Creek Mine No. 1 Grid Coordinate Northing _____ Easting _____

Drilling Contractor Holcomb Foundation Engineering Date Drilled Start: 6/5/2012

Driller Jeff Carter Geologist Tim Holcomb Date Completed: 6/5/2012

Drilling Method Hollow Stem Augers

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ lbs. per bag _____

Amount of bentonite: # of bags _____ lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet): Granular Chips

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Sand Pack: FilterSil #0

Source of Sand: FilterSil Junction City, GA

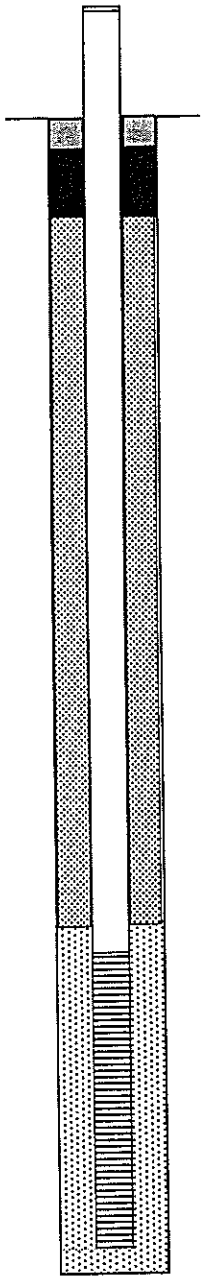
Amount of Sand: # of bags 7 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			Sch 40	
Riser pipe above wt			Sch 40	
Riser pipe below wt			Sch 40	
Screen			Sch 40	
Coupling joint screen to riser			Sch 40	
Protective Casing				

Measurements to .1 ft. (where applicable)

Riser pipe length			10.0'	
Protective casing length				
Screen length			9.8'	
Bottom of screen to end cap			0.1'	
Top of screen to first joint			0.1'	
Total length of casing			—	
Screen slot size			0.010"	
% of openings in screen			—	
Diameter of borehole (in)			8.0"	
ID of riser pipe (in)			2.0"	



+3.0 MSL Top of Riser Pipe

0 MSL Ground Surface

2 ft. Concrete Seal

2 ft. Top of Bentonite

3 ft. Bentonite

5 ft. Top of Sand

6 ft. Top of Screen

10.0 ft. Total Screen Interval

16 ft. Bottom of Screen

17 ft. Bottom of Borehole

Completed by: T. Holcomb Surveyed by: _____ Ill. registration # _____

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

Atterberg Limits Test Results

Pond Creek Mine #1
Refuse Disposal Area

HFE File: H-08283
Date: 6/30/12

Boring/Depth(Ft.)	Liquid Limit(%)	Plastic Limit(%)	Plasticity Index	Soil Classification
D-1 (8.5-11.0')	51.3	21.2	30.1	Fat CLAY (CH)
D-2 (13.5-16.0')	24.1	14.7	9.4	Silty CLAY (CL)
D-2 (18.5-21.0')	41.2	22.5	18.7	Silty CLAY (CL)

Geotechnology, Inc.
11816 Lackland Road, Suite 150
St. Louis, MO 63146
314-997-7440

GEOTECHNOLOGY, INC.
ENGINEERING AND ENVIRONMENTAL SERVICES

TEST REPORT

Prepared For:
Holcomb Foundation Engineering Company
P.O. Box 88
Carbondale, IL 62903
618-529-5262

Report No.:	**J019144.02**	**June 29, 2012**
Material:	**Sample**	**Page 1 of 23**
Project:	**Mach Mine**	
Sampled By:	**Client**	
Attention:	**Mr. Tim Holcomb**	

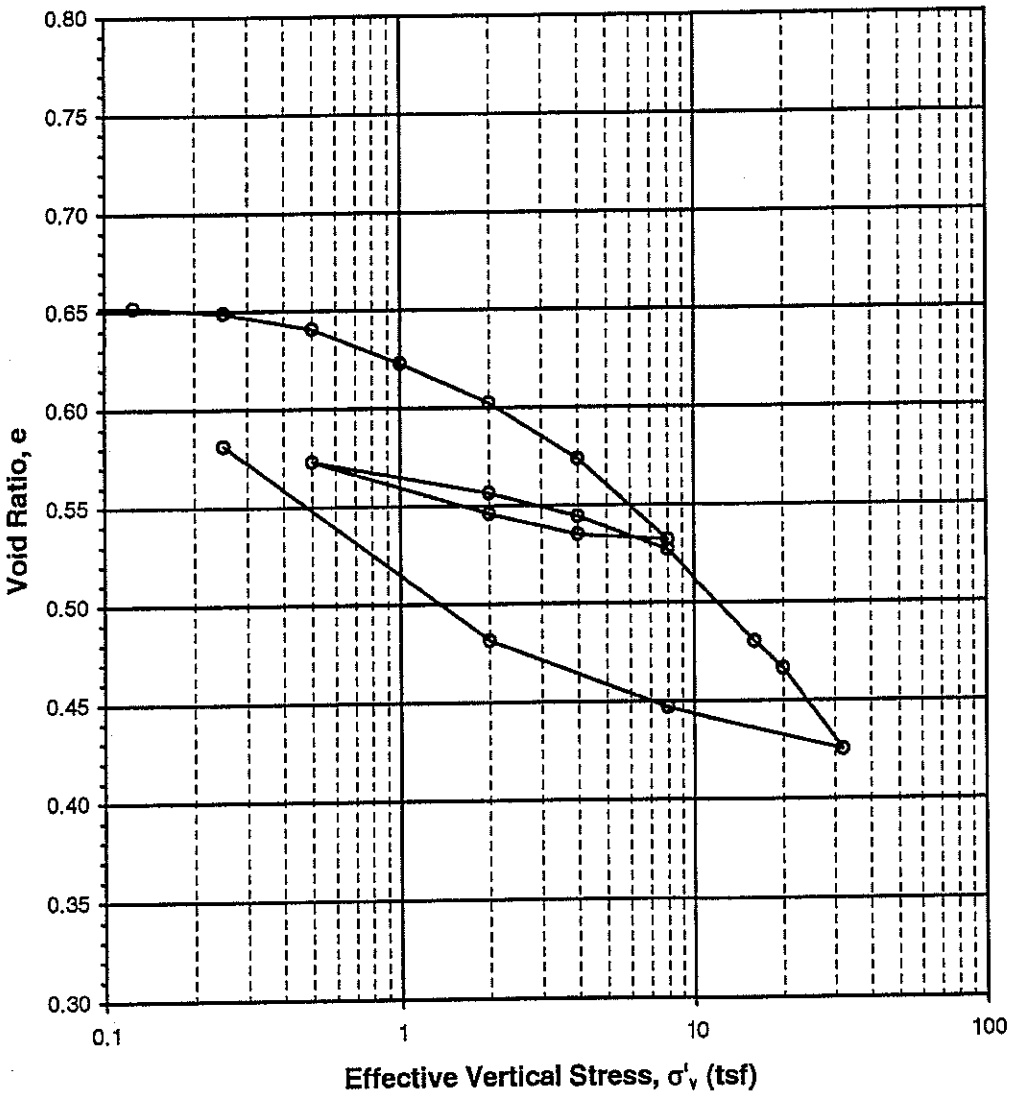
INCREMENTAL CONSOLIDATION TEST
ASTM D2435

Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)
23.0	126	102

Time curves and plot attached.

GEOTECHNOLOGY INC
FROM THE GROUND UP

Liquid Limit=		Plastic Limit=	
Plastic Index =		USCS:	
Compression Index, C_c =	0.144	Void Ratio, e_o =	0.652
Recompression Index, C_r =	0.038	Preconsolidation Pressure =	1.9 tsf



1-D CONSOLIDATION TEST: INCREMENTAL

ASTM D 2435
Project No.: J019144.02
Boring: D-1
Sample: - Depth: 10 ft.

ONE - DIMENSIONAL CONSOLIDATION TEST ASTM D2435:
INCREMENTAL LOADING DATA (Input: Deformation)

Project Number: J019144.02
Project Name: MACH MINE
Boring No.: D-1
Sample No.:
Depth (ft): 10

Test Station No.: INC-149
Data; Start: 6/12/2012
Completed: 6/22/2012
Initial Height, H_o (mm): 0.997

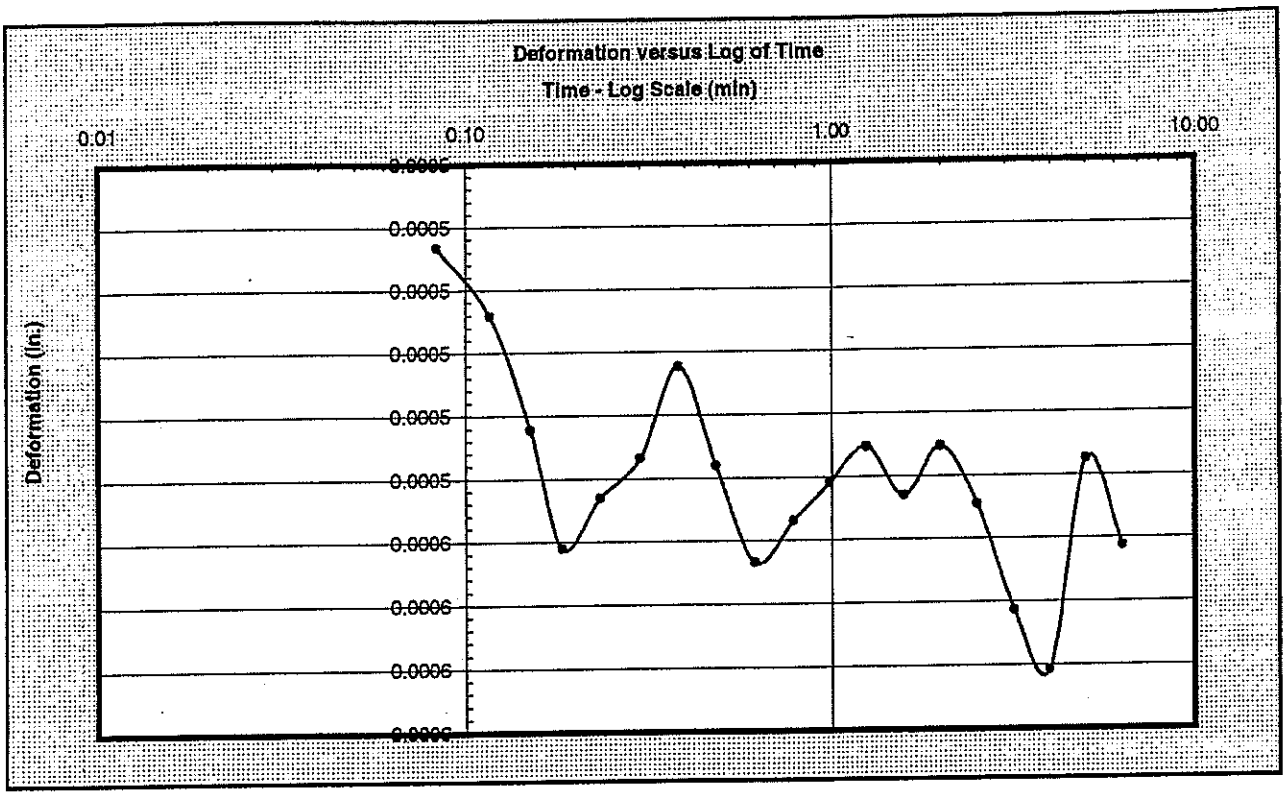
Dial Gauge No.: DG-149
Disp. Trans. No: DT-149
Station No.: 149
DT Factor (in/V/V): 151.918
Excitation Voltage,V: 10.0297

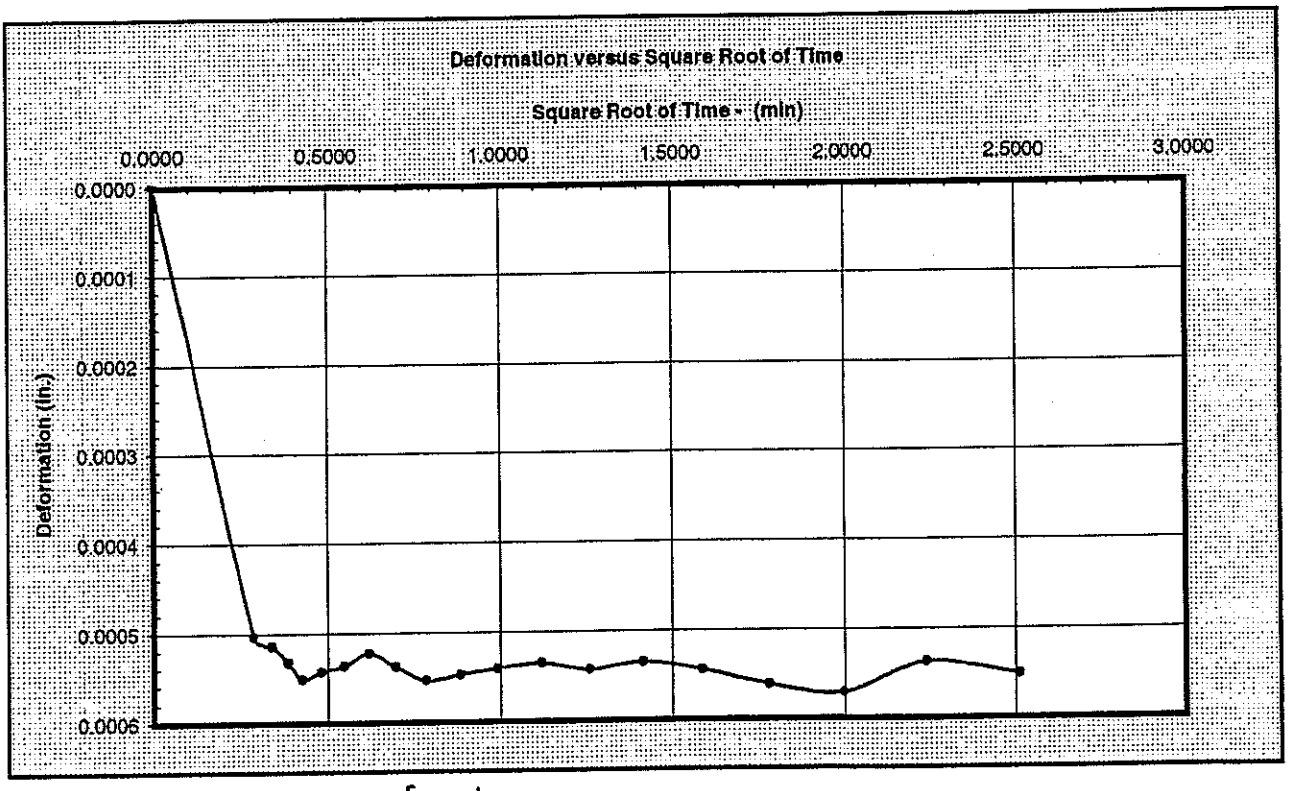
Notes:
(1) W - water added, S - stress level applied to prevent swelling,
(2) Increasing deformation reading or fitting value indicates: [X] compression or, [ ] swell.
(3) Value in brackets indicates, it is an assumed value.

Summary Data Inputted By: KA , _____ , _____

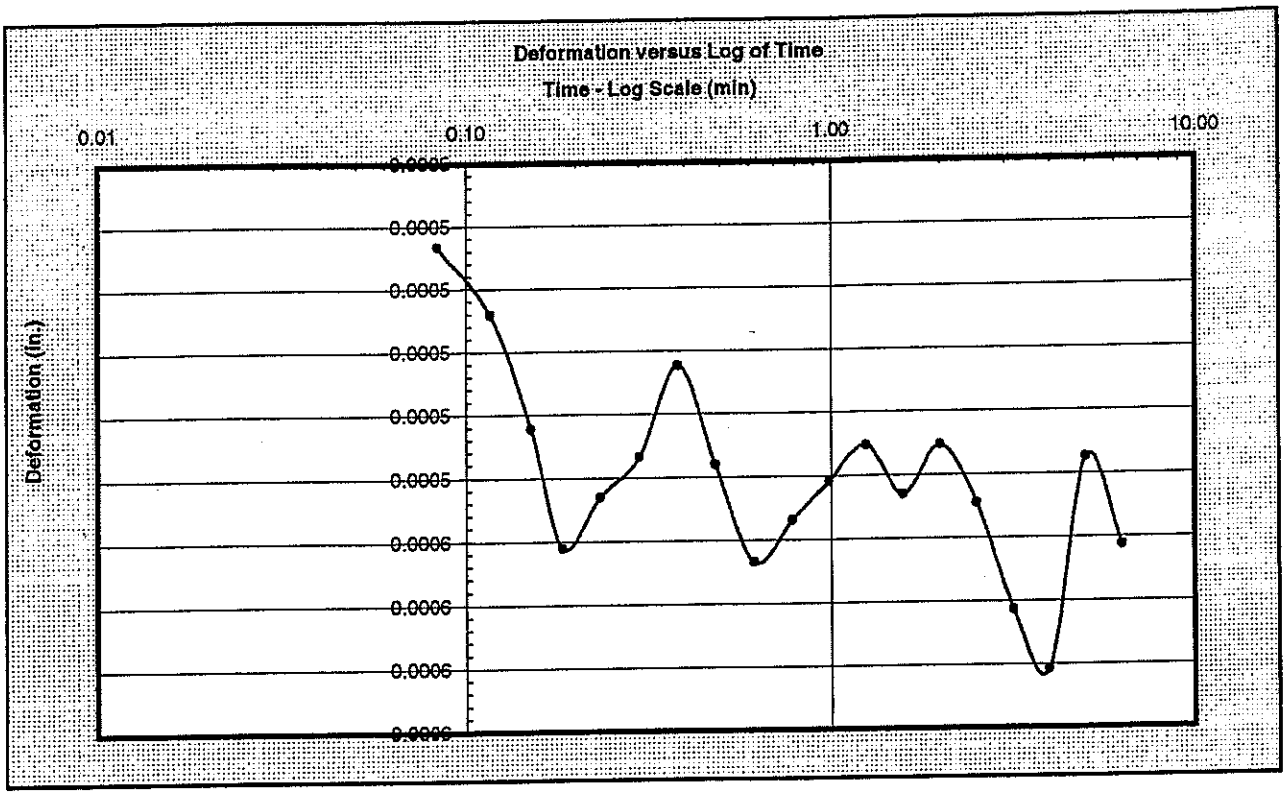
Reviewed By: _____
Spot Checked By: KA
Checked By: _____

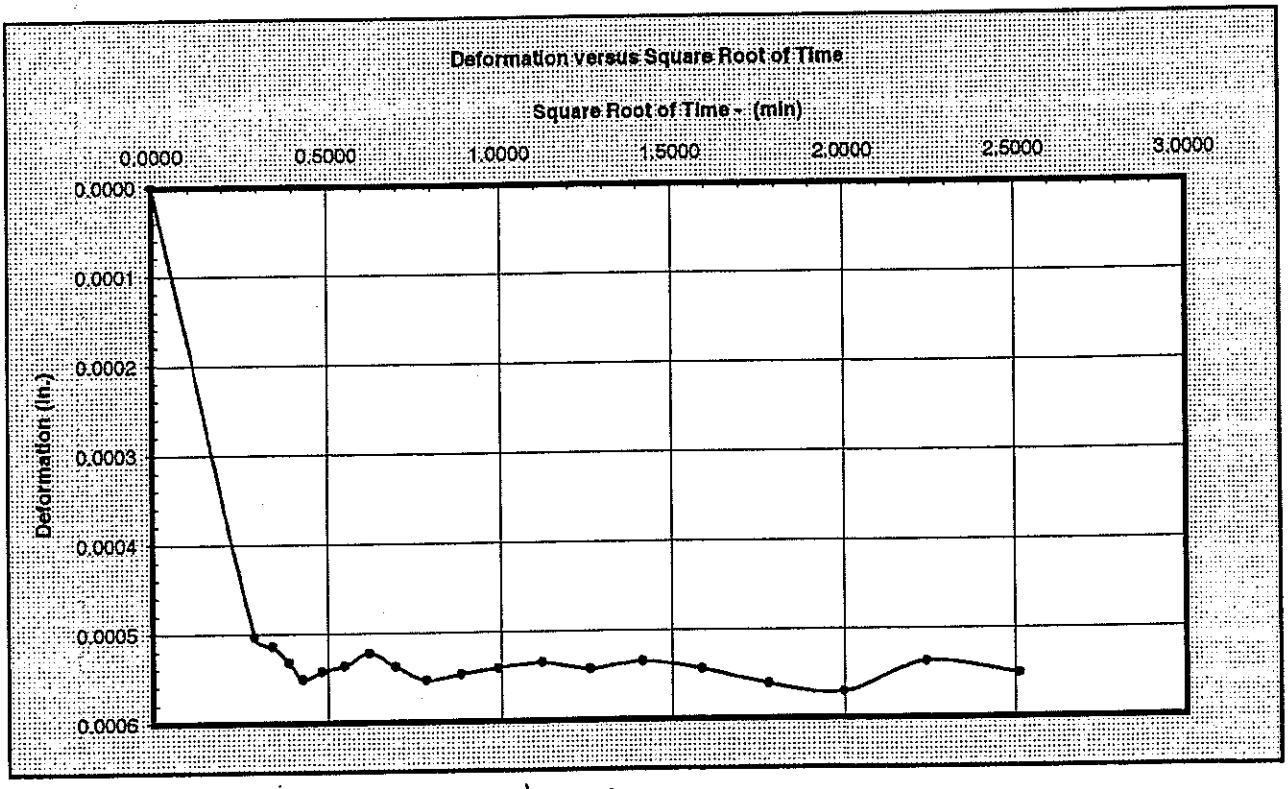
(1)	Final Applied Effective Stress, $\sigma'_{v,c}$ (tsf)	Volumetric (Axial) Strain, $\varepsilon_{v,n}$ ($\varepsilon_{a,n}$) $\Delta H_{c,n} / H_o$ (%)	Void Ratio e_n	Duration of Stress (Load) Increment (hr)	Final Deformation Reading, $d_{rf,n}$ (2) (in)	Total App. Flexibility Correction $\Sigma\Delta d_{afc,n}$ (2) (in)
	0.010	0.03	0.652		0.0005	0.0002
	0.125	0.04	0.652		0.0005	0.0003
	0.250	0.22	0.649		0.0055	0.0036
	0.500	0.72	0.640		0.0122	0.0086
	1.000	1.80	0.623		0.0211	0.0118
	2.000	3.04	0.602		0.0328	0.0143
	4.000	4.76	0.574		0.0500	0.0168
	8.000	7.28	0.532		0.0735	0.0177
	4.000	7.10	0.535		0.0712	0.0181
	2.000	6.45	0.546		0.0663	0.0201
	0.500	4.80	0.573		0.0496	0.0218
	2.000	5.81	0.557		0.0591	0.0230
	4.000	6.55	0.544		0.0671	0.0248
	8.000	7.60	0.527		0.0763	0.0253
	16.000	10.46	0.480		0.1058	0.0268
	20.000	11.28	0.466		0.1157	0.0300
	32.000	13.77	0.425		0.1423	0.0350
	8.000	12.45	0.447		0.1257	0.0365
	2.000	10.38	0.481		0.1075	0.0405
	0.250	4.30	0.581		0.0543	0.0519


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
Deformation (in.)
0.0005
0.0005
0.0005
0.0005
0.0006
0.0006
0.0006

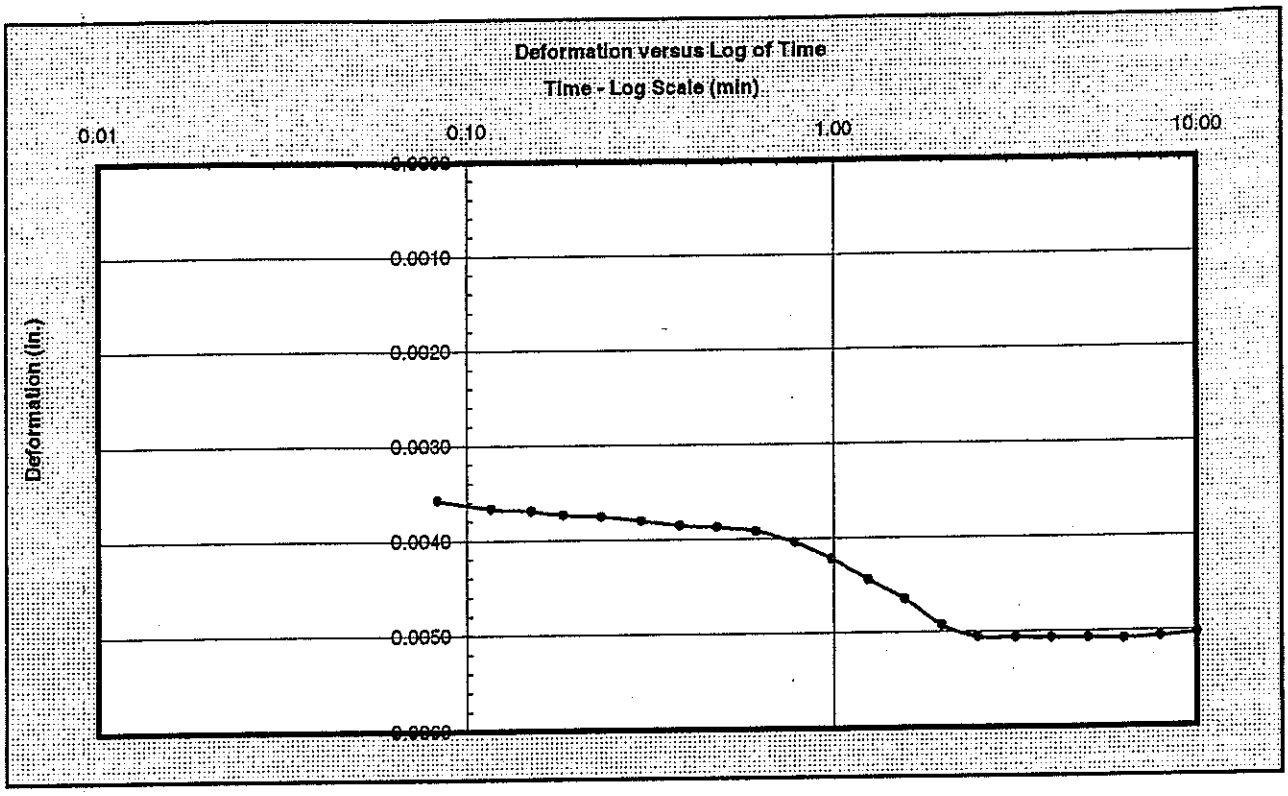

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
Deformation (in.)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006

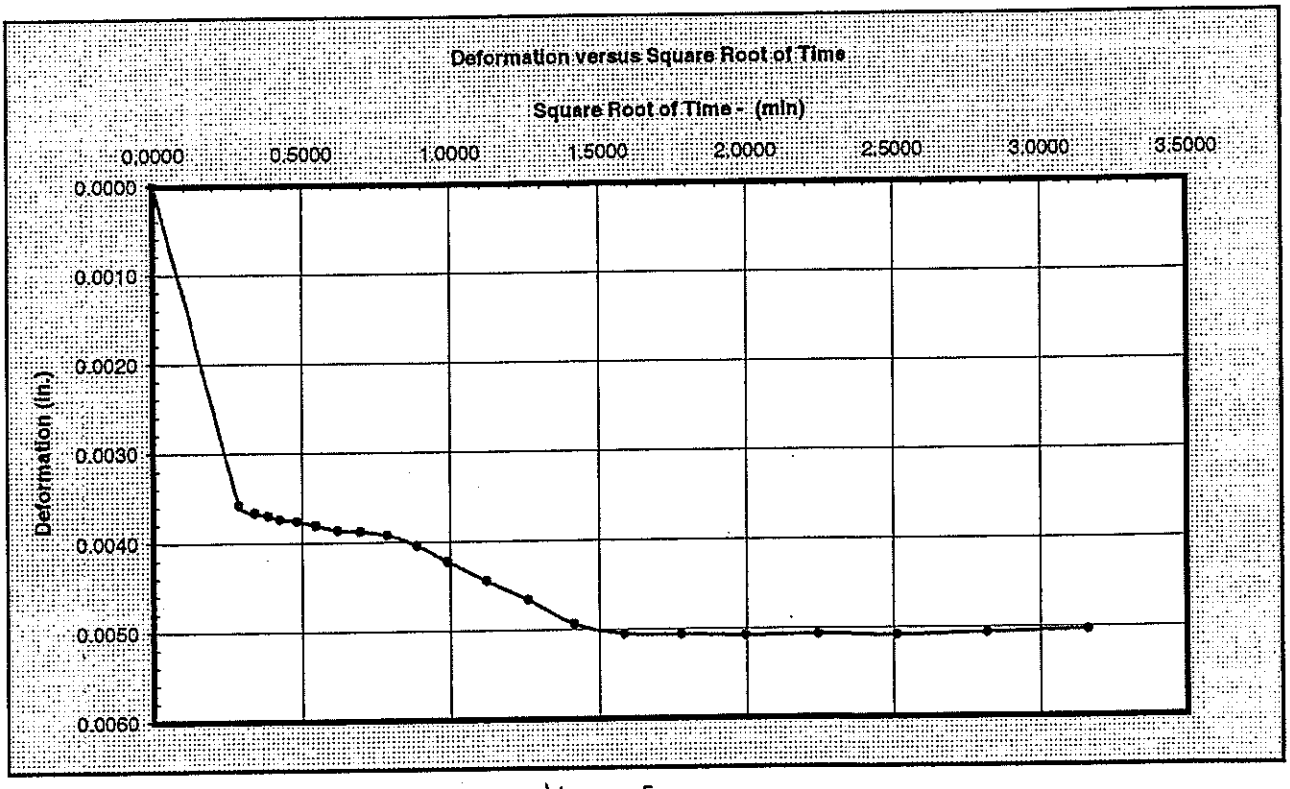
Seating


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
Deformation (in.)
0.0005
0.0005
0.0005
0.0005
0.0006
0.0006

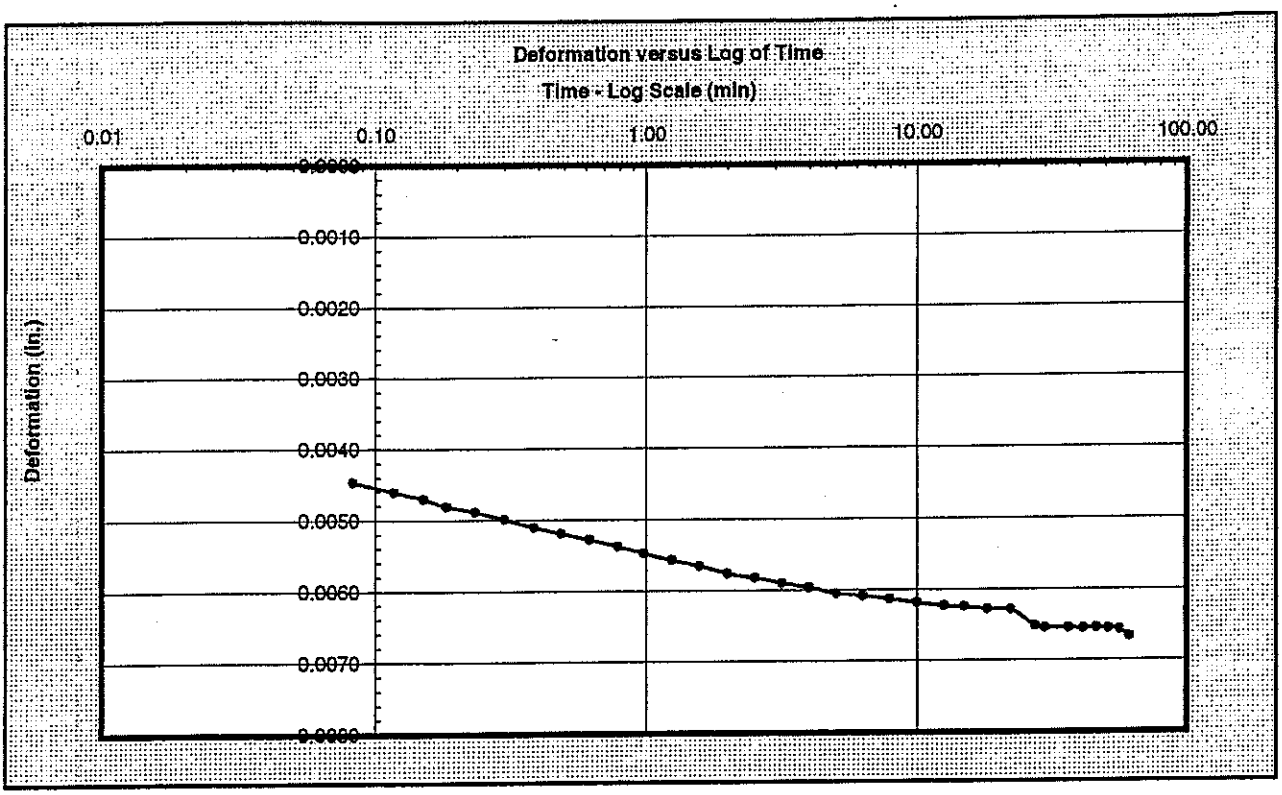

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
Deformation (in.)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006

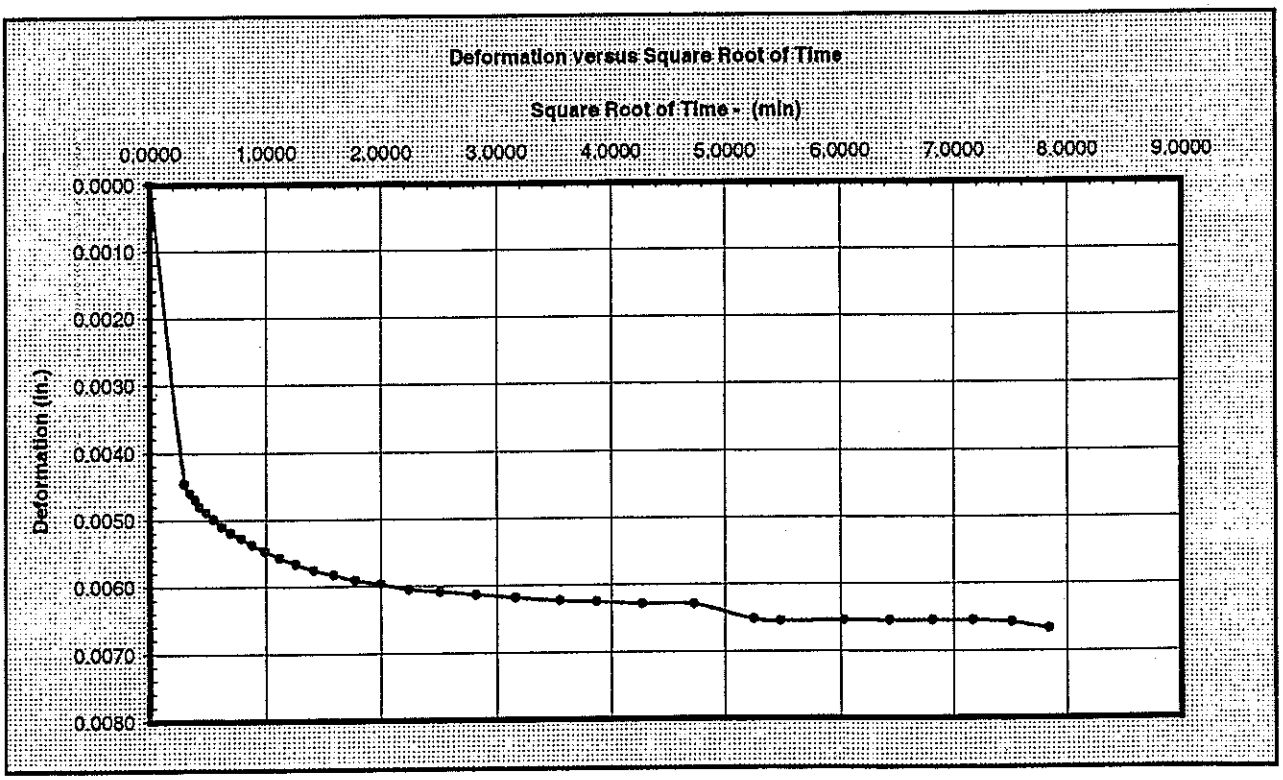
1/8 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
Deformation (in.)

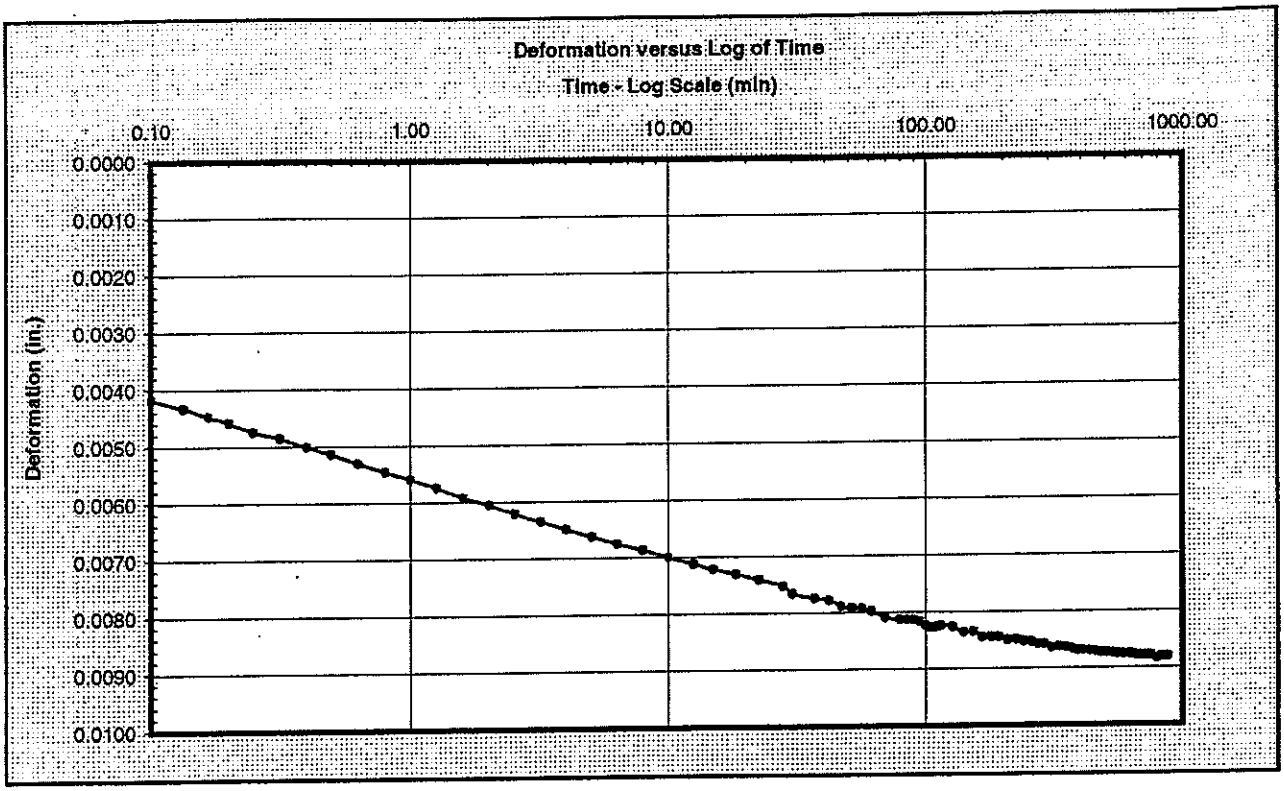

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
3.5000
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
Deformation (in.)

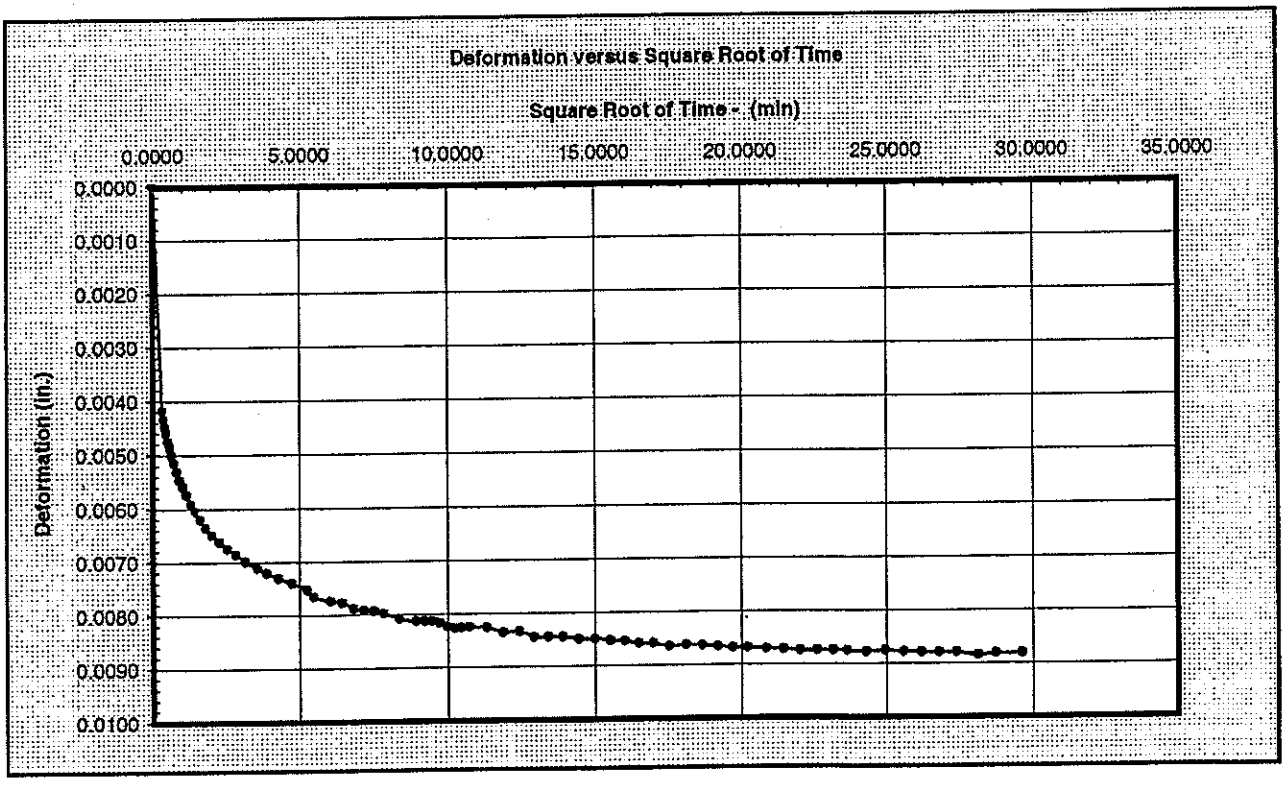
1/4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
Deformation (in.)
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070

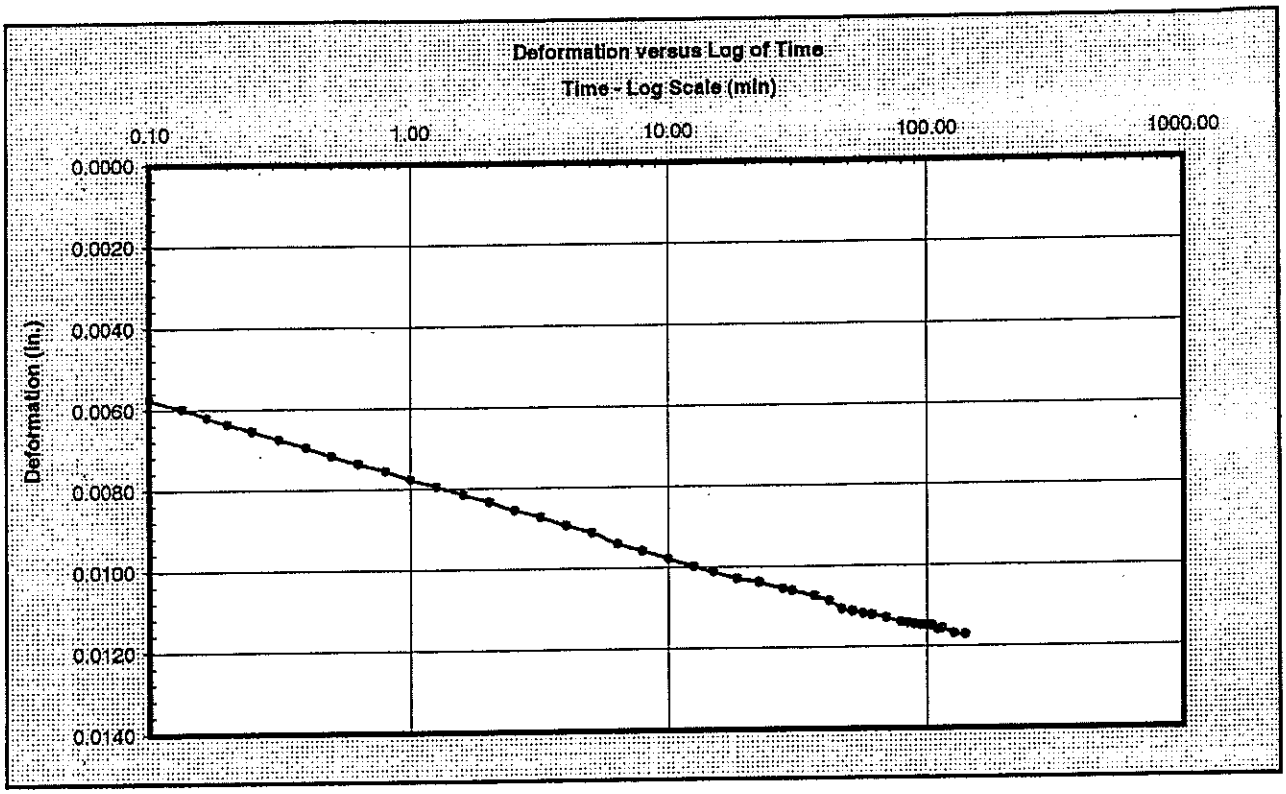

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080

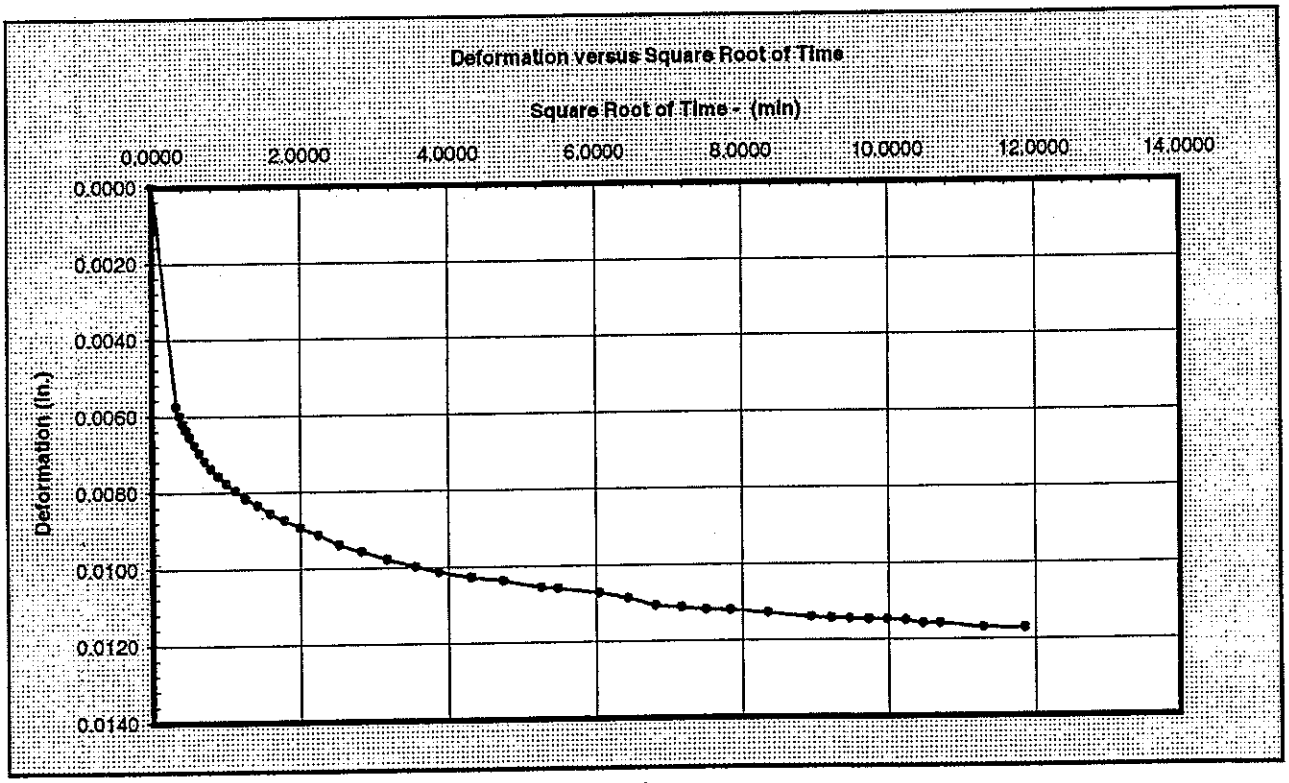
½ tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

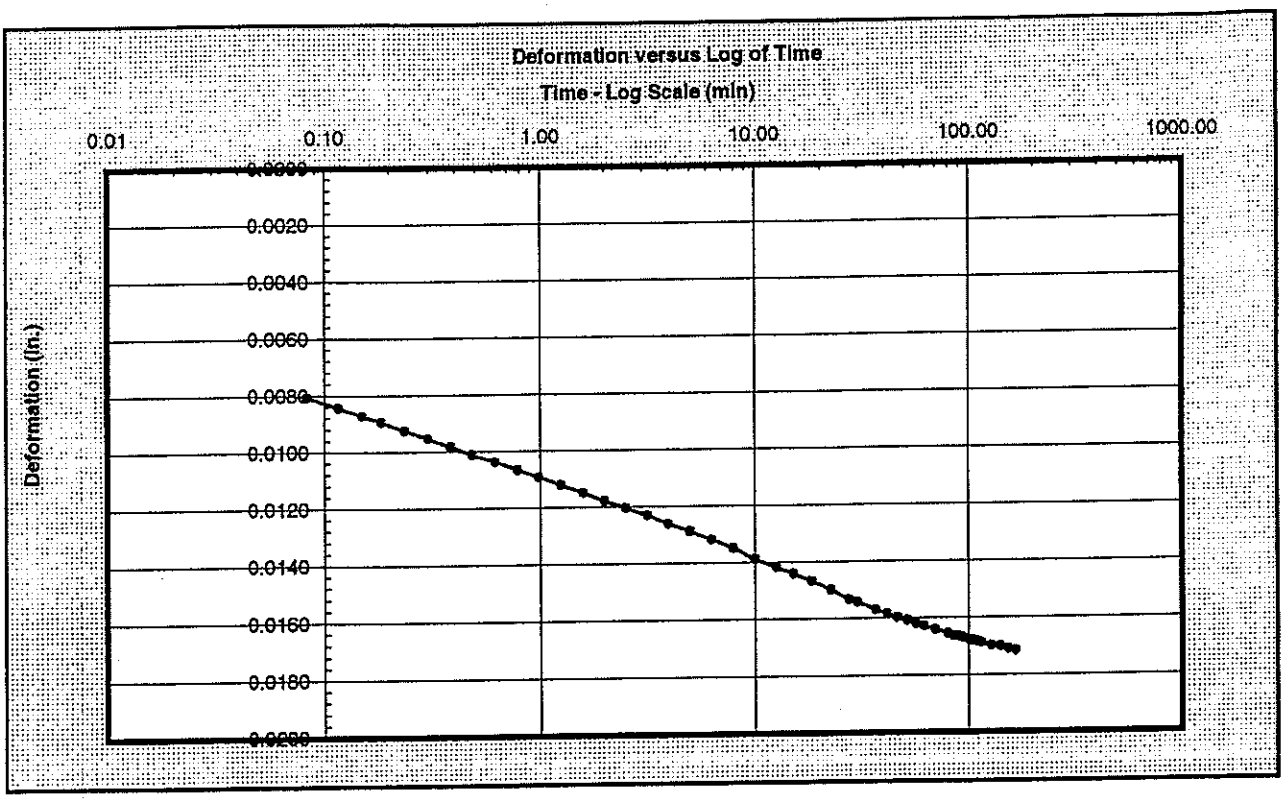

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

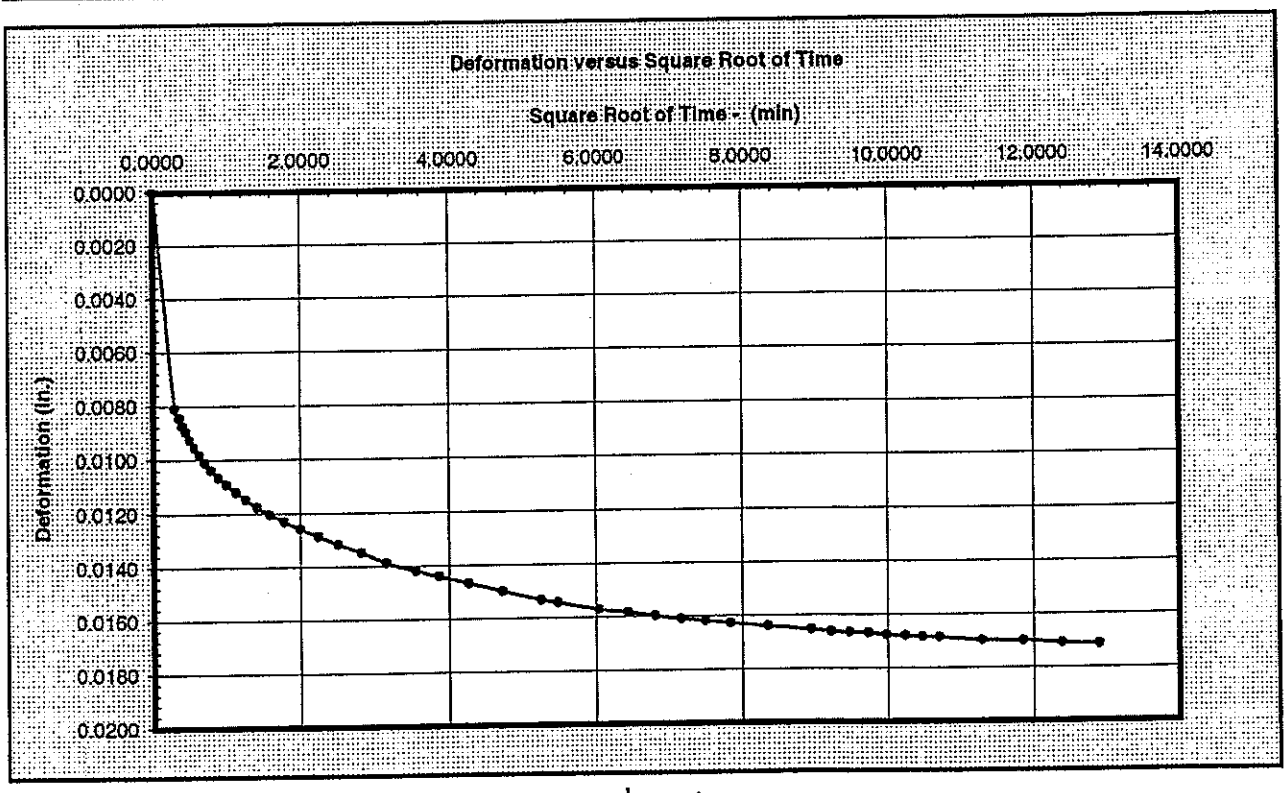
1 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
Deformation (in.)

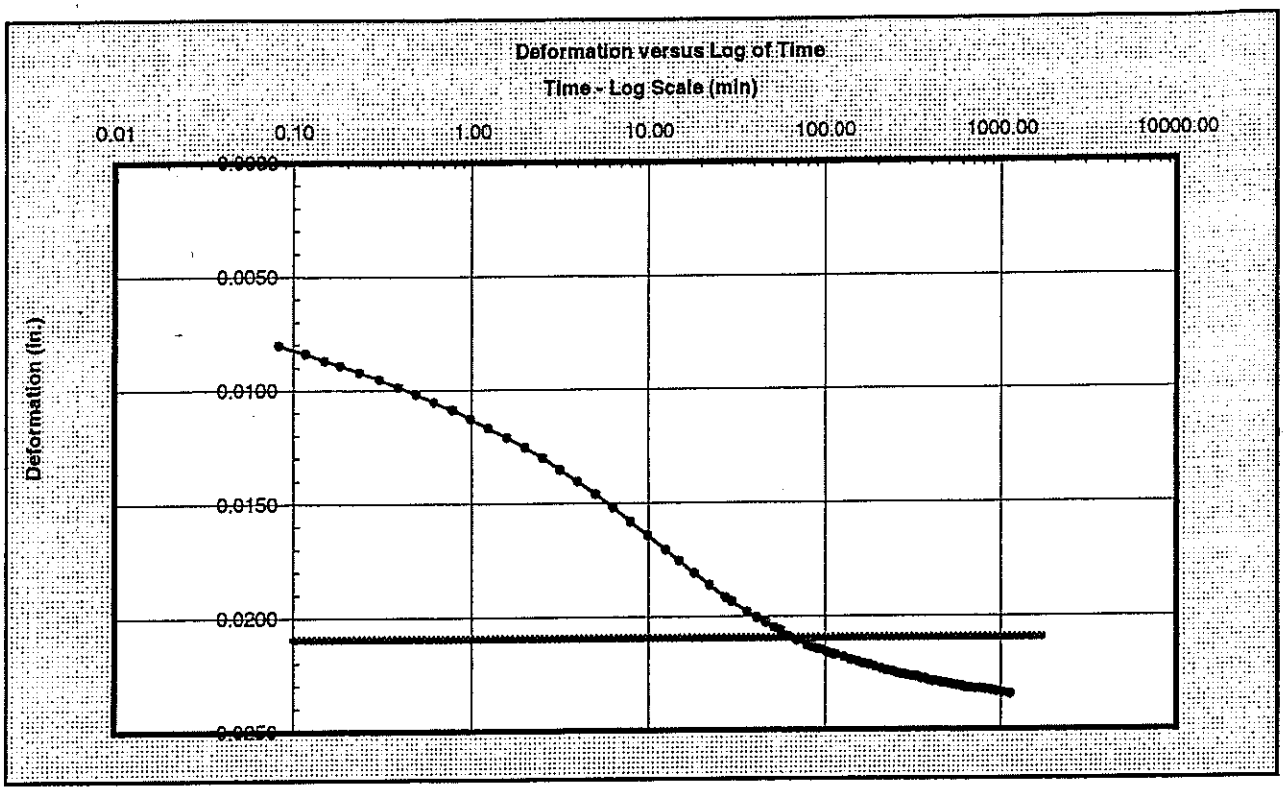

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
Deformation (in.)

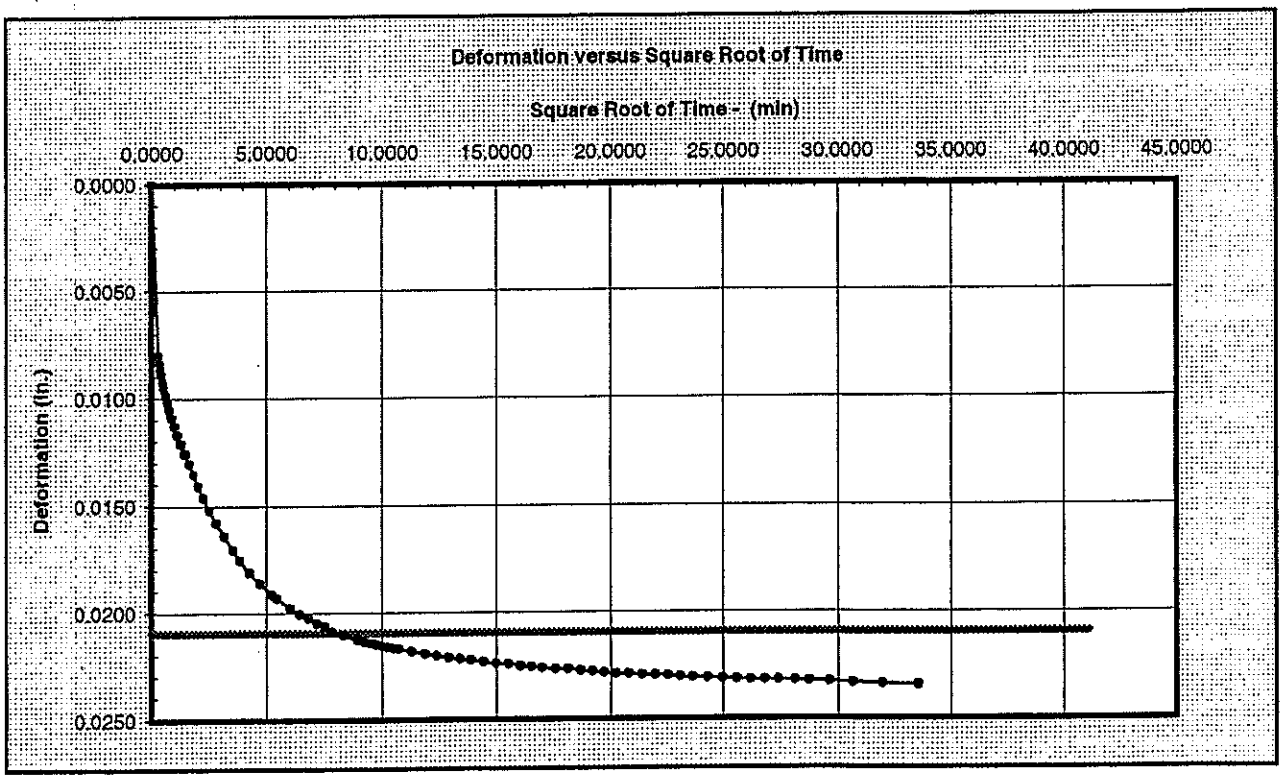
2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
0.0160
0.0180

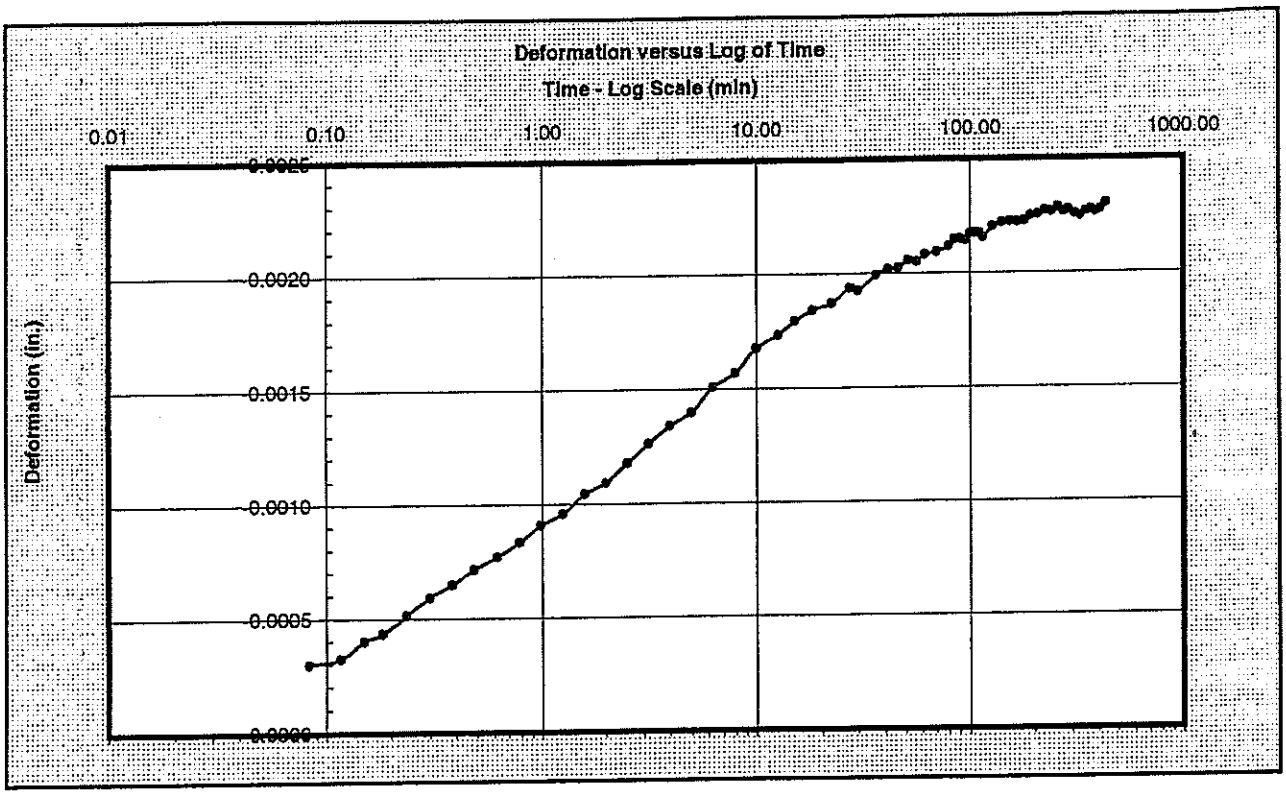

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
Deformation (in.)
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
0.0140
0.0160
0.0180
0.0200

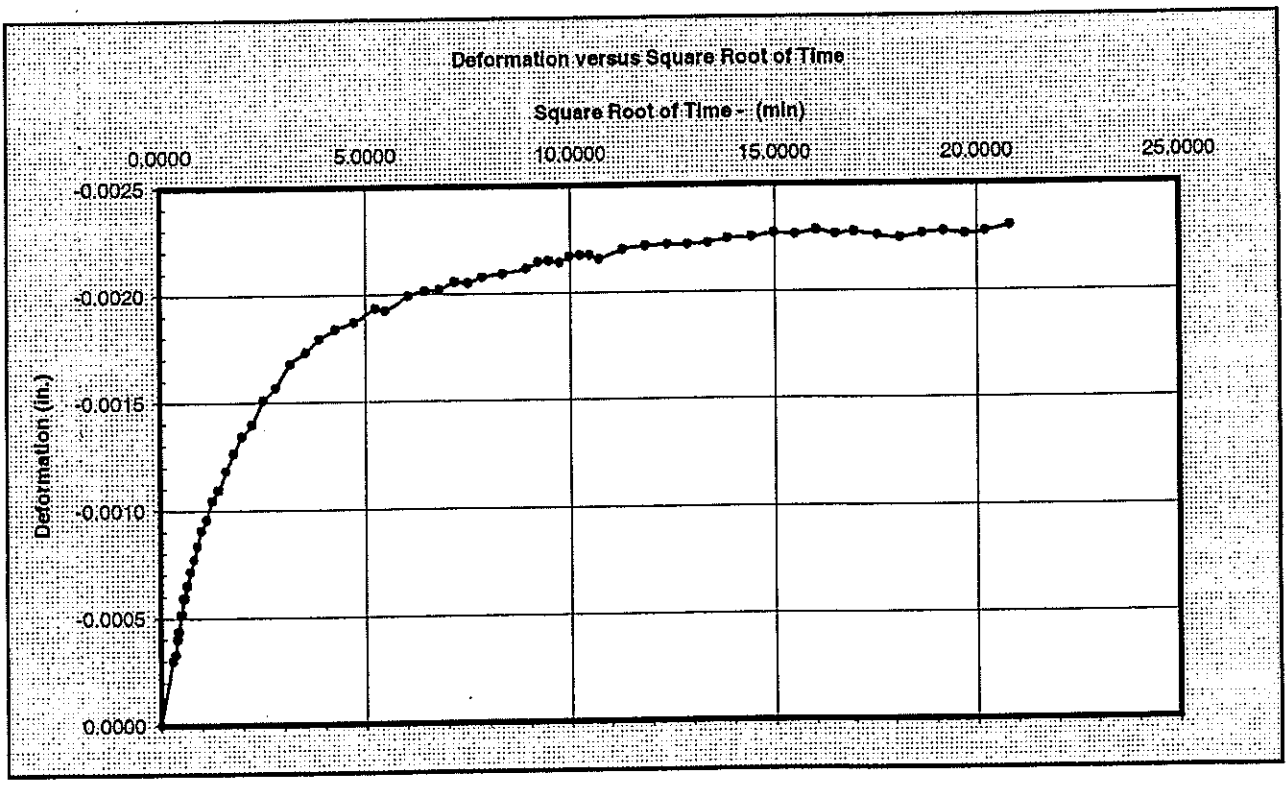
4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
Deformation (in.)

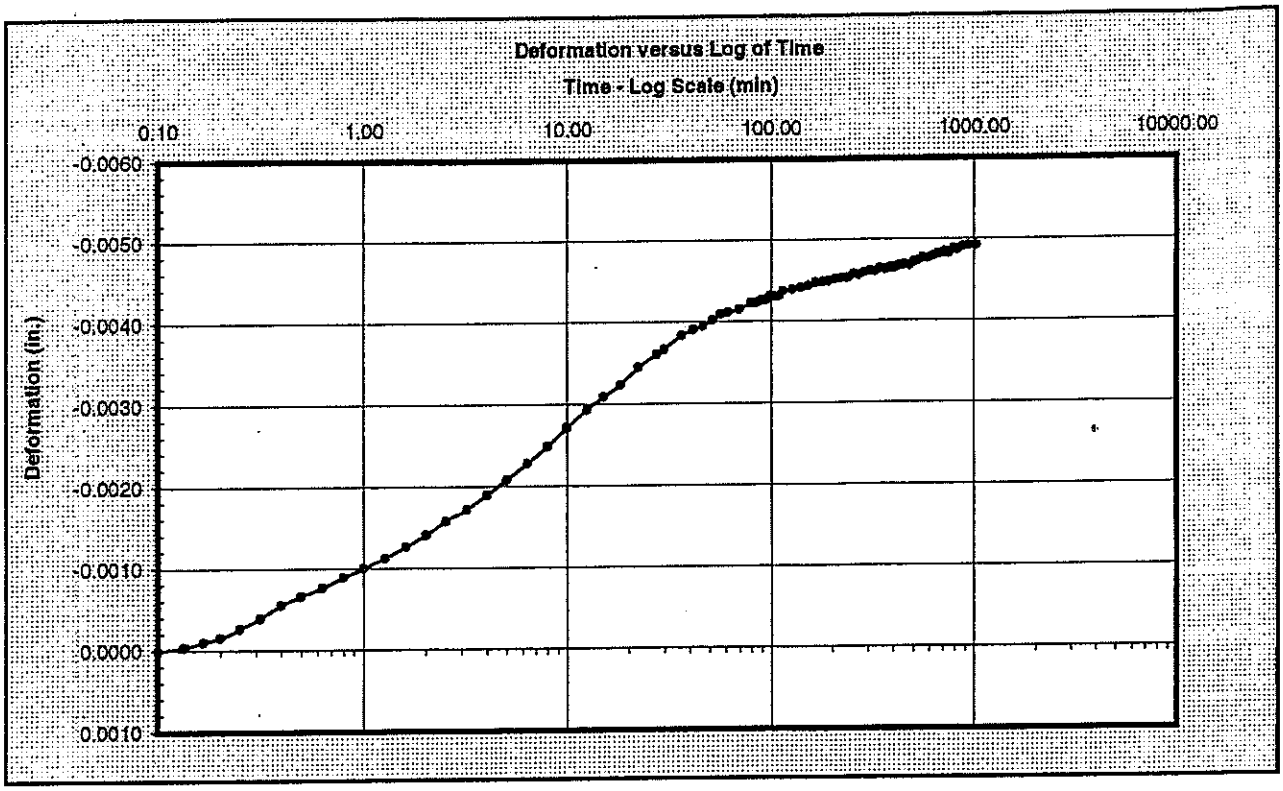

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
Deformation (in.)

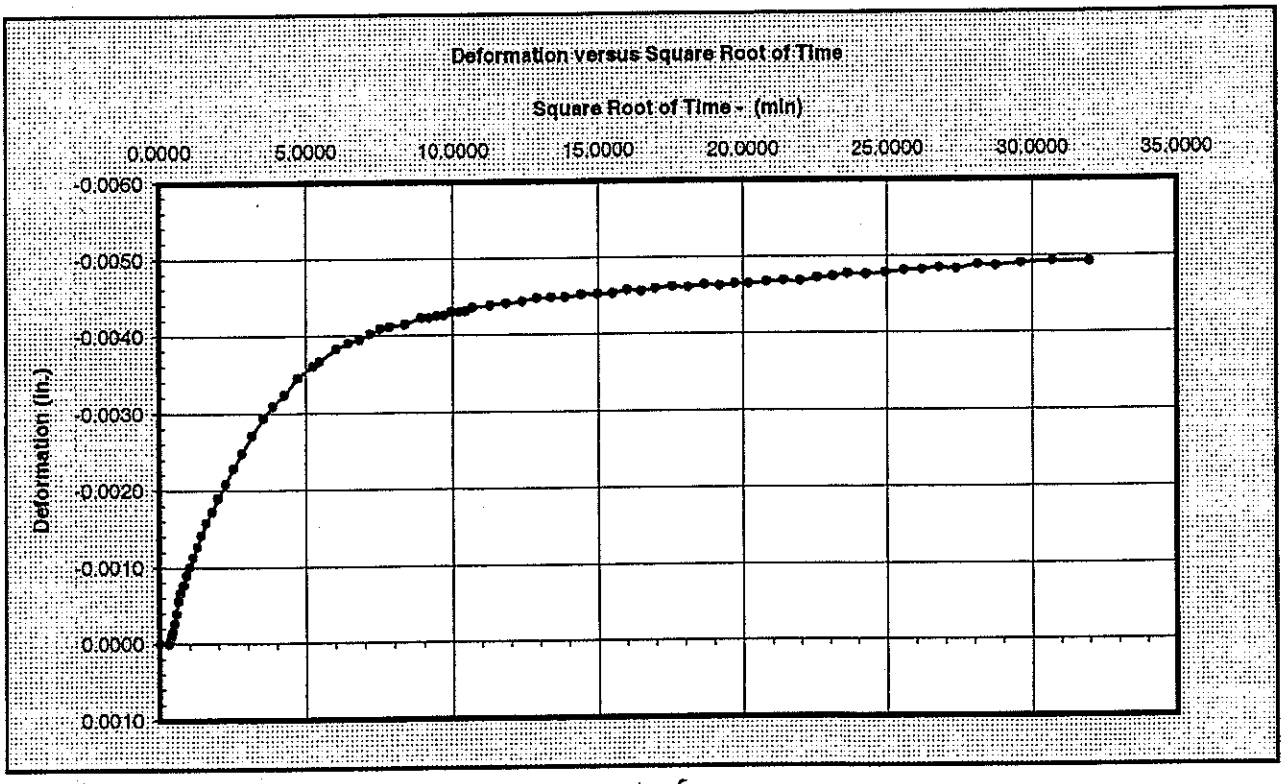
8 of 8


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0020
0.0015
0.0010
0.0005

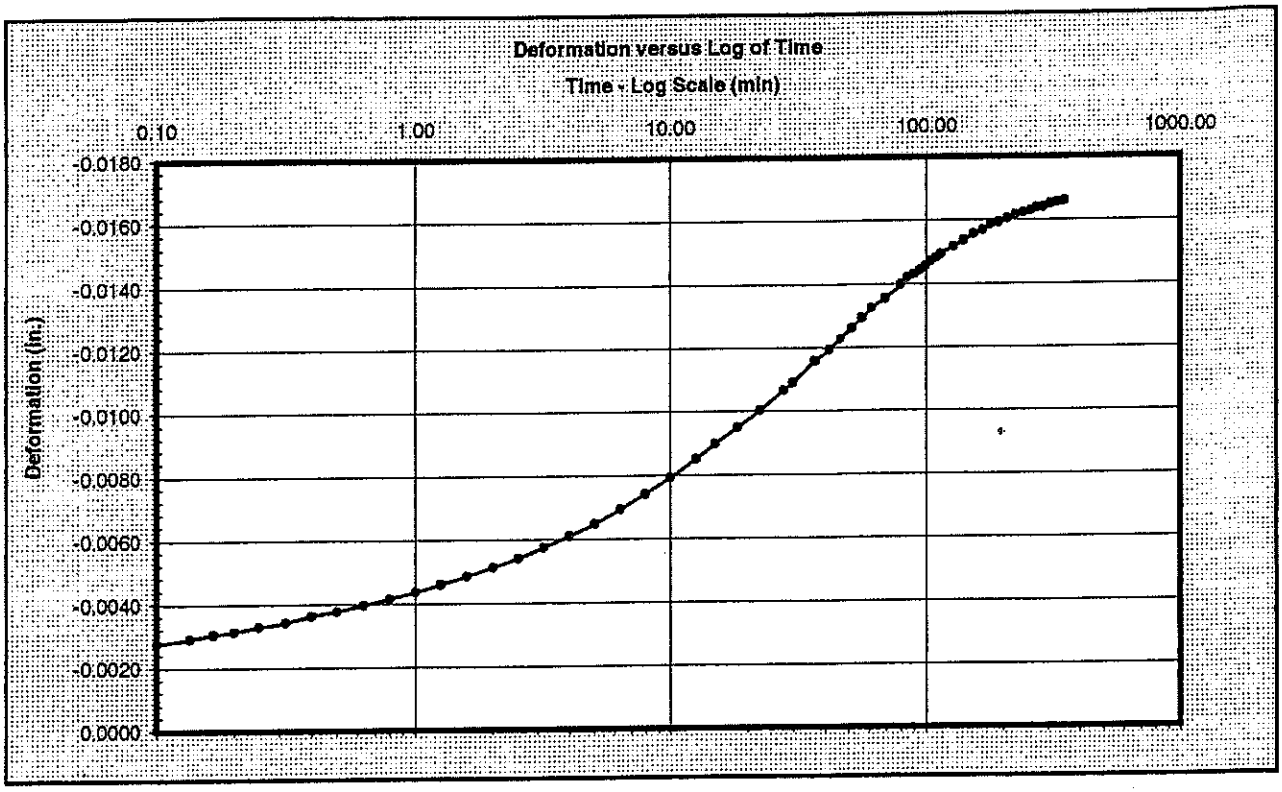

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
Deformation (in.)
-0.0025
-0.0020
-0.0015
-0.0010
-0.0005
0.0000

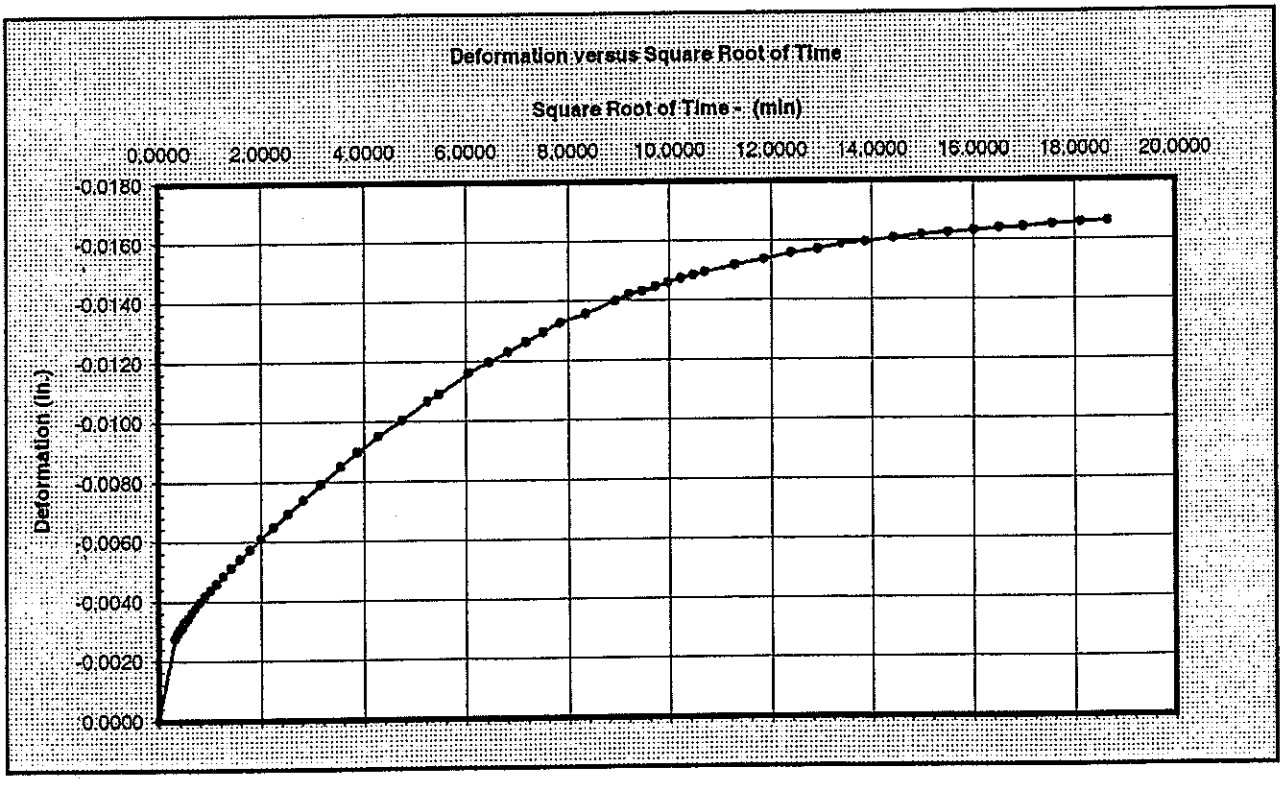
-4 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
-0.0060
-0.0050
-0.0040
-0.0030
-0.0020
-0.0010
0.0000
0.0010
Deformation (in.)

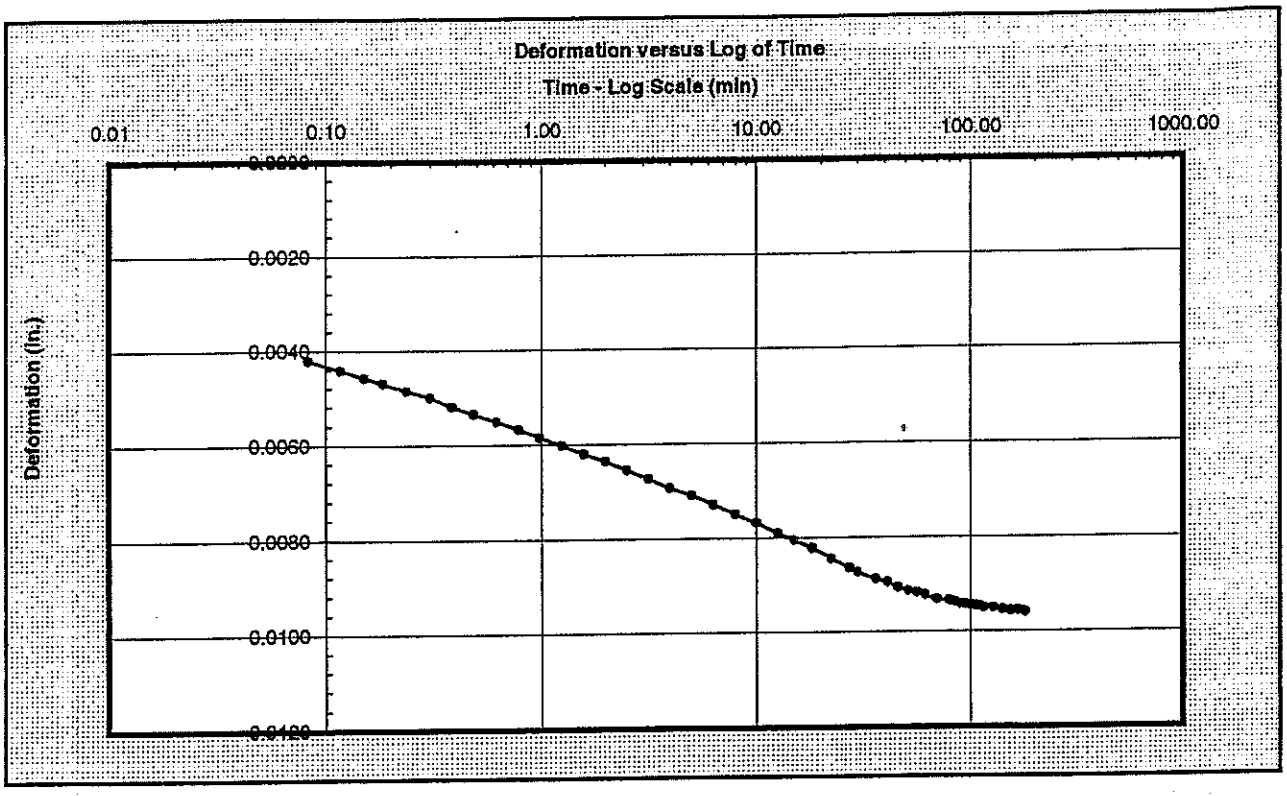

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
-0.0060
-0.0050
-0.0040
-0.0030
-0.0020
-0.0010
0.0000
0.0010
Deformation (in.)

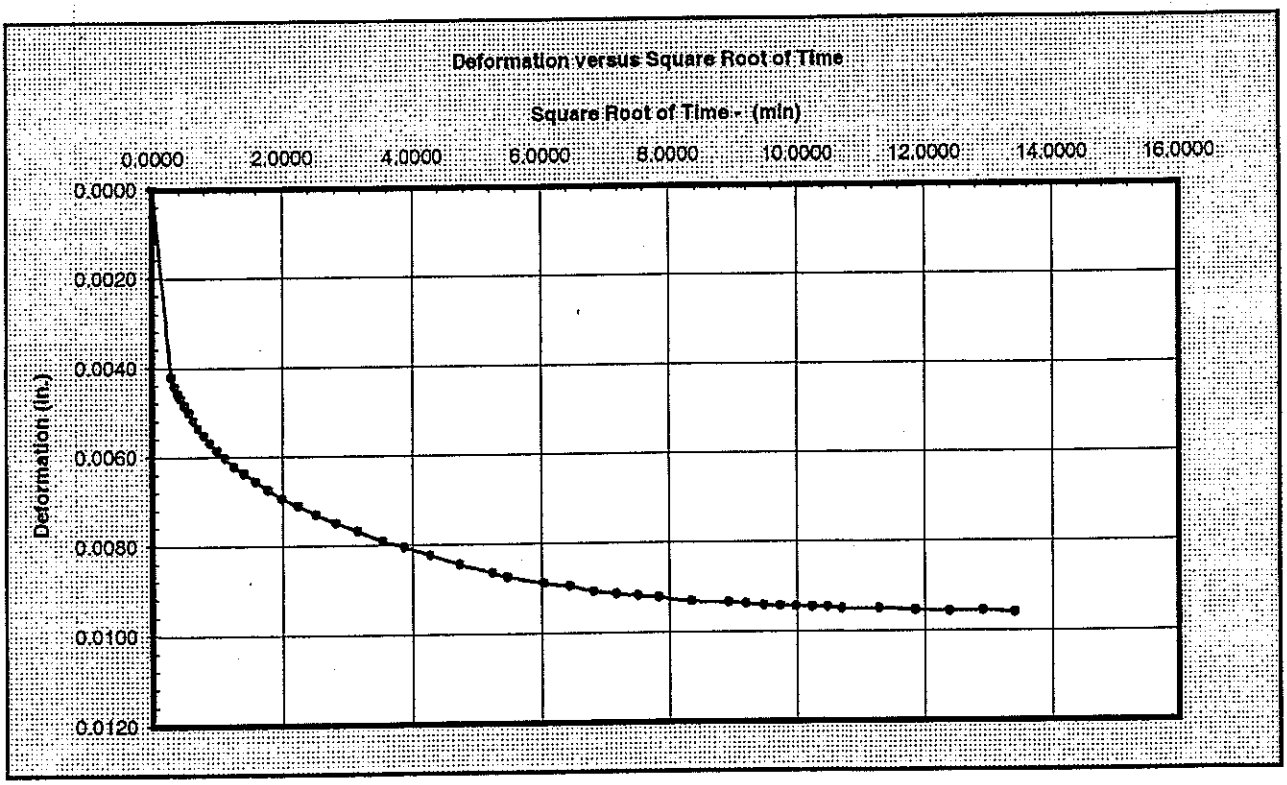
-2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

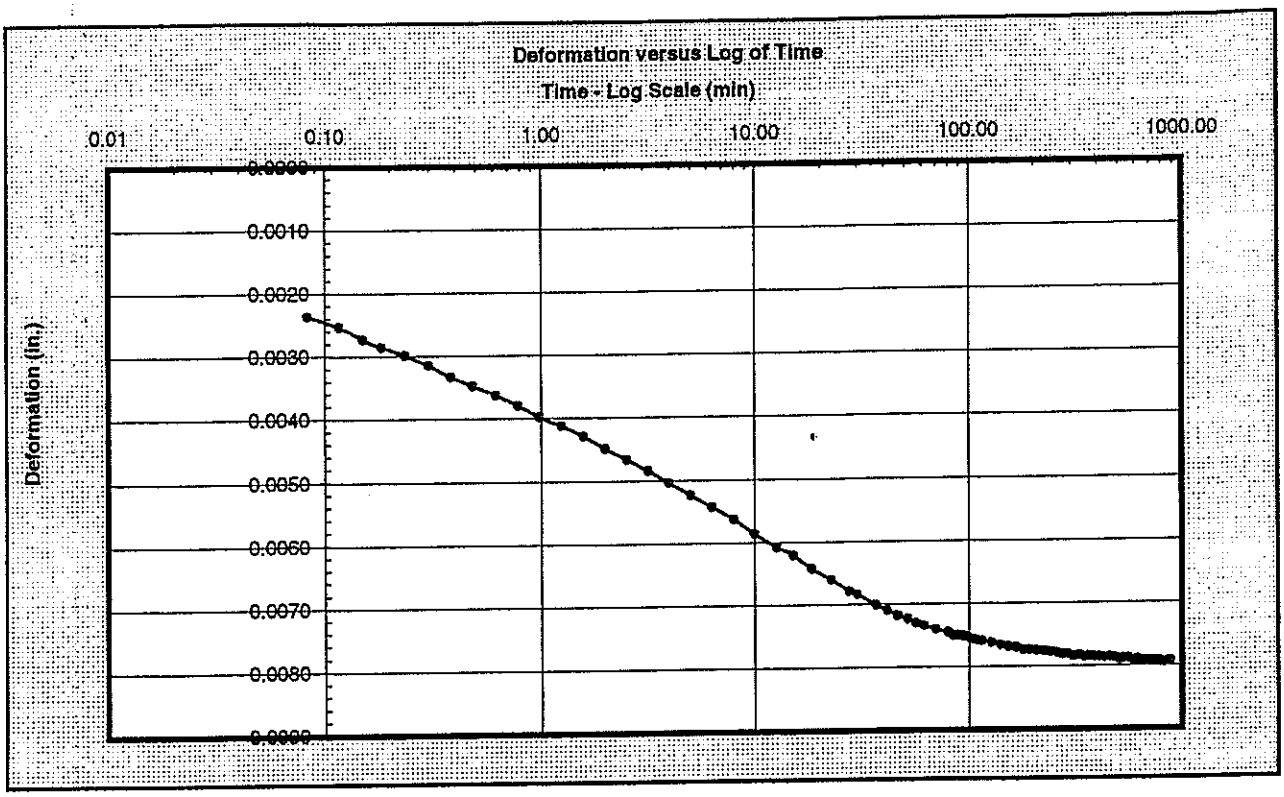

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
18.0000
20.0000
Deformation (in.)
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

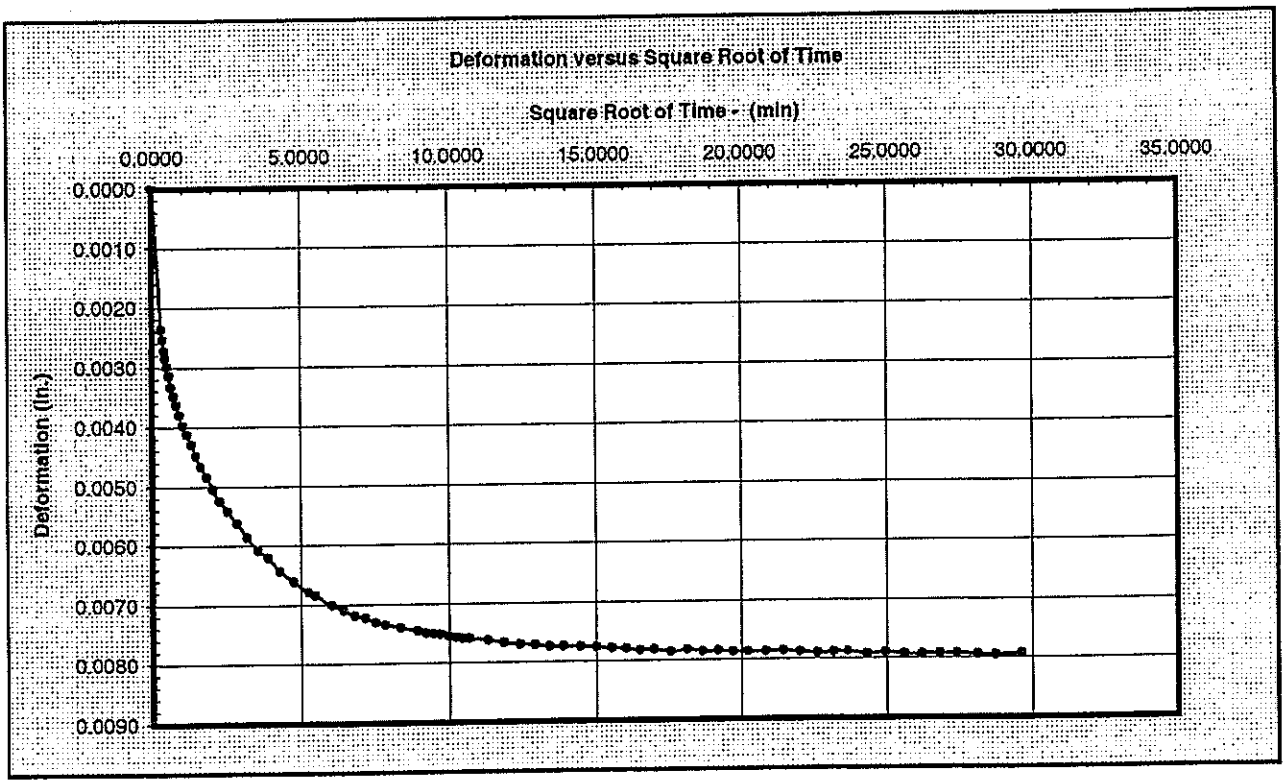
-1/2 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
0.0020
0.0040
0.0060
0.0080
0.0100
Deformation (in.)

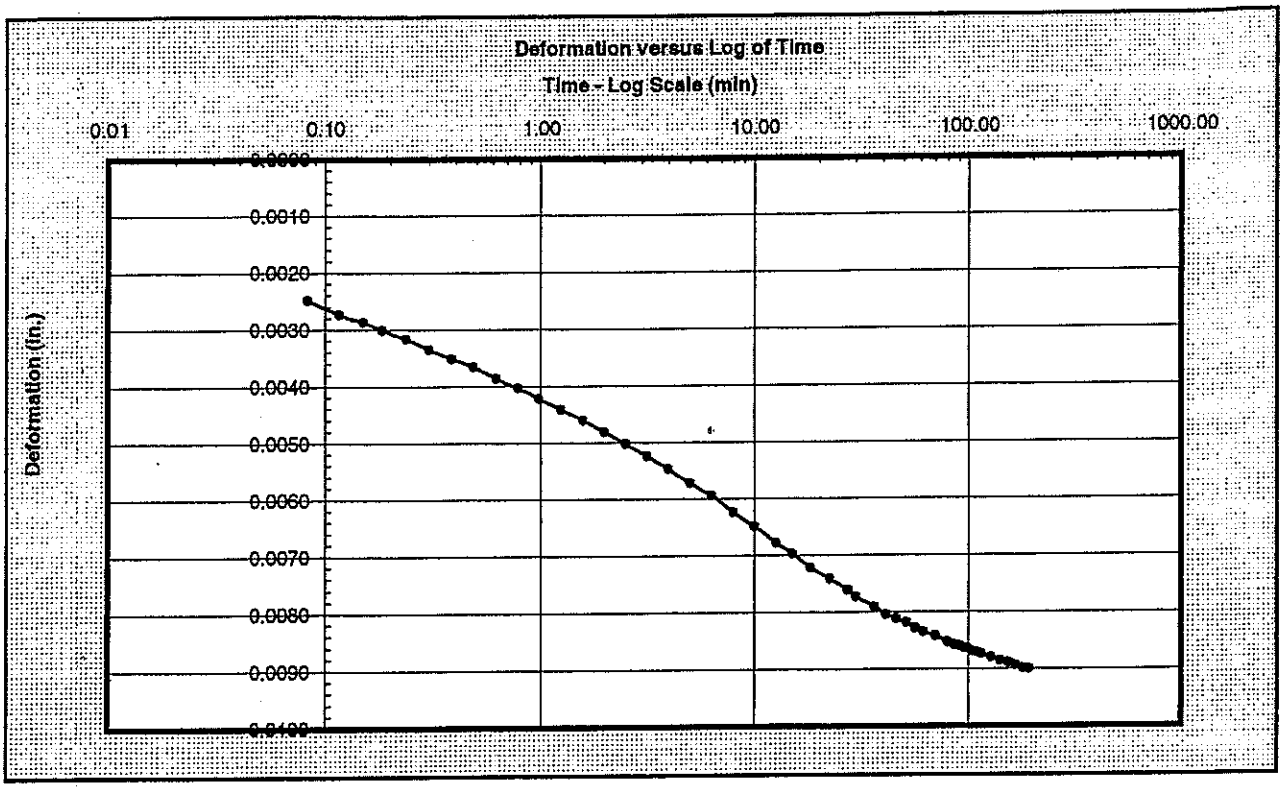

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

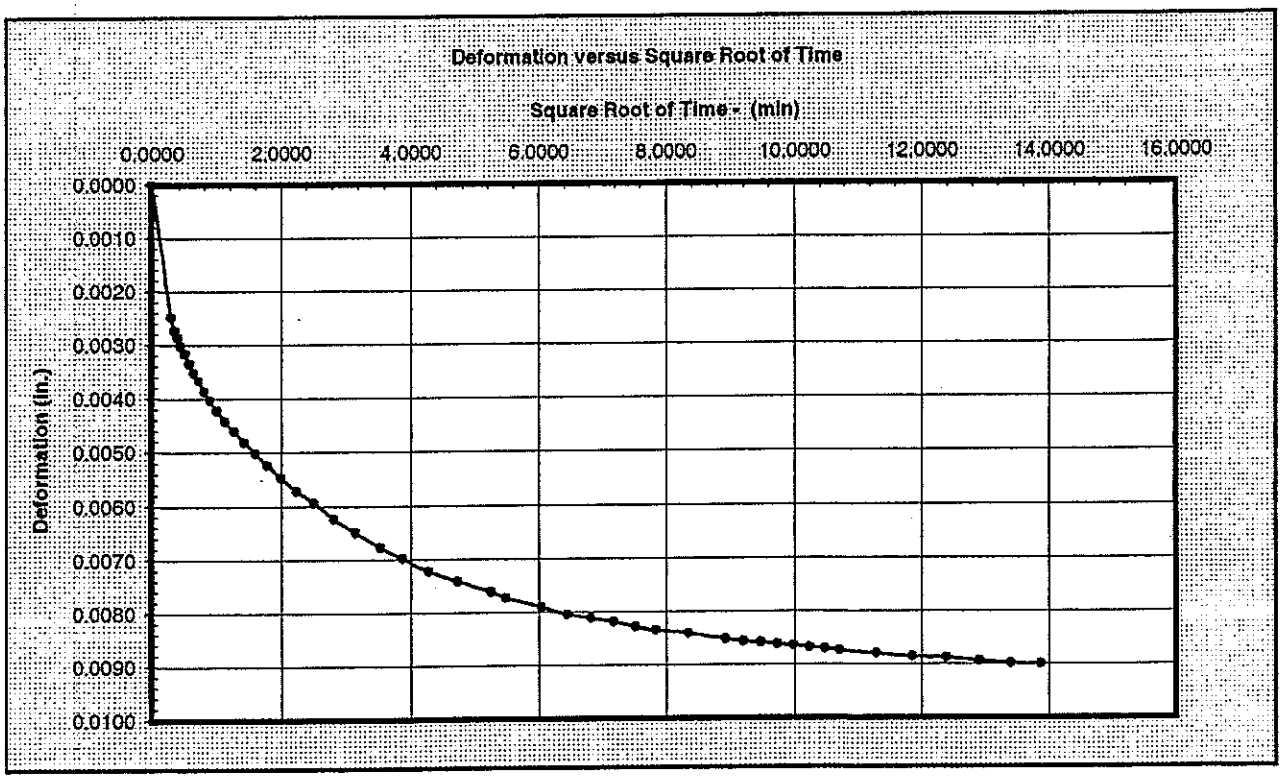
2a tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080

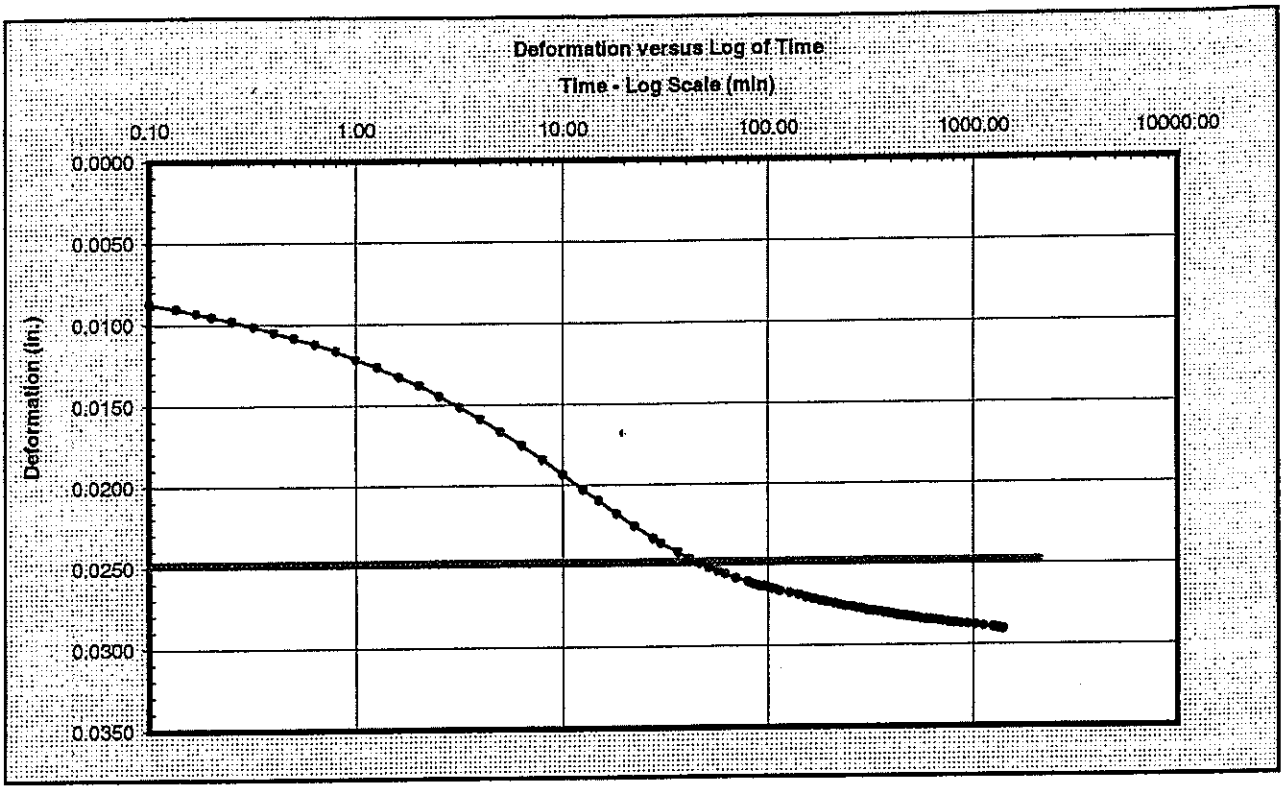

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090

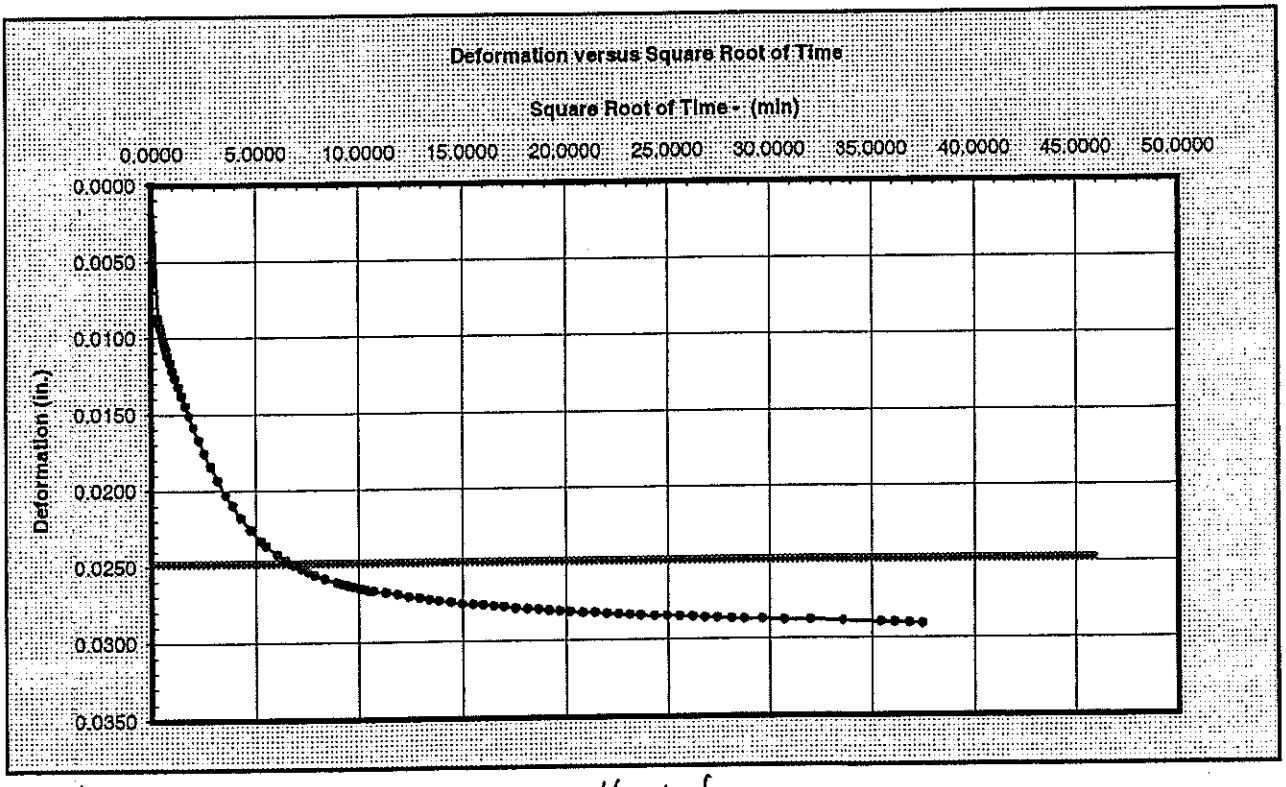
4a tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090

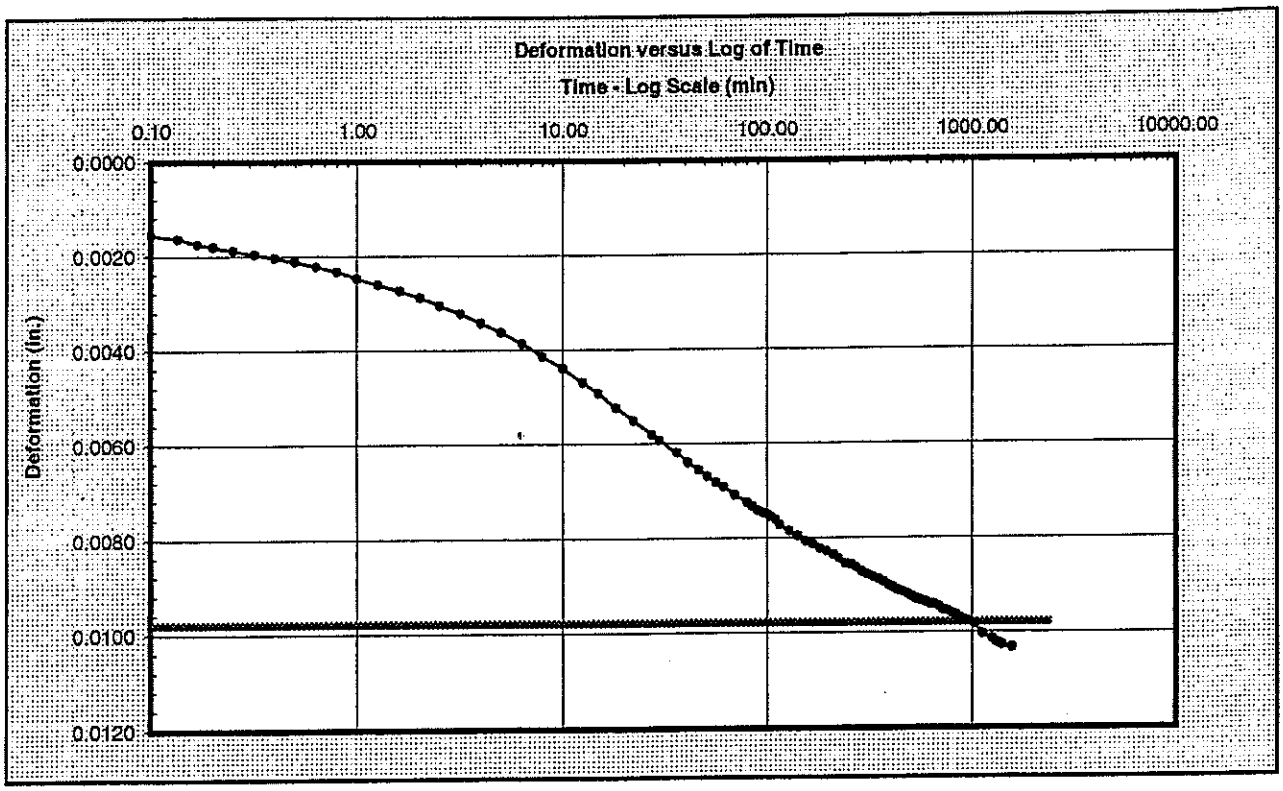

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
2.0000
4.0000
6.0000
8.0000
10.0000
12.0000
14.0000
16.0000
Deformation (in.)
0.0000
0.0010
0.0020
0.0030
0.0040
0.0050
0.0060
0.0070
0.0080
0.0090
0.0100

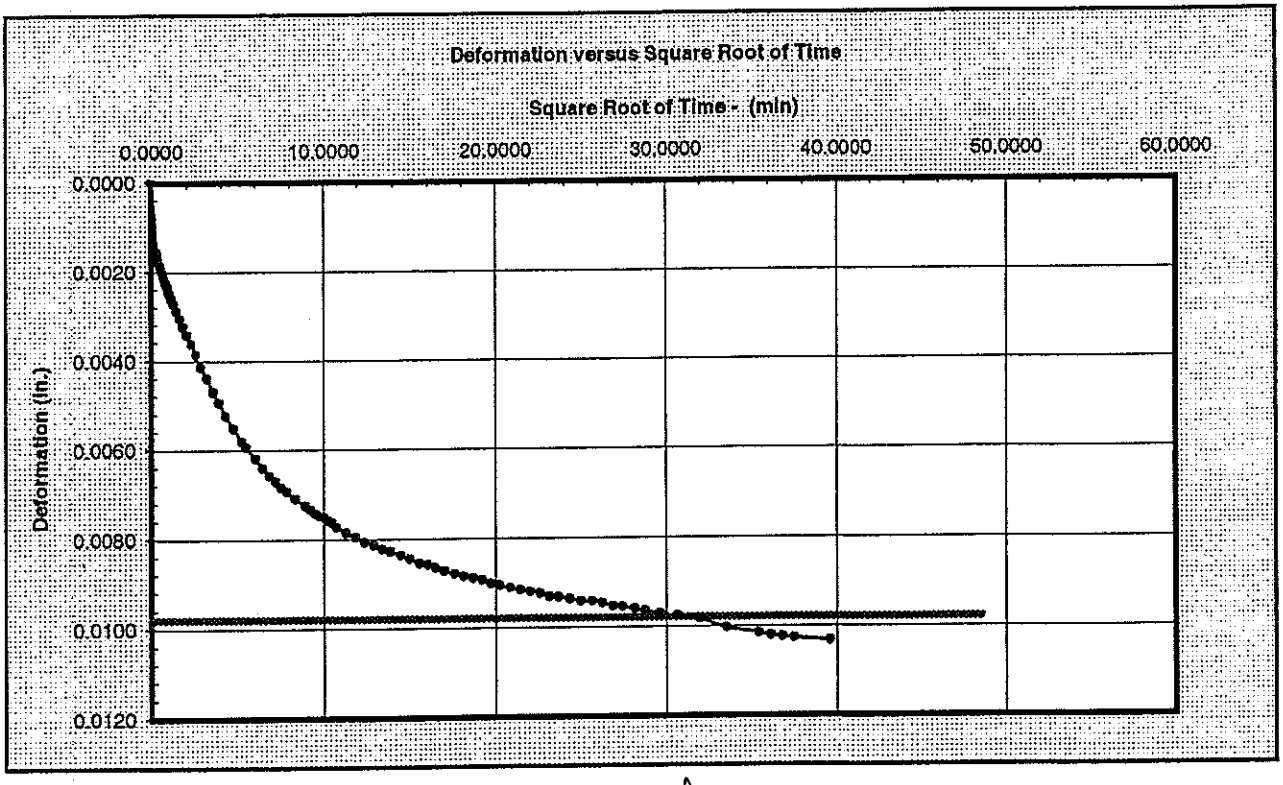
Qa tuf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
Deformation (in.)

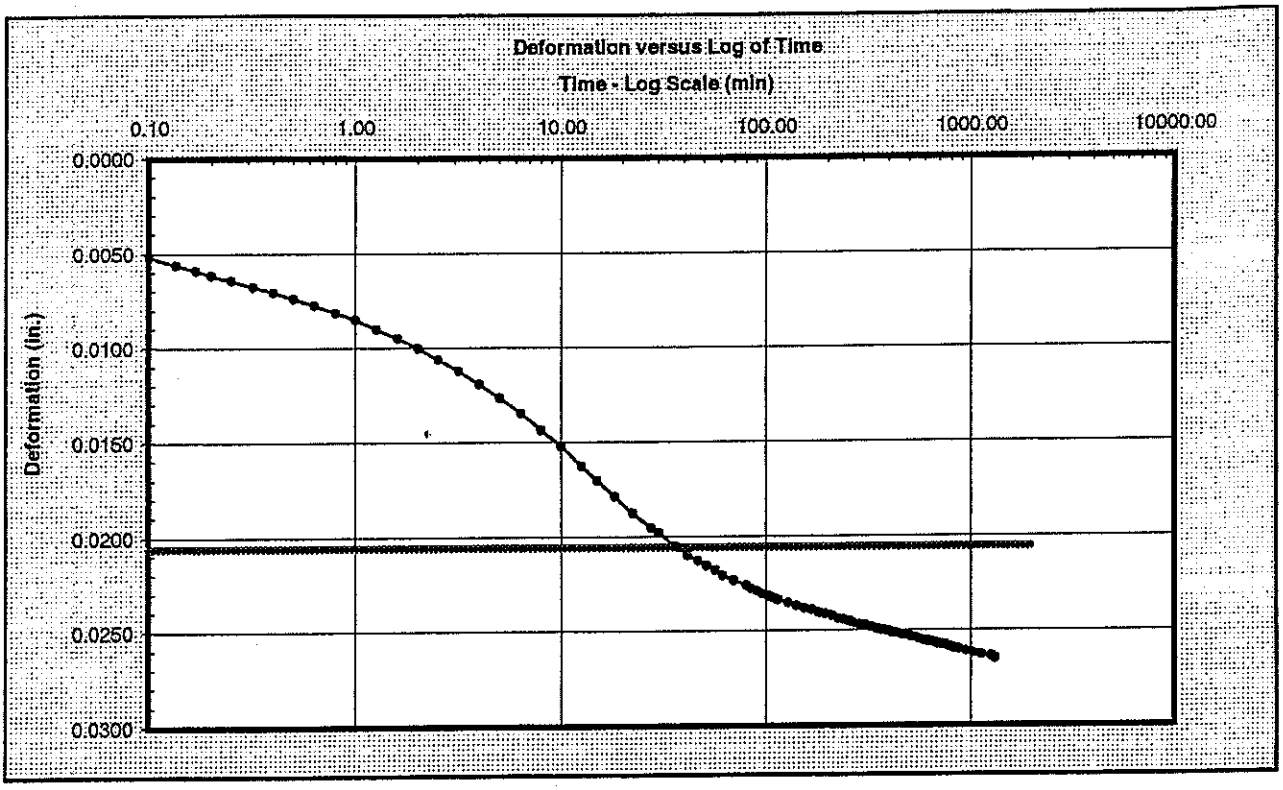

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
50.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
Deformation (in.)

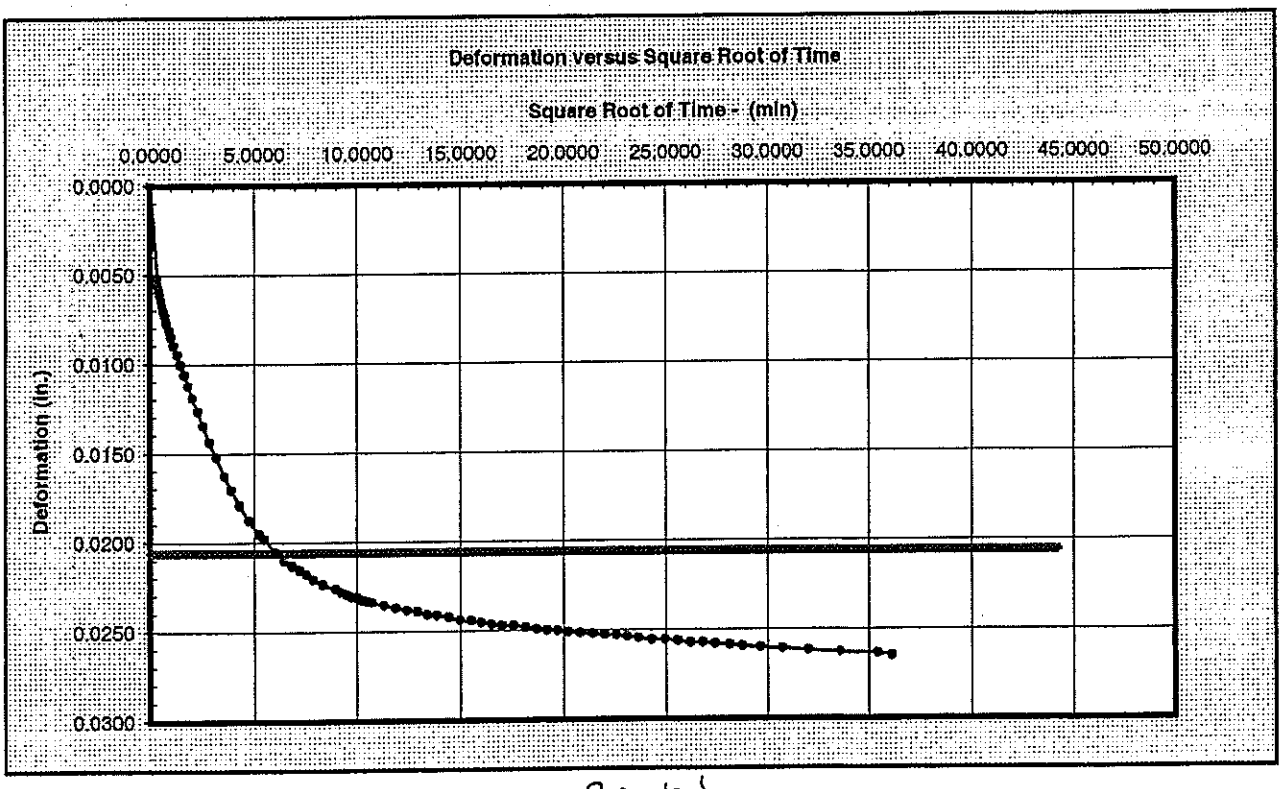
16 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

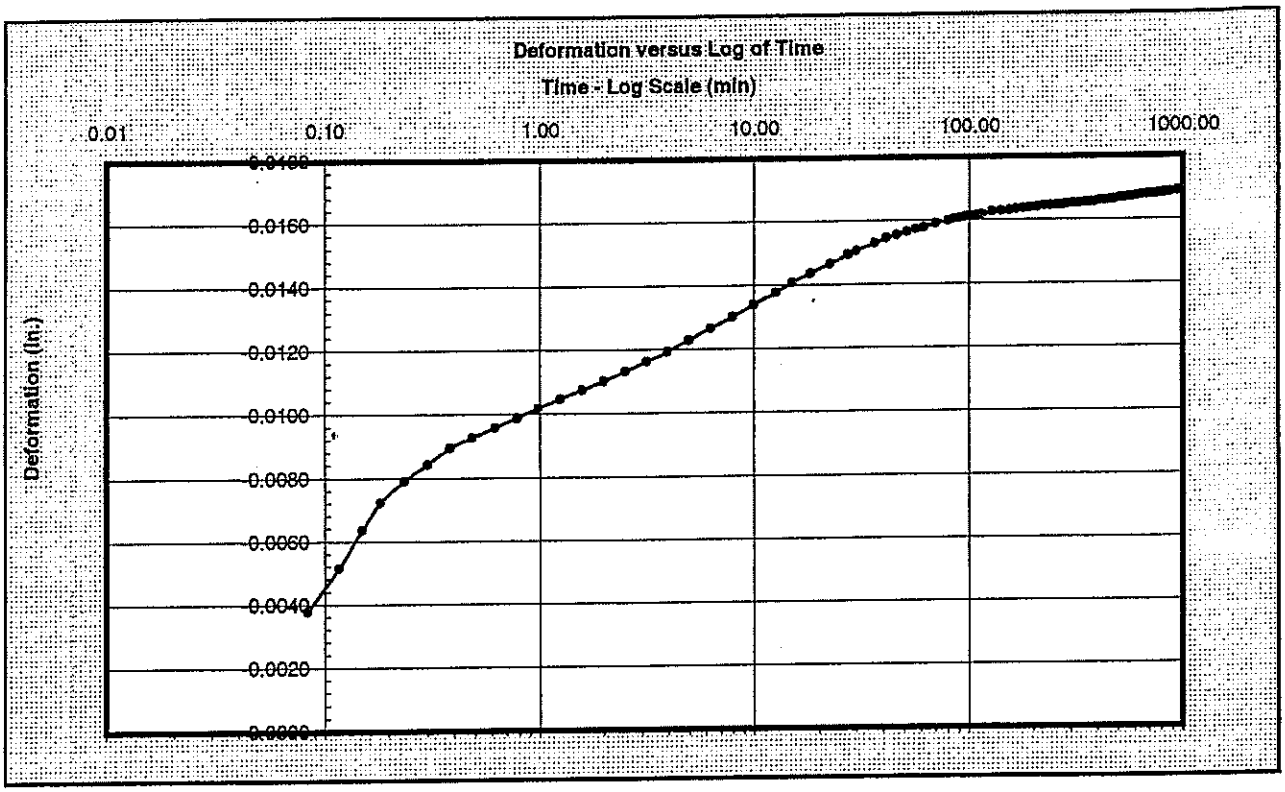

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
10.0000
20.0000
30.0000
40.0000
50.0000
60.0000
0.0000
0.0020
0.0040
0.0060
0.0080
0.0100
0.0120
Deformation (in.)

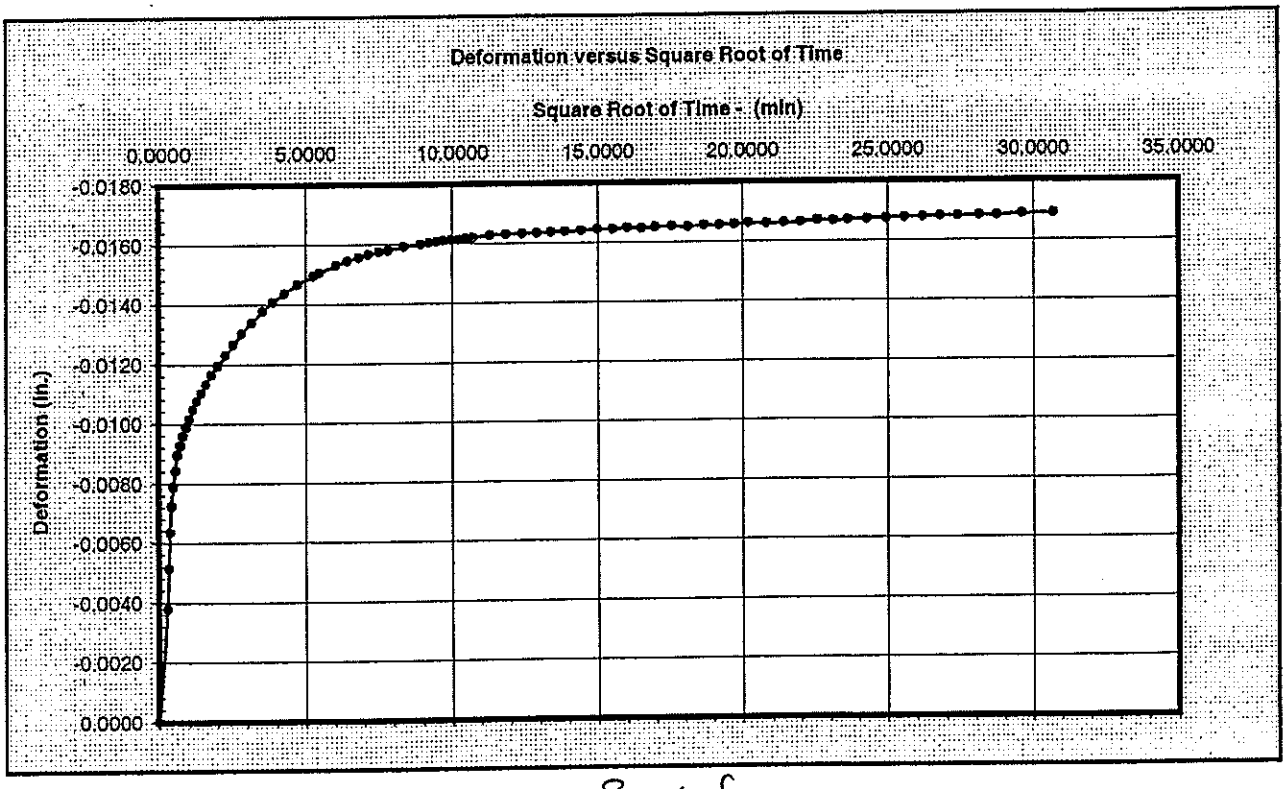
20 tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
Deformation (in.)

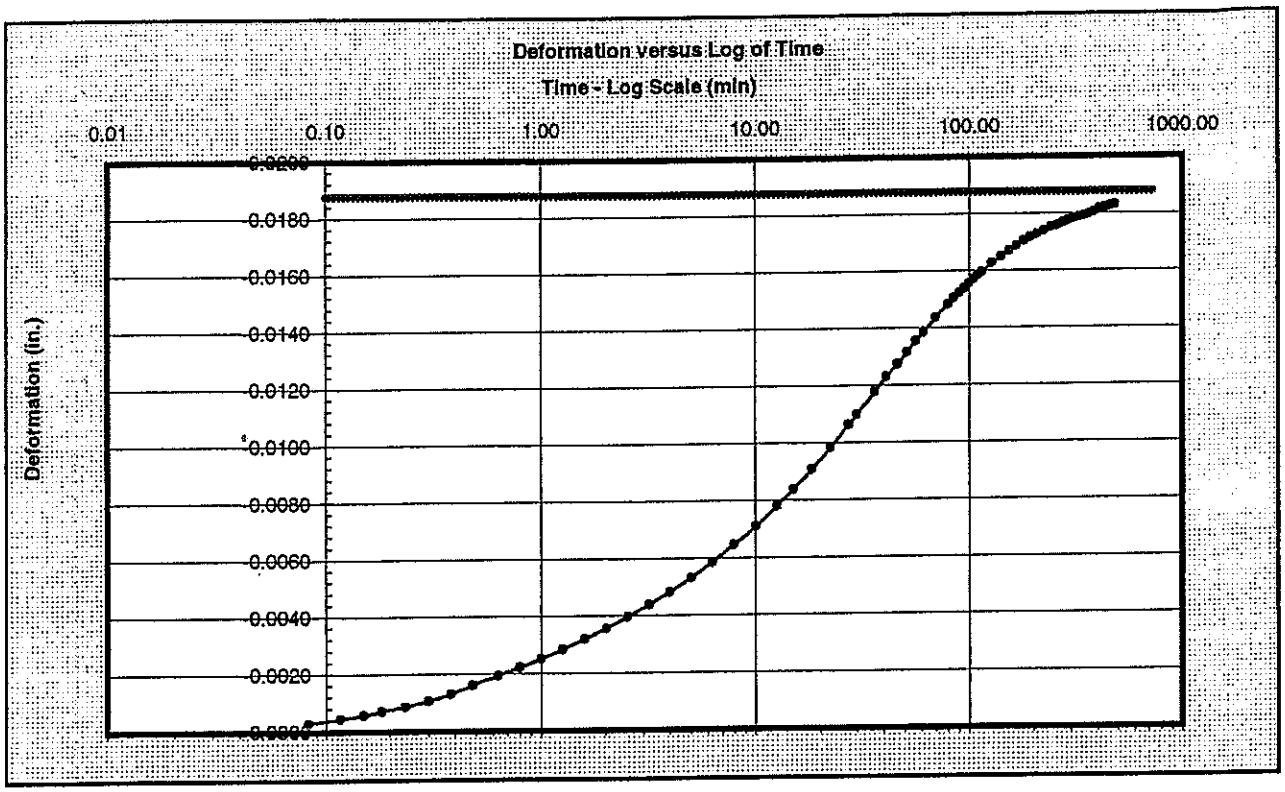

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
40.0000
45.0000
50.0000
0.0000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
Deformation (in.)

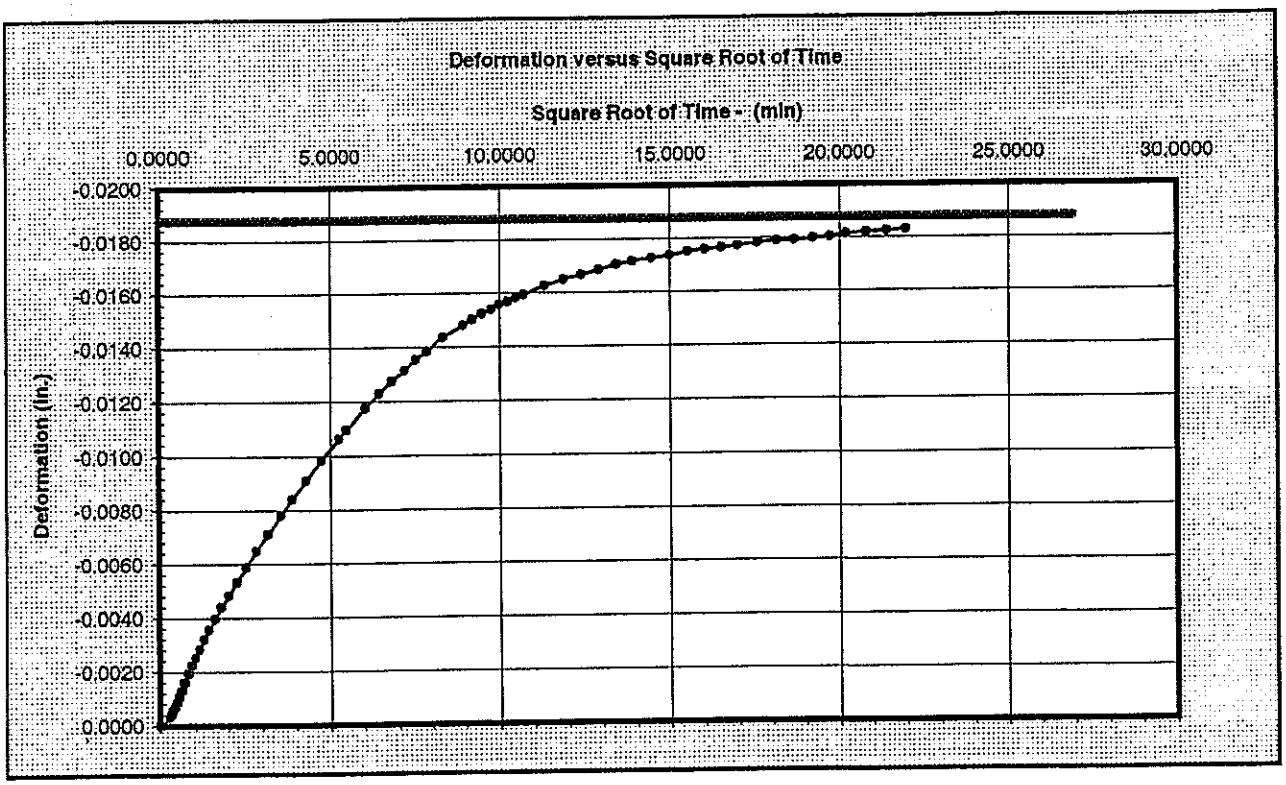
32 tst


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0160
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020

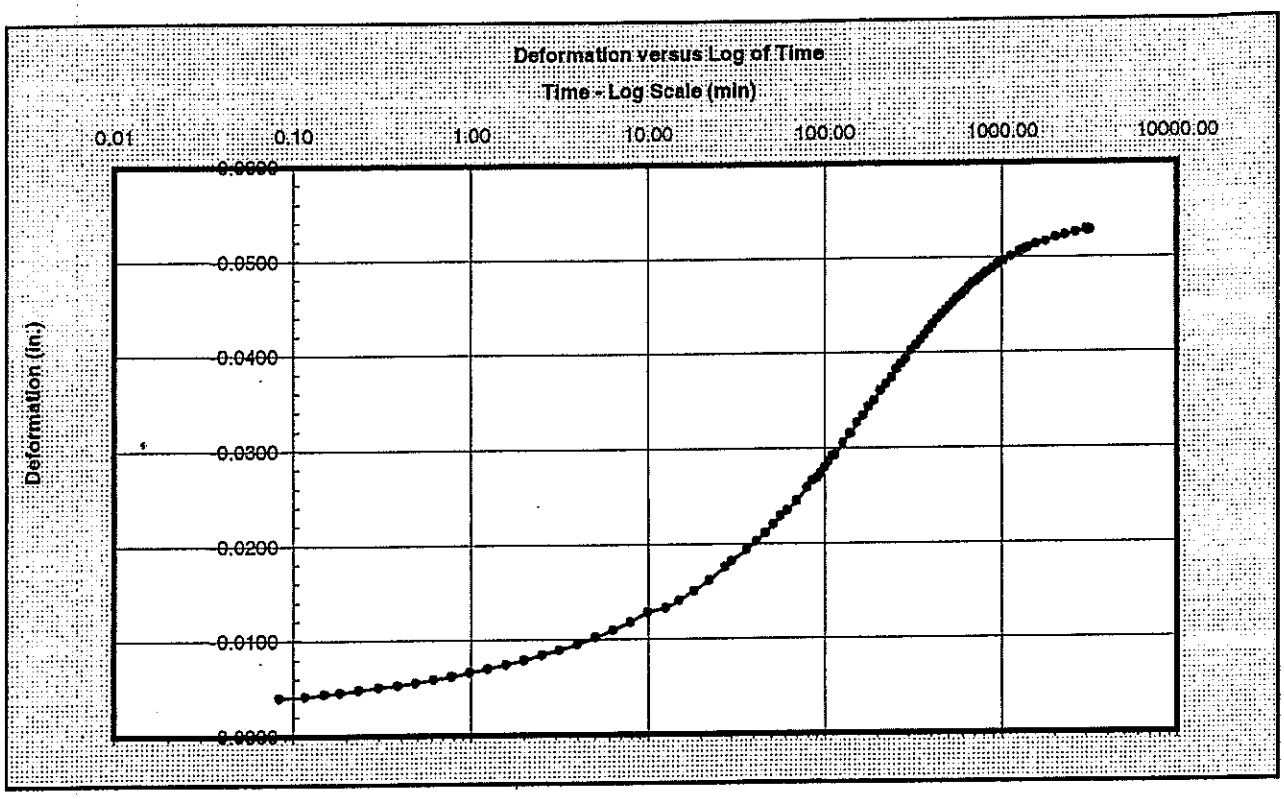

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
35.0000
Deformation (in.)
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

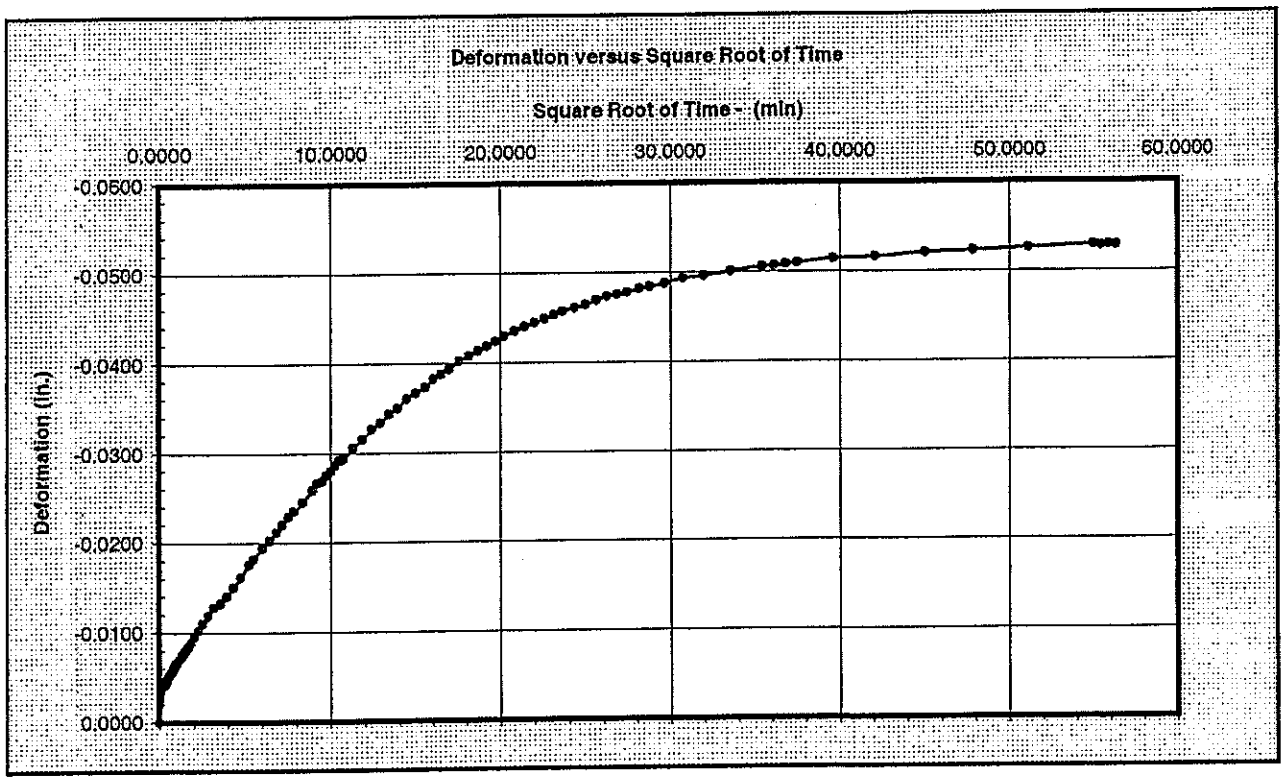
-8a tsf


Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
Deformation (in.)
0.0180
0.0160
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020

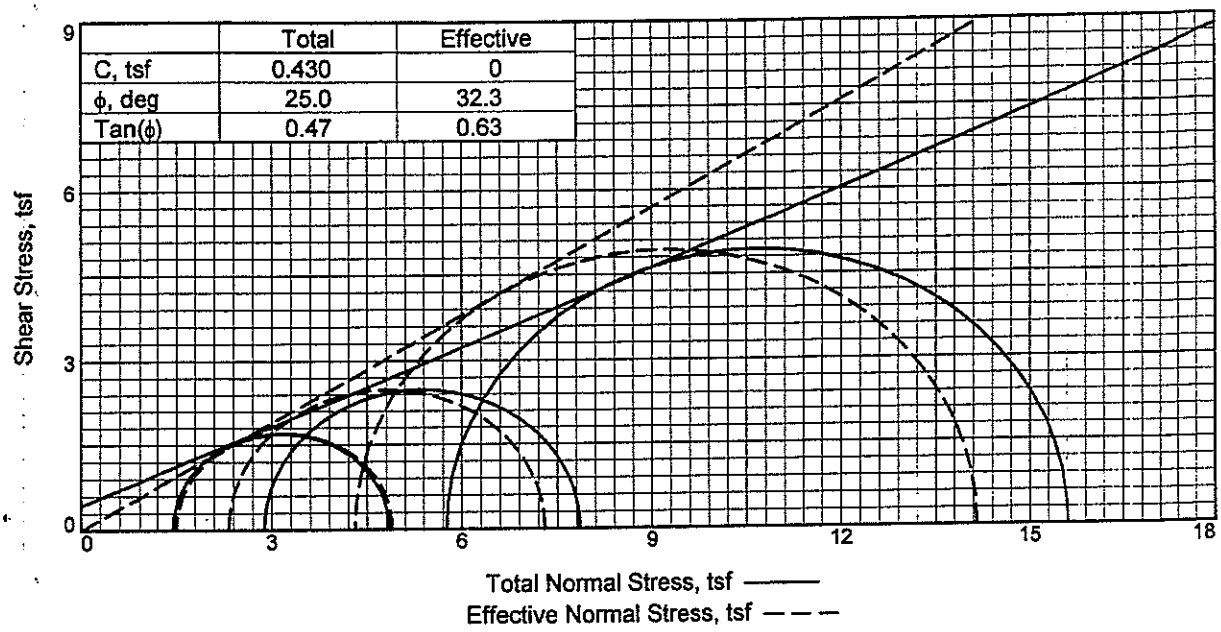

Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
5.0000
10.0000
15.0000
20.0000
25.0000
30.0000
Deformation (in.)
-0.0200
-0.0180
-0.0160
-0.0140
-0.0120
-0.0100
-0.0080
-0.0060
-0.0040
-0.0020
0.0000

-2a tst

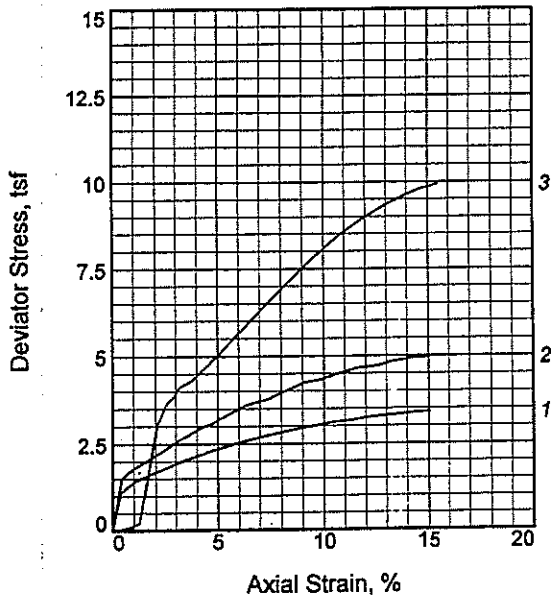

Deformation versus Log of Time
Time - Log Scale (min)
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
Deformation (in.)


Deformation versus Square Root of Time
Square Root of Time - (min)
0.0000
10.0000
20.0000
30.0000
40.0000
50.0000
60.0000
-0.0600
-0.0500
-0.0400
-0.0300
-0.0200
-0.0100
0.0000
Deformation (in.)

-1/4 tsf



	Total	Effective
C, tsf	0.430	0
ϕ, deg	25.0	32.3
Tan(ϕ)	0.47	0.63



Sample No.		1	2	3
Initial	Water Content,	17.7	17.5	18.9
	Dry Density, pcf	113.2	113.9	111.8
	Saturation,	101.6	102.6	104.7
	Void Ratio	0.4617	0.4527	0.4791
	Diameter, in.	2.83	2.85	2.85
	Height, in.	5.30	4.75	4.88
At Test	Water Content,	17.4	17.1	18.1
	Dry Density, pcf	113.2	113.9	111.8
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.4617	0.4527	0.4791
	Diameter, in.	2.82	2.85	2.85
	Height, in.	5.30	4.75	4.88
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.6	3.6	1.4
Cell Pressure, tsf		5.0	6.5	7.2
Fail. Stress, tsf		3.4	5.0	9.9
Total Pore Pr., tsf		3.5	4.2	2.9
Ult. Stress, tsf		3.4	5.0	9.9
Total Pore Pr., tsf		3.5	4.2	2.9
$\bar{\sigma}_1$ Failure, tsf		4.9	7.3	14.2
$\bar{\sigma}_3$ Failure, tsf		1.5	2.3	4.3

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Sandy CLAY to Clayey SAND

Assumed Specific Gravity= 2.65
Remarks:

Client: Williamson Energy

Project: Pond Creek Mine #1
Refuse Disposal Area
Location: Boring D-2 (13.5-16.0')

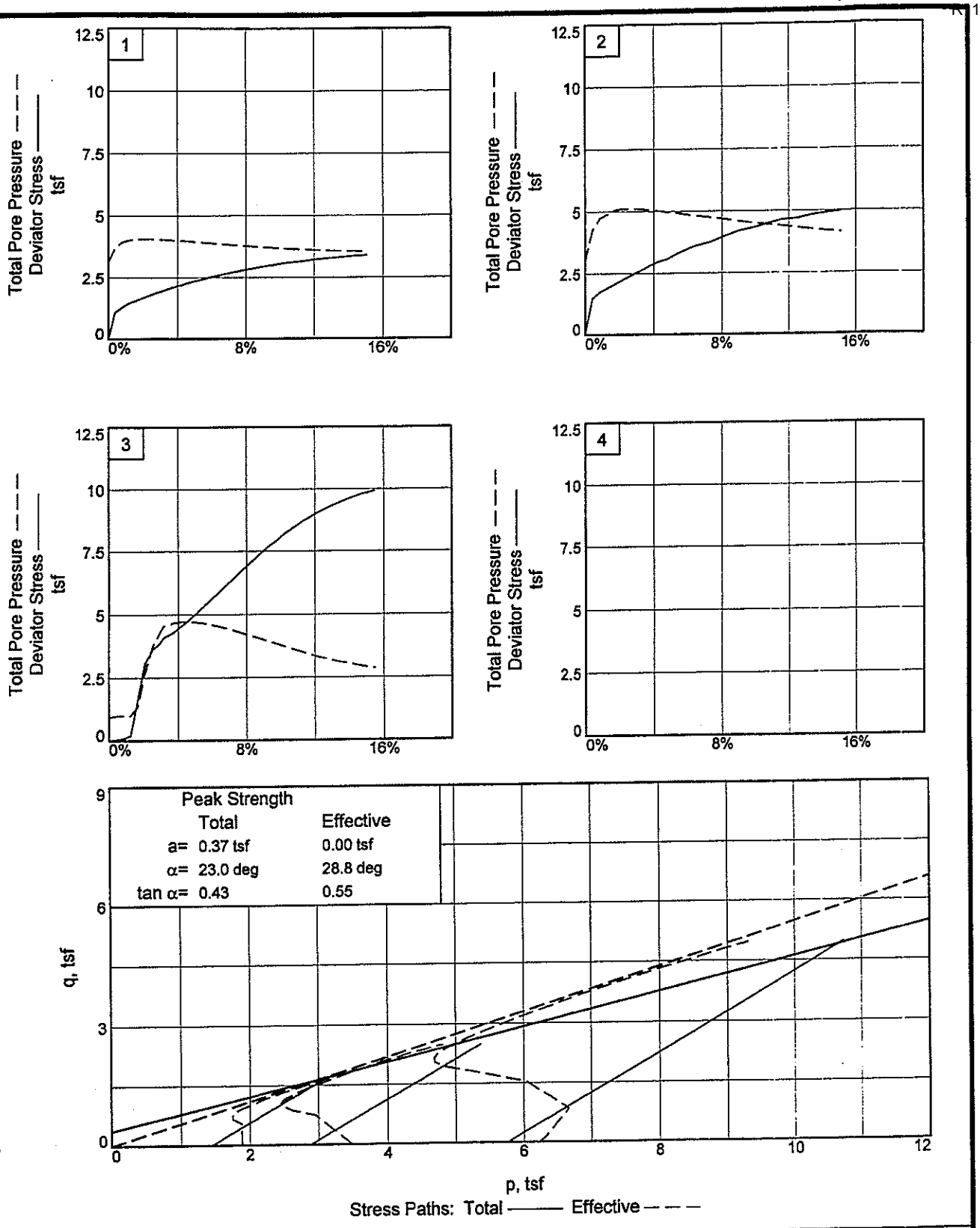
Proj. No.: H-08283 **Date:** 6/18/12

TRIAXIAL SHEAR TEST REPORT

HOLCOMB FOUNDATION ENGINEERING CO.

Plate _____

Tested By: LC **Checked By:** TH



Client: Williamson Energy
Project: Pond Creek Mine #1
Location: Boring D-2 (13.5-16.0')
Project No.: H-08283

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC _____ **Checked By:** TH _____

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

6/28/2012
7:25 PM

Date: 6/18/12
Client: Williamson Energy
Project: Pond Creek Mine #1
Refuse Disposal Area
Williamson County, Illinois
Location: Boring D-2 (13.5-16.0')
Description: Brown Mottled Gray Sandy CLAY to Clayey SAND
Remarks:
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	231.000			1289.300
Moisture content: Dry soil+tare, gms.	204.800			1128.400
Moisture content: Tare, gms.	56.800			140.300
Moisture, %	17.7	17.4	17.4	16.3
Moist specimen weight, gms.	1161.0			
Diameter, in.	2.83	2.83	2.82	
Area, in.²	6.27	6.27	6.27	
Height, in.	5.30	5.30	5.30	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.2	132.9	132.9	
Dry density, pcf	113.2	113.2	113.2	
Void ratio	0.4617	0.4617	0.4617	
Saturation, %	101.6	100.0	100.0	

Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.403 tsf **at reading no.** 27
Ult. Stress = 3.403 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	1.886	1.886	1.00	43.80	1.886	0.000
1	0.0200	119.00	94.0	0.4	1.076	1.339	2.415	1.80	51.40	1.877	0.538
2	0.0410	139.80	114.8	0.8	1.308	1.094	2.403	2.20	54.80	1.749	0.654
3	0.0610	153.10	128.1	1.2	1.455	1.015	2.470	2.43	55.90	1.742	0.727
4	0.0820	163.10	138.1	1.5	1.562	0.972	2.534	2.61	56.50	1.753	0.781
5	0.1020	173.10	148.1	1.9	1.668	0.958	2.626	2.74	56.70	1.792	0.834
6	0.1230	183.10	158.1	2.3	1.774	0.958	2.732	2.85	56.70	1.845	0.887
7	0.1430	192.20	167.2	2.7	1.869	0.972	2.841	2.92	56.50	1.906	0.934
8	0.1640	200.60	175.6	3.1	1.955	0.986	2.941	2.98	56.30	1.964	0.977
9	0.1840	209.70	184.7	3.5	2.048	1.001	3.049	3.05	56.10	2.025	1.024
10	0.2040	218.00	193.0	3.9	2.132	1.022	3.154	3.08	55.80	2.088	1.066
11	0.2250	225.50	200.5	4.2	2.205	1.044	3.249	3.11	55.50	2.147	1.103
12	0.2450	233.90	208.9	4.6	2.289	1.058	3.347	3.16	55.30	2.203	1.144
13	0.2660	241.30	216.3	5.0	2.360	1.080	3.440	3.19	55.00	2.260	1.180
14	0.2860	248.00	223.0	5.4	2.423	1.102	3.525	3.20	54.70	2.313	1.212
15	0.3070	256.30	231.3	5.8	2.503	1.130	3.633	3.21	54.30	2.382	1.251
16	0.3480	269.60	244.6	6.6	2.625	1.166	3.792	3.25	53.80	2.479	1.313
17	0.3880	282.10	257.1	7.3	2.737	1.210	3.947	3.26	53.20	2.578	1.368
18	0.4290	293.80	268.8	8.1	2.838	1.253	4.090	3.27	52.60	2.672	1.419
19	0.4700	305.40	280.4	8.9	2.935	1.289	4.224	3.28	52.10	2.756	1.468
20	0.5110	316.20	291.2	9.6	3.022	1.325	4.347	3.28	51.60	2.836	1.511
21	0.5520	327.10	302.1	10.4	3.109	1.361	4.469	3.28	51.10	2.915	1.554
22	0.5930	334.60	309.6	11.2	3.158	1.390	4.548	3.27	50.70	2.969	1.579
23	0.6340	344.50	319.5	12.0	3.231	1.418	4.649	3.28	50.30	3.034	1.615
24	0.6750	352.00	327.0	12.7	3.278	1.440	4.718	3.28	50.00	3.079	1.639
25	0.7160	359.50	334.5	13.5	3.323	1.462	4.785	3.27	49.70	3.123	1.662
26	0.7560	367.00	342.0	14.3	3.368	1.476	4.844	3.28	49.50	3.160	1.684
27	0.7970	373.70	348.7	15.0	3.403	1.498	4.900	3.27	49.20	3.199	1.701

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	167.200			1137.200
Moisture content: Dry soil+tare, gms.	152.000			1000.100
Moisture content: Tare, gms.	65.300			92.400
Moisture, %	17.5	17.1	17.1	15.1
Moist specimen weight, gms.	1064.6			
Diameter, in.	2.85	2.85	2.85	
Area, in.²	6.38	6.38	6.38	
Height, in.	4.75	4.75	4.75	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.8	133.3	133.3	
Dry density, pcf	113.9	113.9	113.9	
Void ratio	0.4527	0.4527	0.4527	
Saturation, %	102.6	100.0	100.0	

Consolidation cell pressure = 90.00 psi (6.480 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.880 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.973 tsf **at reading no.** 24
Ult. Stress = 4.973 tsf **at reading no.** 24

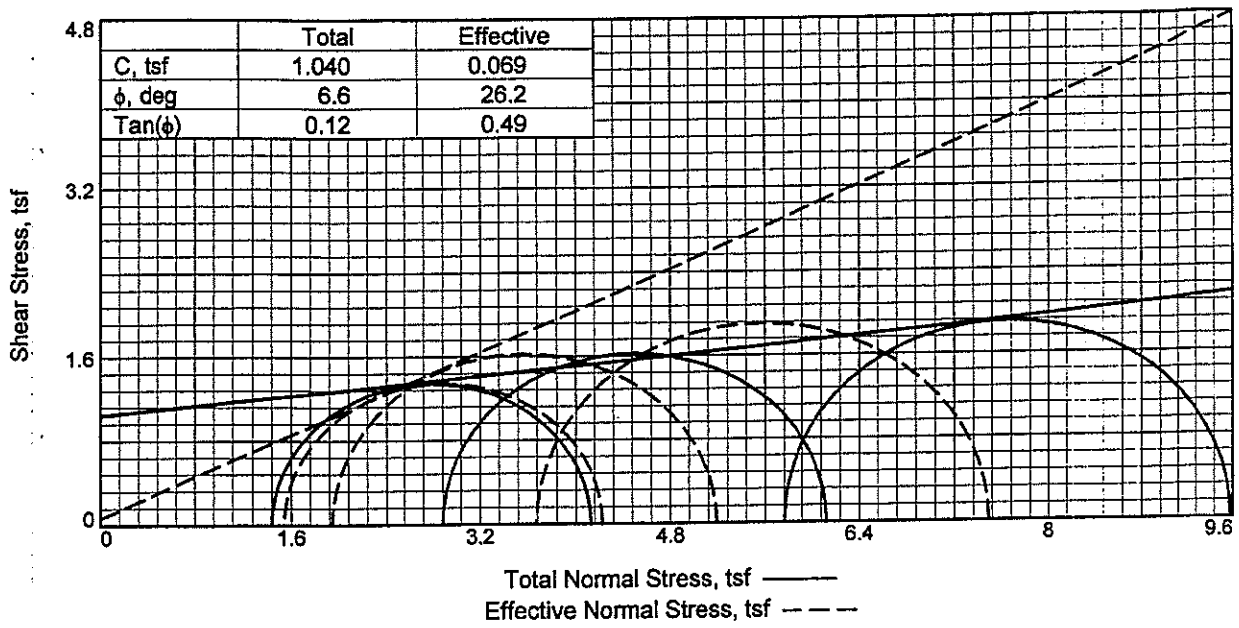
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	59.90	0.0	0.0	0.000	3.485	3.485	1.00	41.60	3.485	0.000
1	0.0200	193.10	133.2	0.4	1.497	2.203	3.700	1.68	59.40	2.952	0.749
2	0.0410	216.40	156.5	0.9	1.751	1.735	3.486	2.01	65.90	2.611	0.876
3	0.0820	246.30	186.4	1.7	2.067	1.418	3.486	2.46	70.30	2.452	1.034
4	0.1020	262.20	202.3	2.1	2.234	1.368	3.602	2.63	71.00	2.485	1.117
5	0.1230	277.10	217.2	2.6	2.388	1.361	3.749	2.75	71.10	2.555	1.194
6	0.1430	292.90	233.0	3.0	2.551	1.368	3.919	2.86	71.00	2.643	1.275
7	0.1640	307.90	248.0	3.5	2.702	1.390	4.092	2.94	70.70	2.741	1.351
8	0.1840	322.90	263.0	3.9	2.853	1.418	4.272	3.01	70.30	2.845	1.427
9	0.2040	336.20	276.3	4.3	2.984	1.447	4.432	3.06	69.90	2.939	1.492
10	0.2250	346.20	286.3	4.7	3.078	1.490	4.569	3.07	69.30	3.030	1.539
11	0.2450	362.00	302.1	5.2	3.234	1.526	4.760	3.12	68.80	3.143	1.617
12	0.2660	376.20	316.3	5.6	3.370	1.570	4.940	3.15	68.20	3.255	1.685
13	0.2860	390.30	330.4	6.0	3.504	1.613	5.117	3.17	67.60	3.365	1.752
14	0.3070	403.60	343.7	6.5	3.628	1.649	5.277	3.20	67.10	3.463	1.814
15	0.3480	420.30	360.4	7.3	3.770	1.721	5.490	3.19	66.10	3.606	1.885
16	0.3880	446.10	386.2	8.2	4.003	1.793	5.796	3.23	65.10	3.794	2.001
17	0.4290	471.90	412.0	9.0	4.230	1.872	6.102	3.26	64.00	3.987	2.115
18	0.4700	486.00	426.1	9.9	4.333	1.944	6.277	3.23	63.00	4.111	2.167
19	0.5110	507.70	447.8	10.8	4.510	2.016	6.526	3.24	62.00	4.271	2.255
20	0.5520	526.80	466.9	11.6	4.657	2.081	6.738	3.24	61.10	4.409	2.329
21	0.5930	536.00	476.1	12.5	4.703	2.146	6.848	3.19	60.20	4.497	2.351
22	0.6340	554.30	494.4	13.3	4.835	2.210	7.046	3.19	59.30	4.628	2.418
23	0.6750	567.60	507.7	14.2	4.916	2.268	7.184	3.17	58.50	4.726	2.458
24	0.7160	578.70	518.8	15.1	4.973	2.326	7.298	3.14	57.70	4.812	2.486

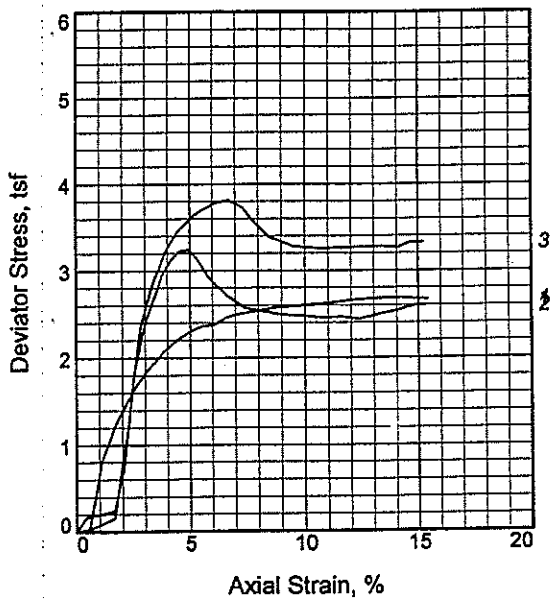
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	229.700			1184.900
Moisture content: Dry soil+tare, gms.	199.800			1044.600
Moisture content: Tare, gms.	41.800			134.900
Moisture, %	18.9	18.1	18.1	15.4
Moist specimen weight, gms.	1084.6			
Diameter, in.	2.85	2.85	2.85	
Area, in.²	6.36	6.36	6.36	
Height, in.	4.88	4.88	4.88	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	133.0	132.1	132.1	
Dry density, pcf	111.8	111.8	111.8	
Void ratio	0.4791	0.4791	0.4791	
Saturation, %	104.7	100.0	100.0	

Consolidation cell pressure = 100.00 psi (7.200 tsf)
Consolidation back pressure = 20.00 psi (1.440 tsf)
Consolidation effective confining stress = 5.760 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 9.855 tsf **at reading no.** 26
Ult. Stress = 9.855 tsf **at reading no.** 26

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	39.90	0.0	0.0	0.000	6.278	6.278	1.00	12.80	6.278	0.000
1	0.0200	42.40	2.5	0.4	0.028	6.221	6.249	1.00	13.60	6.235	0.014
2	0.0410	47.40	7.5	0.8	0.084	6.214	6.298	1.01	13.70	6.256	0.042
3	0.0610	57.40	17.5	1.2	0.196	6.199	6.395	1.03	13.90	6.297	0.098
4	0.0820	189.70	149.8	1.7	1.667	5.832	7.499	1.29	19.00	6.665	0.833
5	0.1020	317.90	278.0	2.1	3.081	4.493	7.574	1.69	37.60	6.033	1.540
6	0.1230	367.80	327.9	2.5	3.618	3.449	7.067	2.05	52.10	5.258	1.809
7	0.1430	392.00	352.1	2.9	3.868	2.916	6.784	2.33	59.50	4.850	1.934
8	0.1540	413.60	373.7	3.2	4.096	2.650	6.746	2.55	63.20	4.698	2.048
9	0.1840	436.10	396.2	3.8	4.315	2.527	6.842	2.71	64.90	4.685	2.158
10	0.2040	459.40	419.5	4.2	4.550	2.477	7.026	2.84	65.60	4.752	2.275
11	0.2250	482.70	442.8	4.6	4.781	2.470	7.250	2.94	65.70	4.860	2.390
12	0.2450	507.70	467.8	5.0	5.029	2.491	7.520	3.02	65.40	5.006	2.514
13	0.2660	535.10	495.2	5.4	5.299	2.534	7.834	3.09	64.80	5.184	2.650
14	0.2860	562.60	522.7	5.9	5.569	2.592	8.161	3.15	64.00	5.377	2.785
15	0.3070	589.20	549.3	6.3	5.826	2.657	8.483	3.19	63.10	5.570	2.913
16	0.3480	645.00	605.1	7.1	6.360	2.808	9.168	3.27	61.00	5.988	3.180
17	0.3880	699.90	660.0	7.9	6.876	2.974	9.850	3.31	58.70	6.412	3.438
18	0.4290	755.70	715.8	8.8	7.390	3.154	10.543	3.34	56.20	6.848	3.695
19	0.4700	808.90	769.0	9.6	7.866	3.341	11.207	3.35	53.60	7.274	3.933
20	0.5110	860.50	820.6	10.5	8.316	3.528	11.844	3.36	51.00	7.686	4.158
21	0.5520	908.00	868.1	11.3	8.715	3.708	12.423	3.35	48.50	8.065	4.357
22	0.5930	949.60	909.7	12.1	9.046	3.881	12.926	3.33	46.10	8.404	4.523
23	0.6340	987.70	947.8	13.0	9.334	4.025	13.359	3.32	44.10	8.692	4.667
24	0.6750	1022.00	982.1	13.8	9.579	4.147	13.726	3.31	42.40	8.937	4.789
25	0.7160	1053.60	1013.7	14.7	9.791	4.255	14.046	3.30	40.90	9.151	4.895

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
26	0.7360	1065.20	1025.3	15.1	9.855	4.298	14.154	3.29	40.30	9.226	4.928
27	0.7560	1078.60	1038.7	15.5	9.936	4.334	14.270	3.29	39.80	9.302	4.968





Sample No.		1	2	3
Initial	Water Content,	28.3	21.5	27.6
	Dry Density, pcf	101.7	107.0	98.1
	Saturation,	120.0	104.3	106.4
	Void Ratio	0.6260	0.5465	0.6867
	Diameter, in.	2.80	2.82	2.83
	Height, in.	3.72	4.95	3.63
At Test	Water Content,	23.6	20.6	25.9
	Dry Density, pcf	101.7	107.0	98.1
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.6260	0.5465	0.6867
	Diameter, in.	2.80	2.82	2.82
	Height, in.	3.72	4.95	3.63
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	1.44
Cell Pressure, tsf		5.04	6.48	7.20
Fail. Stress, tsf		2.69	3.24	3.82
Total Pore Pr., tsf		3.50	4.54	3.53
Ult. Stress, tsf		2.67	2.60	3.32
Total Pore Pr., tsf		3.47	4.10	3.37
$\bar{\sigma}_1$ Failure, tsf		4.23	5.19	7.49
$\bar{\sigma}_3$ Failure, tsf		1.54	1.94	3.67

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:

Plate _____

Client: Williamson Energy

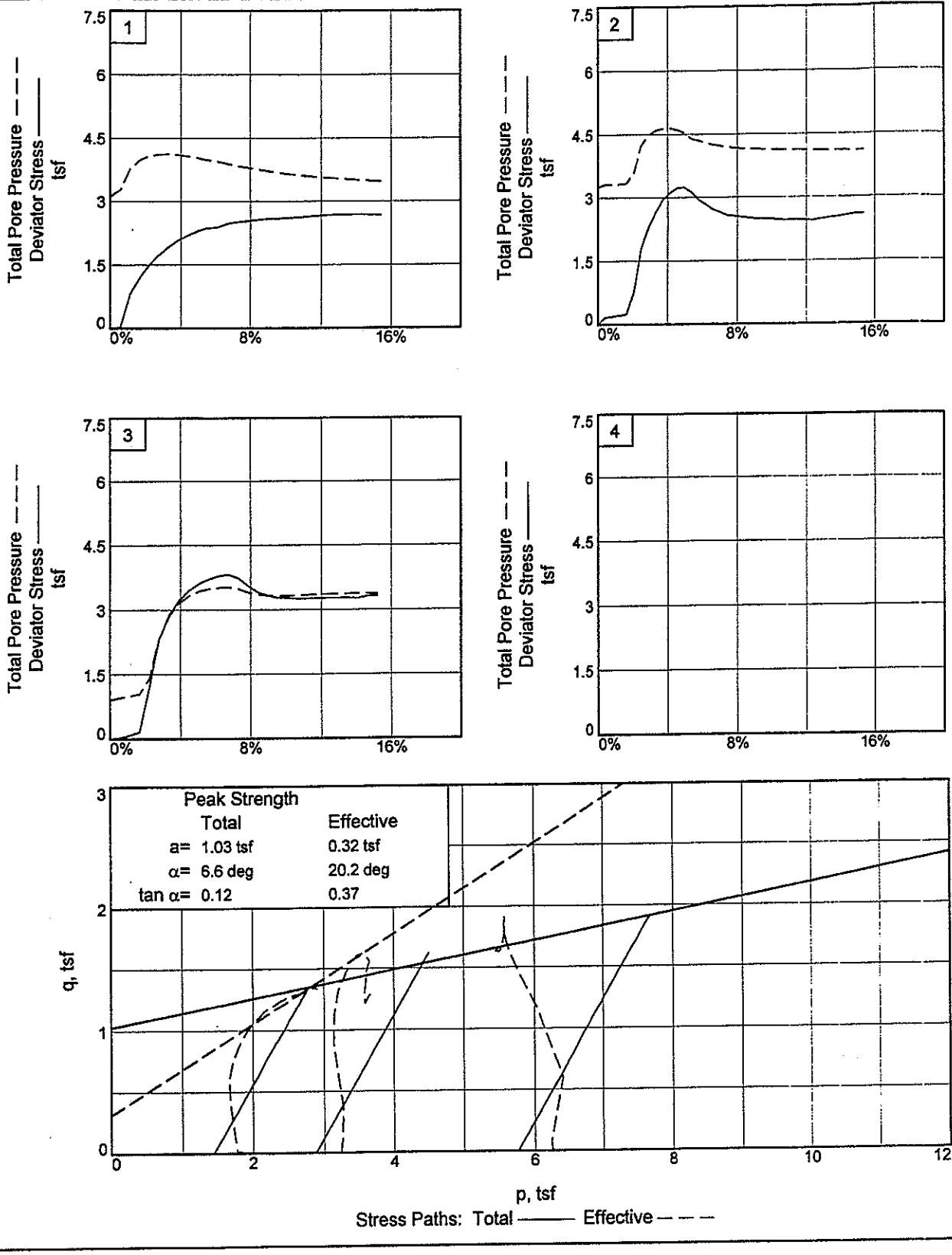
Project: Pond Creek Mine #1
Refuse Disposal Area
Location: Boring D-2 (18.5-21.0')

Proj. No.: H-08283 **Date:** 6-12-12

TRIAXIAL SHEAR TEST REPORT

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH



Client: Williamson Energy
Project: Pond Creek Mine #1
Location: Boring D-2 (18.5-21.0')
Project No.: H-08283

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC _____ **Checked By:** TH _____

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

6/28/2012
7:48 PM

Date: 6-12-12
Client: Williamson Energy
Project: Pond Creek Mine #1
Refuse Disposal Area
Williamson County, Illinois
Location: Boring D-2 (18.5-21.0')
Description: Brown Mottled Gray Silty CLAY
Remarks:
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	120.000			887.700
Moisture content: Dry soil+tare, gms.	107.900			732.700
Moisture content: Tare, gms.	65.200			103.100
Moisture, %	28.3	23.6	23.6	24.6
Moist specimen weight, gms.	785.1			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	3.72	3.72	3.72	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.6	125.8	125.8	
Dry density, pcf	101.7	101.7	101.7	
Void ratio	0.6260	0.6260	0.6260	
Saturation, %	120.0	100.0	100.0	

Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.686 tsf **at reading no.** 21
Ult. Stress = 2.668 tsf **at reading no.** 23

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0020	21.60	0.0	0.0	0.000	1.937	1.937	1.00	43.10	1.937	0.000
1	0.0230	24.10	2.5	0.6	0.029	1.757	1.786	1.02	45.60	1.771	0.015
2	0.0430	91.50	69.9	1.1	0.808	1.274	2.083	1.63	52.30	1.679	0.404
3	0.0640	127.30	105.7	1.7	1.215	1.058	2.274	2.15	55.30	1.666	0.608
4	0.0840	153.10	131.5	2.2	1.504	0.965	2.469	2.56	56.60	1.717	0.752
5	0.1040	173.90	152.3	2.7	1.732	0.929	2.661	2.86	57.10	1.795	0.866
6	0.1250	192.20	170.6	3.3	1.929	0.922	2.850	3.09	57.20	1.886	0.964
7	0.1450	206.40	184.8	3.8	2.078	0.936	3.014	3.22	57.00	1.975	1.039
8	0.1660	218.00	196.4	4.4	2.195	0.972	3.167	3.26	56.50	2.070	1.098
9	0.1860	228.00	206.4	4.9	2.294	1.008	3.302	3.28	56.00	2.155	1.147
10	0.2070	235.50	213.9	5.5	2.363	1.058	3.422	3.23	55.30	2.240	1.182
11	0.2270	238.00	216.4	6.0	2.377	1.094	3.472	3.17	54.80	2.283	1.189
12	0.2480	247.20	225.6	6.6	2.463	1.145	3.608	3.15	54.10	2.377	1.232
13	0.2680	252.20	230.6	7.2	2.504	1.195	3.699	3.09	53.40	2.447	1.252
14	0.2880	255.50	233.9	7.7	2.525	1.231	3.756	3.05	52.90	2.494	1.262
15	0.3090	259.70	238.1	8.3	2.554	1.274	3.829	3.00	52.30	2.552	1.277
16	0.3290	263.00	241.4	8.8	2.575	1.310	3.885	2.96	51.80	2.598	1.287
17	0.3700	268.00	246.4	9.9	2.596	1.375	3.971	2.89	50.90	2.673	1.298
18	0.4110	273.80	252.2	11.0	2.625	1.426	4.050	2.84	50.20	2.738	1.312
19	0.4520	280.50	258.9	12.1	2.661	1.469	4.130	2.81	49.60	2.799	1.331
20	0.4930	285.50	263.9	13.2	2.678	1.505	4.183	2.78	49.10	2.844	1.339
21	0.5340	289.60	268.0	14.3	2.686	1.541	4.226	2.74	48.60	2.884	1.343
22	0.5540	290.40	268.8	14.8	2.677	1.555	4.232	2.72	48.40	2.894	1.338
23	0.5750	291.30	269.7	15.4	2.668	1.570	4.237	2.70	48.20	2.904	1.334

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	168.800			1180.800
Moisture content: Dry soil+tare, gms.	149.000			979.100
Moisture content: Tare, gms.	56.900			127.400
Moisture, %	21.5	20.6	20.6	23.7
Moist specimen weight, gms.	1053.2			
Diameter, in.	2.82	2.82	2.82	
Area, in.²	6.23	6.23	6.23	
Height, in.	4.95	4.95	4.95	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.0	129.0	129.0	
Dry density, pcf	107.0	107.0	107.0	
Void ratio	0.5465	0.5465	0.5465	
Saturation, %	104.3	100.0	100.0	

Consolidation cell pressure = 90.00 psi (6.480 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.880 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.244 tsf **at reading no.** 12
Ult. Stress = 2.598 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	25.80	0.0	0.0	0.000	3.240	3.240	1.00	45.00	3.240	0.000
1	0.0220	39.90	14.1	0.4	0.162	3.168	3.330	1.05	46.00	3.249	0.081
2	0.0420	42.40	16.6	0.8	0.190	3.168	3.358	1.06	46.00	3.263	0.095
3	0.0620	44.10	18.3	1.2	0.209	3.161	3.370	1.07	46.10	3.265	0.104
4	0.0830	47.40	21.6	1.7	0.245	3.139	3.385	1.08	46.40	3.262	0.123
5	0.1030	92.40	66.6	2.1	0.754	2.894	3.648	1.26	49.80	3.271	0.377
6	0.1240	183.10	157.3	2.5	1.772	2.254	4.026	1.79	58.70	3.140	0.886
7	0.1440	228.90	203.1	2.9	2.279	2.009	4.287	2.13	62.10	3.148	1.139
8	0.1650	263.00	237.2	3.3	2.649	1.886	4.536	2.40	63.80	3.211	1.325
9	0.1850	290.40	264.6	3.7	2.943	1.843	4.786	2.60	64.40	3.315	1.472
10	0.2060	307.10	281.3	4.1	3.115	1.836	4.951	2.70	64.50	3.394	1.558
11	0.2260	317.90	292.1	4.5	3.221	1.872	5.093	2.72	64.00	3.483	1.611
12	0.2460	321.20	295.4	4.9	3.244	1.944	5.188	2.67	63.00	3.566	1.622
13	0.2670	311.30	285.5	5.4	3.121	2.088	5.209	2.49	61.00	3.649	1.561
14	0.2870	296.30	270.5	5.8	2.944	2.131	5.076	2.38	60.40	3.603	1.472
15	0.3080	286.30	260.5	6.2	2.823	2.189	5.012	2.29	59.60	3.600	1.411
16	0.3280	278.00	252.2	6.6	2.721	2.232	4.953	2.22	59.00	3.593	1.361
17	0.3690	266.30	240.5	7.4	2.572	2.290	4.862	2.12	58.20	3.576	1.286
18	0.4100	264.60	238.8	8.3	2.531	2.326	4.856	2.09	57.70	3.591	1.265
19	0.4510	263.00	237.2	9.1	2.491	2.340	4.831	2.06	57.50	3.586	1.246
20	0.4920	264.60	238.8	9.9	2.485	2.347	4.832	2.06	57.40	3.590	1.243
21	0.5330	263.80	238.0	10.7	2.454	2.354	4.809	2.04	57.30	3.581	1.227
22	0.5740	267.10	241.3	11.6	2.465	2.362	4.827	2.04	57.20	3.594	1.233
23	0.6140	267.10	241.3	12.4	2.443	2.369	4.811	2.03	57.10	3.590	1.221
24	0.6550	274.60	248.8	13.2	2.495	2.369	4.864	2.05	57.10	3.616	1.247
25	0.6960	281.30	255.5	14.0	2.537	2.369	4.906	2.07	57.10	3.638	1.269

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
26	0.7370	289.60	263.8	14.9	2.595	2.376	4.971	2.09	57.00	3.673	1.297
27	0.7580	291.30	265.5	15.3	2.598	2.376	4.974	2.09	57.00	3.675	1.299

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	91.300			834.500
Moisture content: Dry soil+tare, gms.	80.600			689.300
Moisture content: Tare, gms.	41.800			96.300
Moisture, %	27.6	25.9	25.9	24.5
Moist specimen weight, gms.	746.5			
Diameter, in.	2.83	2.82	2.82	
Area, in.²	6.27	6.27	6.27	
Height, in.	3.63	3.63	3.63	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	125.1	123.5	123.5	
Dry density, pcf	98.1	98.1	98.1	
Void ratio	0.6867	0.6867	0.6867	
Saturation, %	106.4	100.0	100.0	

Consolidation cell pressure = 100.00 psi (7.200 tsf)
Consolidation back pressure = 20.00 psi (1.440 tsf)
Consolidation effective confining stress = 5.760 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.816 tsf **at reading no.** 12
Ult. Stress = 3.324 tsf **at reading no.** 22

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	41.60	0.0	0.0	0.000	6.293	6.293	1.00	12.60	6.293	0.000
1	0.0190	43.30	1.7	0.5	0.019	6.242	6.262	1.00	13.30	6.252	0.010
2	0.0400	49.10	7.5	1.1	0.085	6.199	6.284	1.01	13.90	6.242	0.043
3	0.0600	55.80	14.2	1.7	0.160	6.156	6.316	1.03	14.50	6.236	0.080
4	0.0810	149.00	107.4	2.2	1.206	5.796	7.002	1.21	19.50	6.399	0.603
5	0.1010	251.30	209.7	2.8	2.342	4.860	7.202	1.48	32.50	6.031	1.171
6	0.1220	302.90	261.3	3.4	2.901	4.334	7.235	1.67	39.80	5.785	1.450
7	0.1420	333.70	292.1	3.9	3.224	4.046	7.270	1.80	43.80	5.658	1.612
8	0.1620	356.20	314.6	4.5	3.452	3.874	7.326	1.89	46.20	5.600	1.726
9	0.1830	372.80	331.2	5.0	3.612	3.766	7.378	1.96	47.70	5.572	1.806
10	0.2030	383.70	342.1	5.6	3.710	3.715	7.425	2.00	48.40	5.570	1.855
11	0.2240	392.80	351.2	6.2	3.785	3.686	7.471	2.03	48.80	5.579	1.893
12	0.2440	397.80	356.2	6.7	3.816	3.672	7.488	2.04	49.00	5.580	1.908
13	0.2650	392.00	350.4	7.3	3.731	3.715	7.446	2.00	48.40	5.581	1.865
14	0.2850	377.00	335.4	7.9	3.550	3.802	7.352	1.93	47.20	5.577	1.775
15	0.3060	364.50	322.9	8.4	3.396	3.852	7.248	1.88	46.50	5.550	1.698
16	0.3460	357.00	315.4	9.5	3.277	3.881	7.158	1.84	46.10	5.519	1.639
17	0.3870	358.70	317.1	10.7	3.254	3.866	7.120	1.84	46.30	5.493	1.627
18	0.4280	363.70	322.1	11.8	3.263	3.852	7.115	1.85	46.50	5.484	1.632
19	0.4890	371.20	329.6	13.5	3.276	3.830	7.106	1.86	46.80	5.468	1.638

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
20	0.5100	372.00	330.4	14.1	3.261	3.823	7.085	1.85	46.90	5.454	1.631
21	0.5300	379.50	337.9	14.6	3.314	3.823	7.137	1.87	46.90	5.480	1.657
22	0.5510	382.80	341.2	15.2	3.324	3.830	7.154	1.87	46.80	5.492	1.662

GENERAL NOTES

SAMPLE INDENTIFICATION

The Unified Classification System is used to indentify the soil unless othwerwise noted.

RELATIVE DENSITY & CONSISTENCY CLASSIFICATION

TERM (NON-COHESIVE SOILS)	BLOWS PER FOOT
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	Over 50

TERM (COHESIVE SOILS)	QU (tsf)
Very Soft	0.00- 0.25
Soft	0.25-0.50
Firm	0.50-1.00
Stiff	1.00-2.00
Very Stiff	2.00-4.00
Hard	4.00+

DRILLING & SAMPLING SYMBOLS

ss:	Split Spoon-	1 3/8" I.D., 2" O.D.
st:	Shelby Tube-	2.80" I.D., 3" O.D.
au:	Auger Samples	
cs:	Continuous Sampling	2.0" I.D

SOIL PROPERTY SYMBOLS

●	Unconfined Compressive Strength, Qu (tsf)
+	Penetrometer Value, (tsf)
	Plastic Limit (%)
o	Water Content (%)
	Liquid Limit (%)
x	Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2" O.D. Split Spoon

PARTICLE SIZE

Boulders	8in +	Medium Sand	0.6mm to 0.2mm
Cobbles	8in to 3in	Fine Sand	0.2mm to 0.74 mm
Gravel	3in. to 5mm	Silt	0.074mm to 0.0005mm
Coarse Sand	5mm to 0.6mm	Clay	Less Than 0.005mm

UNIFIED SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		GRAVELS WITH FINES	GM	Silty gravels, gravels-sand silt mixtures
			GC	Clayey gravels, gravel-sand clay mixtures
		CLEAN SANDS	SW	Well-graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, clay-sand mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LOW PLASTICITY		ML	Inoganic silts of clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity
	SILTS AND CLAYS HIGH PLASTICITY		OL	Organic silts and organic silty clays of low plasticity
			MH	Inorganic clays of high plasticity
			CH	Organic clays of high plasticity
HIGHLY ORGANIC SOILS			OH	Organic clays of medium to high plasticity
			PT	Peat, humus, swamp soils with high organic contents

5378-13
Part 4

APPENDIX D

ANALYSIS OF 8-INCH GAS PIPELINE

Mach Mining, LLC

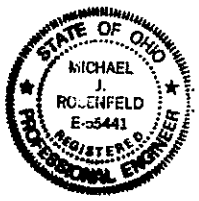
Final Report No. 12-193

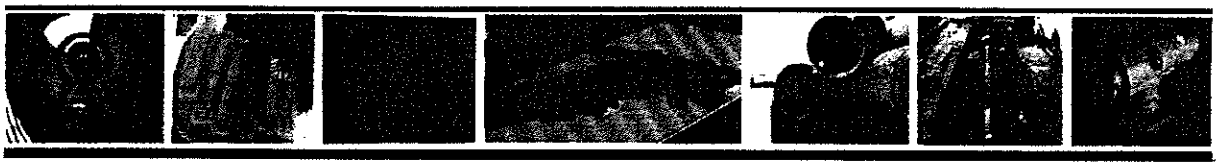
Final Report

Analysis of Mach Mining, LLC's 8-inch Gas Gathering Line under the Proposed Number 1 Mine Coal Refuse Disposal Facility Expansion

Robert B Francini and Cara Macrory-Dalton, PE

December 12, 2012





Kiefner & Associates, Inc.
585 Scherers Court
Worthington, Ohio 43085

(614) 888-8220
www.kiefner.com

Intentionally blank

Final Report No. 12-193

Final Report

on

ANALYSIS OF MACH MINING, LLC'S 8-INCH GAS GATHERING LINE UNDER THE PROPOSED NUMBER 1 MINE COAL REFUSE DISPOSAL FACILITY EXPANSION

to

MACH MINING, LLC

December 12, 2012

by

Robert B Francini and Cara Macrory-Dalton, PE

Kiefner and Associates, Inc.
585 Scherers Court
Worthington, Ohio 43085

0546-1201

DISCLAIMER

This document presents findings and/ or recommendations based on engineering services performed by employees of Kiefner and Associates, Inc. The work addressed herein has been performed according to the authors' knowledge, information, and belief in accordance with commonly accepted procedures consistent with applicable standards of practice, and is not a guaranty or warranty, either expressed or implied.

The analysis and conclusions provided in this report are for the sole use and benefit of the Client. No information or representations contained herein are for the use or benefit of any party other than the party contracting with KAI. The scope of use of the information presented herein is limited to the facts as presented and examined, as outlined within the body of this document. No additional representations are made as to matters not specifically addressed within this report. Any additional facts or circumstances in existence but not described or considered within this report may change the analysis, outcomes and representations made in this report.

TABLE OF CONTENTS

INTRODUCTION 1
CONCLUSIONS AND RECOMMENDATIONS 1
STRESS ANALYSIS 1
Existing Stresses 2
Subsidence Residual Stress 3
Coal Refuse Disposal Facility Overburden Stress 3
Coal Refuse Disposal Facility Consolidation Stress 5
ASME B31.8 Design Stress Analysis 5

LIST OF FIGURES

Figure 1. Profile of the mine subsidence at the western edge of longwall Panel 3 used to calculate subsidence stress 9
Figure 2. Bending stress calculated from the subsidence profile shown in Figure 1 9
Figure 3. Consolidation profile under west side of refuse facility 10
Figure 4. Idealized soil spring model used to analyze buried pipe-soil interaction 10
Figure 5a. FEA model used for consolidation stress analysis 11
Figure 5b. Close-up view of soil springs in FEA model for consolidation stress analysis (arrows show soil springs) 11
Figure 6. Consolidation stresses on 8-inch pipe 12
Figure 7a. Total longitudinal, hoop and combined stresses at 0 psig 12
Figure 7b. Total longitudinal, hoop and combined stresses at 300 psig 13

LIST OF TABLES

Table 1 Stresses on the pipe from the refuse facility surface loading 8
Table 2. Soil properties used for consolidation stress analysis 8
Table 3. Peak hoop, longitudinal and equivalent stresses from Figures 7a and 7b 8

Intentionally blank

Analysis of Mach Mining, LLC's 8-inch Gas Gathering Line under the Proposed Number 1 Mine Coal Refuse Disposal Facility Expansion

Robert B Francini and Cara Macrory-Dalton, PE

INTRODUCTION

Mach Mining, LLC has purchased the former DTE coal bed methane processing facility and the associated gathering lines that are part of this facility. Mach Mining is in the process of designing an expansion to its existing coal refuse disposal facility that will be constructed over the 8-inch inlet line for the processing facility. Mach Mining asked Kiefner to review the design of the proposed expansion to ensure that the integrity of the pipeline is not compromised by the increased overburden and settlement from the expansion. The analysis is complicated by the fact that the line was subsided by Panel 3 of the Number 1 mine. The results of the stress analysis due to these combined stress sources as well as recommendations for maintaining the stress levels within the acceptable design stress levels of ASME B31.8[1] are contained herein.

CONCLUSIONS AND RECOMMENDATIONS

- The results of a stress analysis of the 8-inch inlet line which includes current and anticipated loadings shows that the stresses are within the stress limits of ASME B31.8.
- Based on the results of this analysis Mach Mining, LLC should be able to construct the coal refuse disposal facility over the 8-inch pipeline without compromising the integrity of the pipeline.
    - Mach Mining, LLC should be aware that, once the facility is constructed, access to the pipeline will be limited should future integrity issues arise.

STRESS ANALYSIS

The stress analysis of the proposed expansion requires the calculation of the following stress components:

1. The existing stress on the pipe from internal pressure and thermal expansion,
2. The residual stress on the pipe from the longwall mine subsidence,

[1] ASME B31.8-2010, Gas Transmission and Distribution Piping Systems, American Society of Mechanical Engineers

3. The stress on the pipe from the refuse facility overburden, and
4. The stress on the pipe from the consolidation of the soil under the refuse facility.

Since the analysis being performed is a linear elastic analysis, each of the 4 stresses can be calculated separately and summed in the end. Care must be taken when summing the stresses because they are a combination of uniform hoop and axial stresses that are constant through the wall of the pipe (existing stresses), beam bending stresses that are constant through the wall of the pipe but vary from compression on one side of the pipe and tension on the other side of the pipe (subsidence and settlement) and through-wall bending in the hoop and axial directions (overburden loading).

Existing Stresses

The hoop stress from pressure is:

$$SH_{Pressure}=\frac{PD}{2t} \quad (1)$$

where

P is the internal pressure, psi,

D is the pipe diameter, in, and

t is the pipe wall thickness, in.

The longitudinal stress from pressure is:

$$SL_{Pressure}=\upsilon SH_{Pressure} \quad (2)$$

where

υ is Poisson's ratio for steel, 0.3.

The longitudinal stress from thermal expansion for restrained pipe is:

$$SL_{Thermal}=\alpha E(T_1-T_2) \quad (3)$$

where

α is the coefficient of thermal expansion for steel, 6.5×10^{-6} in/in/F,

E is the modulus of elasticity for steel, 30×10^{6} psi,

T_1 is the temperature of the pipe when it was installed, F, and

T_2 is the operating temperature of the pipe, F.

The pipe diameter is 8.625 inches, the wall thickness is 0.406 inch and the grade is API 5L X42. The operating pressure for the pipe is 300 psig. The hoop stress at operating pressure ($SH_{Pressure}$) is 3,187 psi. The resulting longitudinal stress from pressure ($SL_{Pressure}$) is 956 psi. In order to calculate the thermal stress it was assumed that the pipeline was constructed during the warmer months and that it operates at near the ground temperature which resulted in a temperature differential (T_1-T_2) of 30 F. The resulting thermal stress is 5,850 psi.

Subsidence Residual Stress

The segment of the pipeline that will be under the coal refuse disposal facility was previously subsided during the mining of Panel 3 of the Number 1 mine. The western edge of the longwall panel will be under the disposal facility. There are residual stresses at the edge of the longwall panel from the mine subsidence that need to be included in the stress analysis. Since the pipe at the edge of the panel was exposed during the subsidence, the only longitudinal stresses are bending stresses. If we assume that the pipe conforms to the subsidence profile of the ground surface, the bending stresses can be calculated from the curvature of the surface. Figure 1 shows a graph of the surface profile at the western edge of longwall Panel 3. The survey data shown as the points in Figure 1 was interpolated to a uniformly spaced series of points that were 5 feet apart in order to estimate the curvature. The curvature was calculated from the interpolated data over 75-foot intervals using a cubic curve fit. The curvature at the center of the interval was calculated using the following equation:

$$\kappa = \frac{\frac{d^2y}{dx^2}}{\left(1+\left(\frac{dy}{dx}\right)^2\right)^{3/2}} \qquad (4)$$

where y is the cubic curve fit. The stress can then be calculated using the following formula:

$$SL_{Subsidence} = \frac{ED\kappa}{2} \qquad (5)$$

Figure 2 shows a graph of the subsidence stresses that were calculated from Equations (4) and (5). The peak subsidence stress of ±11,079 psi occurs at survey location 6+55 feet. This compares well with the stress measured from strain gauges on the pipe during subsidence. The measured bending stress was 9,177 psi. The calculated stress was used for our analysis because the single strain gauge measurement site may not have been located exactly at the peak stress location.

Coal Refuse Disposal Facility Overburden Stress

The disposal facility will result in stress on the pipeline as a result of the increased overburden loading. Kiefner used the loading information found in Alliance Consulting, Inc.'s analysis of the loading dated 5/31/2012 for project number B12-218-1413. The relevant parameters were an average overburden density of 139 pounds per cubic foot (pcf) and an effective height of 162 feet. This was considered the worst case for the overburden loading by Alliance Consulting and was assumed to be the same over the entire length of pipe under the refuse facility.

The external load on the pipeline from the increased overburden causes a deflection in the pipe cross section and local circumferential and longitudinal stresses that combine with the circumferential and longitudinal stresses that are present under normal operating conditions.

Kiefner based its analysis of the stress in the pipe from the overburden in the 'CEPA' equation[2]. The 'CEPA' equation effectively combines the internal pressure and lateral soil restraint deflection resistance terms into a single equation for circumferential bending stress.

The load at pipeline depth due to a load at the surface can be calculated using Boussinesq's equation:

$$W_l = \frac{3FD}{2\pi C^2\left[1+\left(\frac{d}{C}\right)^2\right]^{2.5}} \qquad (6)$$

where

F is the point load at the surface (lb)

D is the diameter of the pipe (in)

C is the depth of soil cover (in)

d is the offset distance from the pipe to the line of application of the surface load (in)

Using this equation any load with a known contact area can be represented by a series of point loads at the surface and the total load on the pipe is calculated as the summation of the individual loads.

The fill soil load above the pipeline is calculated as the weight a prism of soil having a width equal to the diameter of the pipe and height equal to the depth of cover:

$$W_f = \rho DC \qquad (7)$$

where

ρ = density of fill (lb/in^3)

The CEPA equation combines the pressure stiffening and soil restraint terms into the following equation for circumferential bending stress:

$$SH_{Surface} = \frac{6K_b W \cdot E \cdot t \cdot r}{Et^3 + 24 \cdot K_z P \cdot r^3 + 0.732E'r^3} \qquad (8)$$

where

K_b = soil parameter

W = sum of live and fill loads at pipeline depth (lb/in)

E = Young modulus for steel (30×10^6 psi)

t = wall thickness (in)

r = pipe radius (in)

K_z = soil parameter

[2] Warman, D. J. and Hart, J.D. "Development of a Pipeline Surface Loading Screening Process & Assessment of Surface Loading Dispersing Methods," Final Report 05-44 to the Canadian Energy Pipeline Association (CEPA). June 17, 2005

P = internal pressure (psig)
E' = modulus of soil reaction (psi)

Since the overburden loading is assumed to be uniform over the length of the pipe the longitudinal load from the overburden is a result of Poisson contraction and is:

$$SL_{Surface} = \upsilon SH_{Surface} \quad (9)$$

The hoop and longitudinal stresses from the surface loading were calculated at the operating pressure and at 0 psig pressure in the event the pipeline is shut down. The results of the analysis are shown in Table 1.

Coal Refuse Disposal Facility Consolidation Stress

The surface loading from the refuse disposal facility will result in consolidation of the soil under the facility. This consolidation will result in additional permanent stresses on the pipeline similar to the stresses caused by subsidence. Kiefner used the results of Alliance Consulting, Inc. consolidation analysis dated 8/2/2012 for project number B12-218-1413. Figure 3 shows the consolidation profile that was used for the analysis. The consolidation profile is from the west end of the refuse facility. Since the consolidation on the west end of the facility will be greater than on the east end it was used for the analysis.

The buried pipe consolidation stresses were analyzed in a finite element analysis (FEA) using the soil spring model outlined in the Guidelines for the Design of Buried Steel Pipe[3]. The model used nonlinear springs to represent the soil-pipe interaction. Figure 4 shows a schematic of the soil spring model. The execution of the soil spring model requires the soil density, cohesion and friction angle for inputs. The results from soil testing performed by Mach Mining were used for the soil property inputs in the analysis. Table 2 shows the results of the soil testing. Figures 5a and 5b show an overview of the FEA model and close-up view of the soil springs used for the analysis. The results of the stress analysis are shown in Figure 6. The peak consolidation stress of ±2,979 psi occurs at survey location 4+65 feet.

ASME B31.8 Design Stress Analysis

The components of the hoop and longitudinal stress analyses must be combined to obtain the total hoop (SH) and longitudinal (SL) stresses. The existing hoop and longitudinal stresses are approximately uniform stresses through the thickness of the pipe wall. The subsidence and consolidations stresses are longitudinal pipe bending stresses that are tensile on one side of the

[3] Guidelines for the Design of Buried Steel Pipe, July 2001 (with addenda through February 2005), AmericanLifelinesAlliance, American Society of Civil Engineers

pipe and compressive on the other side of the pipe but are relatively uniform through-wall stresses. Finally, the overburden stresses are through-wall bending that vary from compression on one side of the wall to compression on the other side of the wall. These stresses do not usually occur at the same location of the pipe circumference for a given survey position. The conservative convention is to assume that the individual stress components all occur at the same circumferential location and sum the results. The combined stress (Seq) is calculated from the total hoop and longitudinal stresses using the following formula:

$$Seq=\sqrt{SH^2-SH\cdot SL+SL^2} \qquad (10)$$

The results for the total longitudinal, hoop and combined stress are shown in Figures 7a and 7b. Figure 7a shows the stresses at 0 psig internal pressure and Figure 7b shows the stresses at 300 psig. The peak stresses are summarized in Table 3.

There is no requirement that an existing pipeline meet the stress limits of ASME B31.8 so long as it can be shown that they are operating safely. However, if the pipe is in good condition and the pipeline has been constructed in accordance with sound construction practices, then it can be stated that the pipeline is operating safely if it meets the B31.8 requirements. The following paragraph is the integrity review of the pipeline from Kiefner report number 10-028 that was performed as part of the longwall subsidence mitigation plan for DTE, the former owners of the pipeline.

"The DTE Sales and Inlet Lines went into service in 2002. The welds were inspected in accordance with API Standard 1104[4] for welding pipelines. The inlet line has a 7-10 mil internal corrosion prevention coating. DTE has an internal corrosion monitoring plan in place for the inlet line and has not found evidence of ongoing internal corrosion. The sales and inlet lines are FBE coated and have cathodic protection. To date, DTE has not experienced issues with external corrosion. Based on this analysis and the recent construction of the lines, we conclude that it is appropriate to use the stress limits given in ASME B31.8 as the stress limits during the subsidence of the pipelines."

ASME B31.8 limits the hoop stress from pressure and local stresses to 0.9 SMYS in Paragraph 833.9(b). The absolute value of the sum of the longitudinal stresses is limited to 0.9 SMYS in Paragraph 833.3(b) and the combined stress is limited to 0.9 SMYS in Paragraph 833.4(b). The stress limits for ASME B31.8 are shown in Table 3 and as the 0.9 SMYS lines in Figures 7a and 7b. Total longitudinal, hoop and combined stresses at 0 psig is in 7a and at 300 psig is in 7b. All of the stresses are within the limits of ASME B31.8 based on this analysis. Based on the results

[4] API Standard 1104, Welding of Pipelines and Related Facilities, 19th Edition, September 1999, American Petroleum Institute

of this analysis Mach Mining, LLC should be able to construct the coal refuse disposal facility over the 8-inch pipeline without compromising the integrity of the pipeline. Mach Mining, LLC should be aware that, once the facility is constructed, future access to the pipeline will be limited should future integrity issues arise.

Table 1 Stresses on the pipe from the refuse facility surface loading

Pressure, psig	$SH_{Surface}$, psi	$SL_{Surface}$, psi
0	27,756	8,327
300	27,097	8,129

Table 2. Soil properties used for consolidation stress analysis

Specimen no.	Northing	Easting	Elevation, ft	C, tsf	φ, deg	Dens. 1, lcf	Dens. 2, lcf	Dens. 3, lcf	Ave. dens., lcf
1	426979.808	360391.353	469.13	0.115	31.0	129.0	129.5	128.1	128.9
2	426915.196	362865.063	470.51	0.000	30.7	128.5	130.8	134.7	131.3
3	426872.850	364429.708	476.96	0.000	30.4	124.5	128.7	131.8	128.3
4	426851.754	365685.028	480.56	0.029	29.7	132.9	132.8	132.5	132.7
5	427055.027	367932.856	527.60	0.000	31.2	123.6	126.8	127.0	125.8
Average				**0.029**	**30.6**	**129.4**			

Table 3. Peak hoop, longitudinal and equivalent stresses from Figures 7a and 7b

Stress Component	Internal pressure, 0 psig		Internal pressure, 300 psig		ASME B31.8 Limit
	psi	/SMYS	psi	/SMYS	/SMYS
SH	27,756	0.66	30,284	0.72	0.9*
|SL|	26,615	0.63	26,418	0.63	0.9
SL compressive	-13,003	-0.31	-12,806	-0.30	>SMYS**
Seq	33,855	0.81	30,296	0.72	0.9
* Combined stress due to pressure and local through wall bending					
** 2/3 of critical buckling limit					

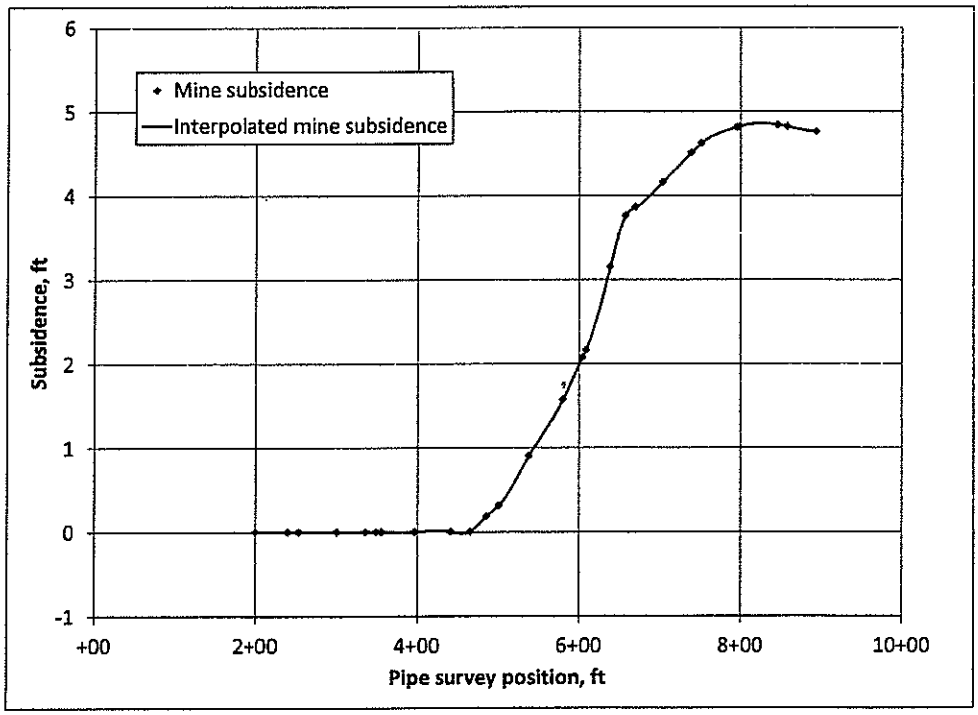


Figure 1. Profile of the mine subsidence at the western edge of longwall Panel 3 used to calculate subsidence stress

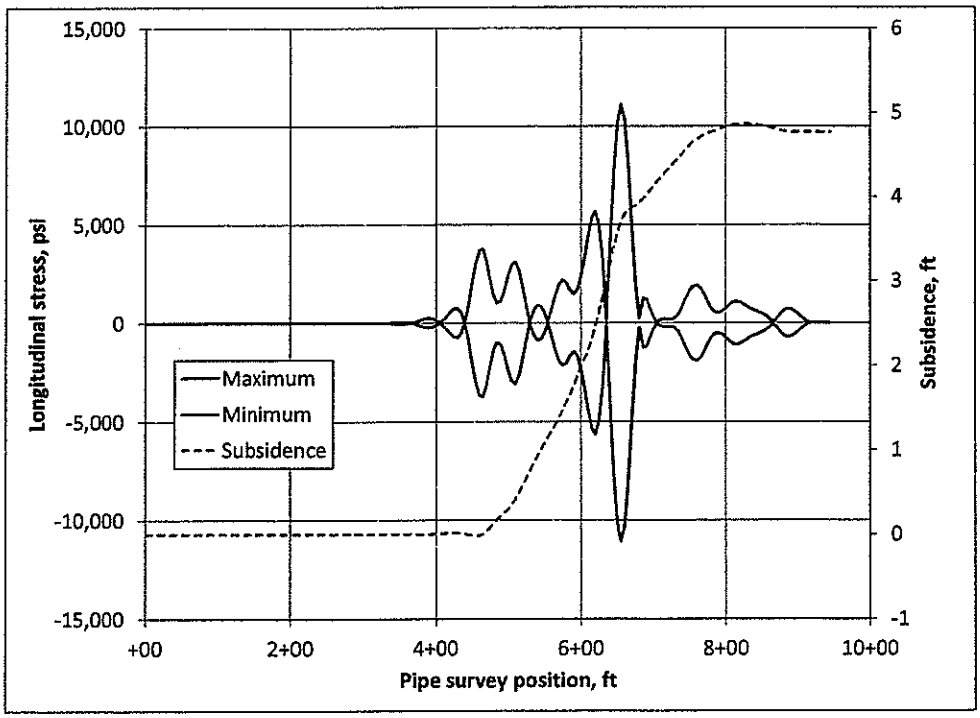


Figure 2. Bending stress calculated from the subsidence profile shown in Figure 1

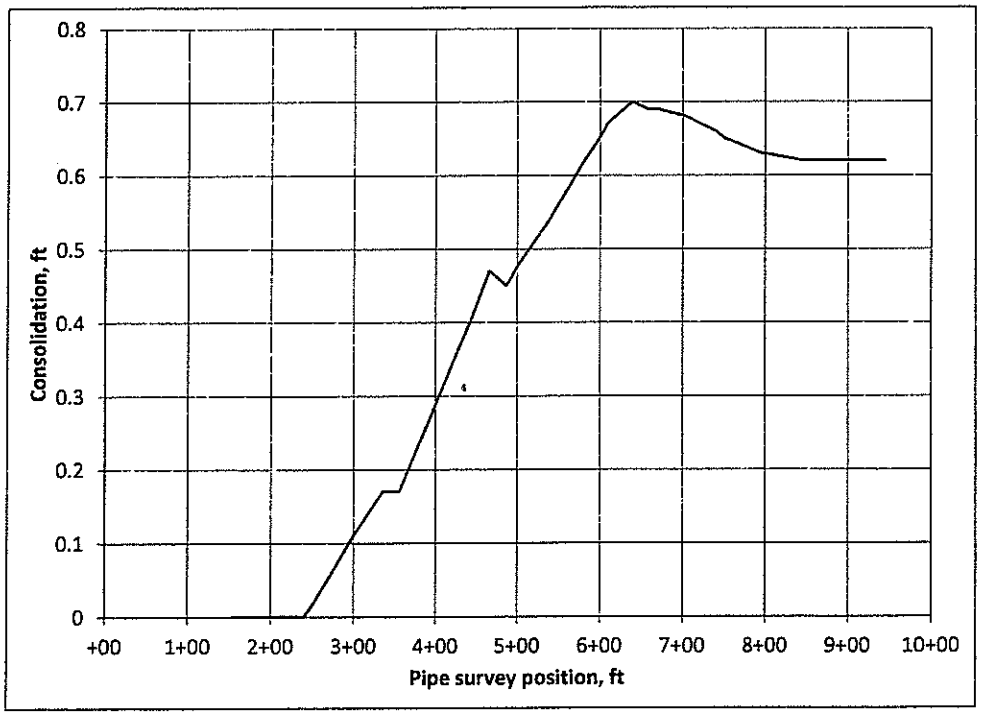
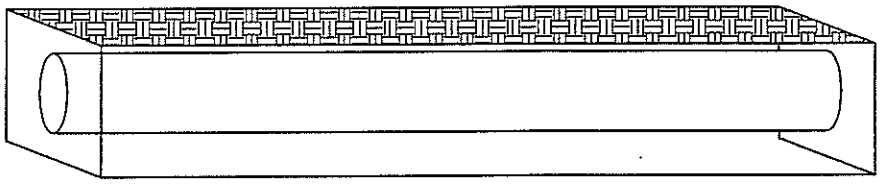
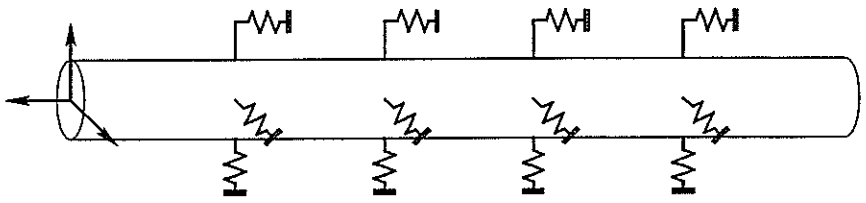


Figure 3. Consolidation profile under west side of refuse facility



a) Actual 3-Dimensional Soil Restraint on Pipeline



b) Idealized Restraint of Soil with Discrete Springs

Figure 4. Idealized soil spring model used to analyze buried pipe-soil interaction



Figure 5a. FEA model used for consolidation stress analysis



Figure 5b. Close-up view of soil springs in FEA model for consolidation stress analysis (arrows show soil springs)

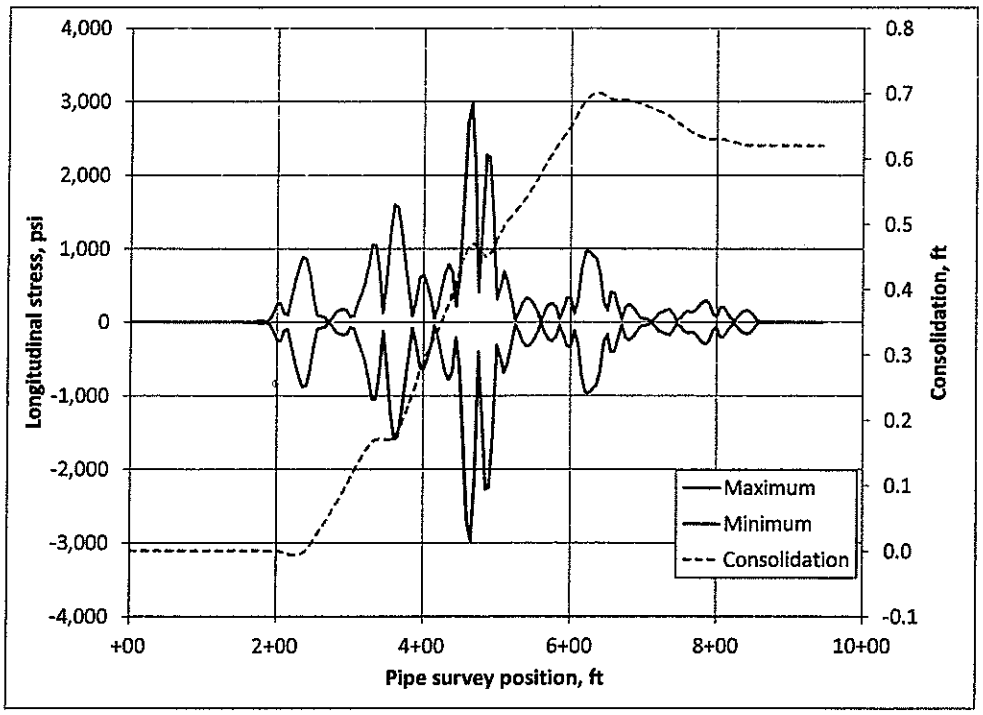


Figure 6. Consolidation stresses on 8-inch pipe

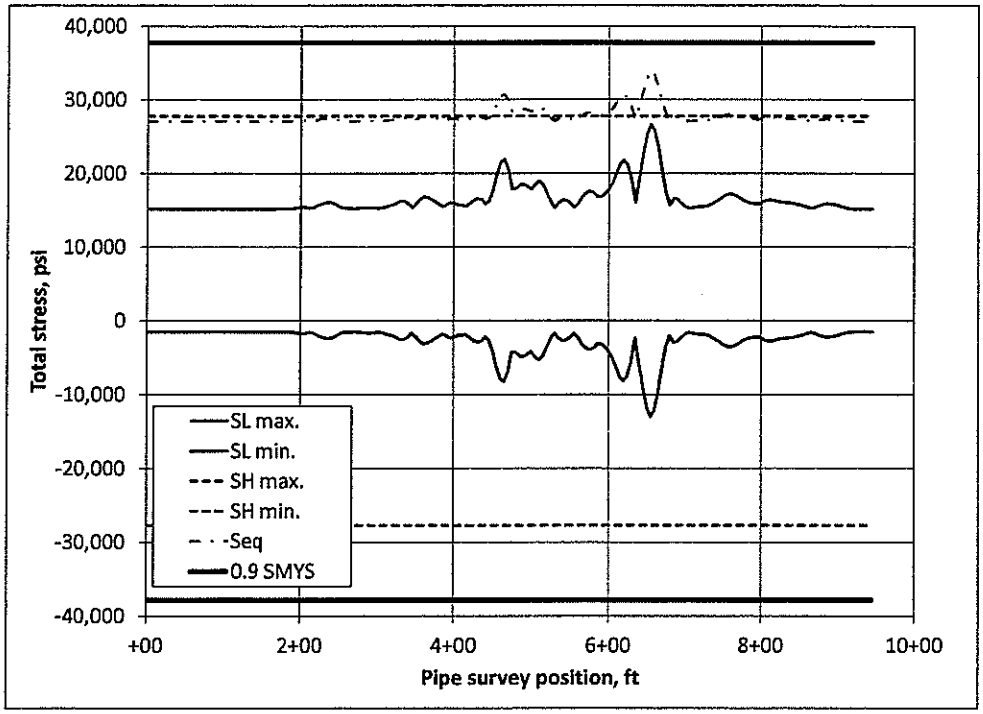


Figure 7a. Total longitudinal, hoop and combined stresses at 0 psig

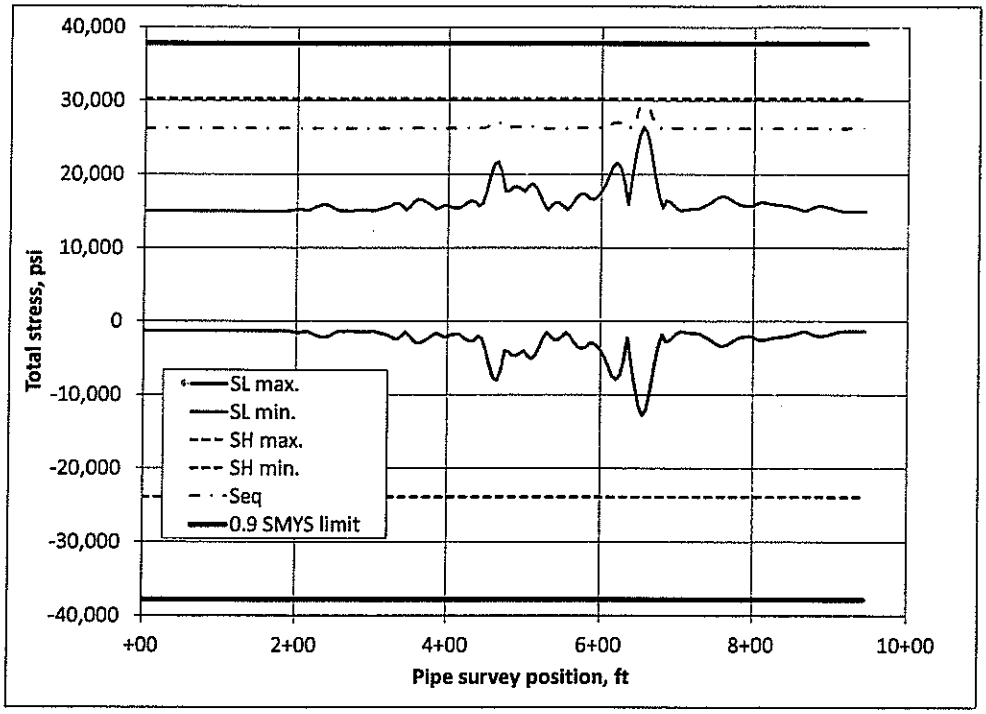


Figure 7b. Total longitudinal, hoop and combined stresses at 300 psig

OPERATIONS, MAINTENANCE & EMERGENCY PROCEDURES MANUAL

8" NATURAL GAS TRANSMISSION & GATHERING PIPELINE

For

Keyrock Energy LLC

January 26, 2012

Prepared By:

USDI

Utility Safety & Design, Inc.
1927 Miller Drive
Olney, IL 62450
(618) 392-5502

5.2 CORROSION CONTROL SYSTEM DESCRIPTION

EXTERNAL COATING FOR BURIED PIPING

All steel pipe used had a fusion bonded epoxy coating (12-14 mil). All roadway bore pipe had an additional Lilly 2040 coating. Refer to as built drawings ICBM-LN-001 through 012 for additional information.

INTERNAL COATING FOR GATHERING PIPELINE

Provision is also made to inject corrosion inhibitors provided by Baker- Petrolite at each field compressor station into the main gathering lines to control internal corrosion. The recommended program is included at the end of this section.

The 8-inch steel line is internally coated with an epoxy 9-12 mil thick to further control internal corrosion. The epoxy is Plastite 7159XV coating installed by In Situ Pipeline Services, Inc.

Because poly pipe is corrosion resistant no additional corrosion control material has been added to these gathering lines.

CATHODIC PROTECTION ANODES

The buried piping is cathodically protected by a sacrificial anode system. High potential sacrificial magnesium anodes were installed during construction of the pipeline. The system consists of nine sacrificial anode ground beds. Each bed contains six-32 pound magnesium anodes located by design from a soils resistively survey along the main gathering line.

ELECTRICAL ISOLATION

The pipeline is electrically isolated from above ground connections by the installation of flange type insulation kits. The field compressors are insulated from the mainline to provide protection to buried piping at the compressor station. Insulating flanges are provided at the pipeline outlet facilities to electrically isolate the gathering line from the plant facilities.

TEST STATIONS

Test stations used to test and monitor the cathodic protection and electrical isolation were installed on the system. A total of 2 test stations are utilized on the transmission (sales) pipeline. A total of 36 test stations are utilized on the gathering pipeline.

EXTERNAL COATING FOR ABOVE GROUND PIPING

All above ground piping is externally coated with a paint system to protect against atmospheric corrosion. Above ground piping shall be primed and painted.

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

December 11, 2009

Williamson Energy
PO Box 1829
Marion, Illinois 62959

Attention: Mr. James Plumley

Re: Shelby Tube Soil Samples - Pipeline Relocation Project
Mach Mine
Williamson County, Illinois
HFE File H-08265
Williamson Energy PO #14173

Dear Sir:

On November 13, 2009, we sampled the subsoils adjacent to the existing pipeline at Mach Mine near Johnston City, Illinois. Five Shelby tubes were taken at locations as indicated on the enclosed Triaxial Shear Test Report forms. The soil samples were extruded from the Shelby tubes and subjected to consolidated-undrained triaxial tests. Results of the tests are attached. The Triaxial Test Report forms are enclosed.

If you should have any questions, please feel free to contact us at your convenience.

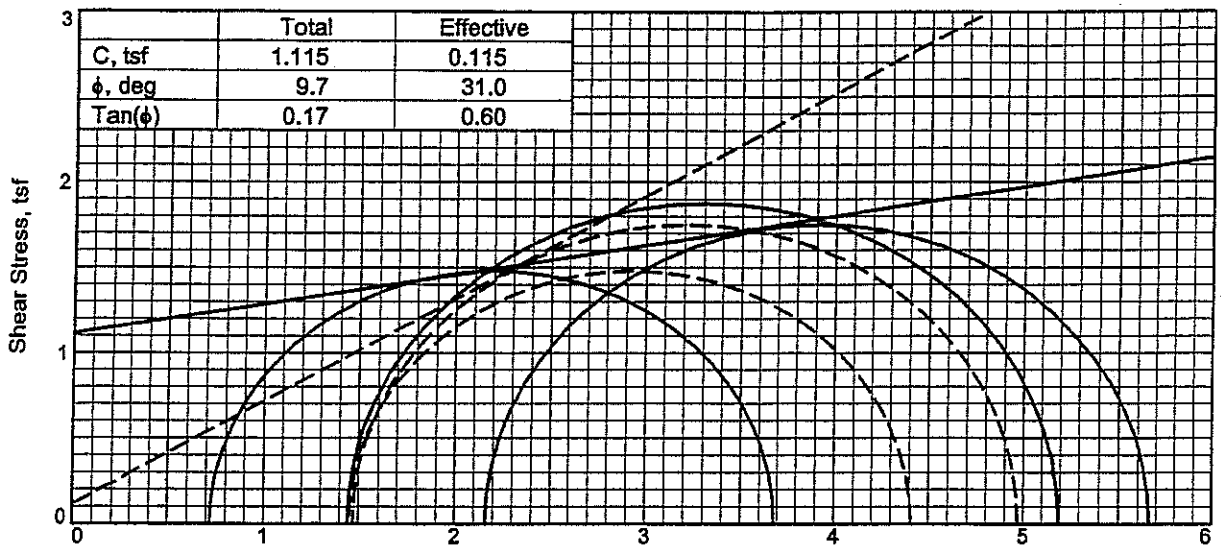
Sincerely,

HOLCOMB FOUNDATION ENGINEERING CO.

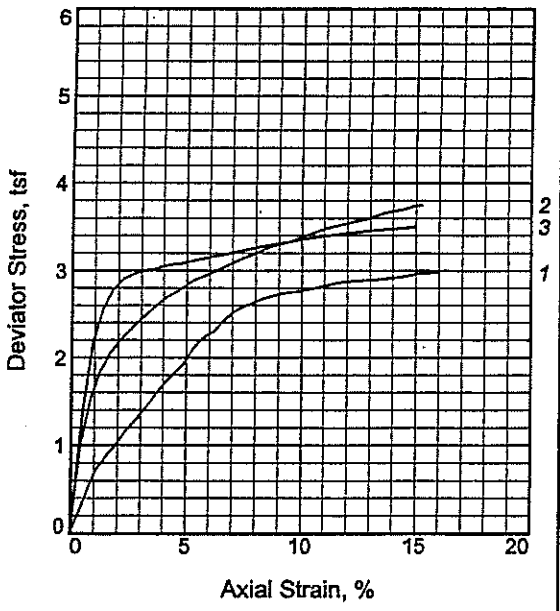
Timothy J. Holcomb, P.E.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY J.
HOLCOMB
062-042149
Exp 11-30-11
ILLINOIS

	Total	Effective
C, tsf	1.115	0.115
ϕ, deg	9.7	31.0
Tan(ϕ)	0.17	0.60



Total Normal Stress, tsf ———
Effective Normal Stress, tsf — — —



Sample No.		1	2	3
Initial	Water Content,	19.5	15.8	16.8
	Dry Density, pcf	107.9	111.8	109.6
	Saturation,	97.0	87.5	87.6
	Void Ratio	0.5333	0.4799	0.5095
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.82	4.95	4.66
At Test	Water Content,	20.1	18.1	19.2
	Dry Density, pcf	107.9	111.8	109.6
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5333	0.4799	0.5095
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.82	4.95	4.66
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		2.96	3.75	3.50
Total Pore Pr., tsf		2.87	3.60	4.29
Ult. Stress, tsf		2.96	3.75	3.50
Total Pore Pr., tsf		2.87	3.60	4.29
$\bar{\sigma}_1$ Failure, tsf		4.41	5.19	4.97
$\bar{\sigma}_3$ Failure, tsf		1.45	1.44	1.47

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Silty CLAY w/ sand

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426979.808 E 360391.353
Ground Elev: 469.13

Plate _____

Client: Mach Mine

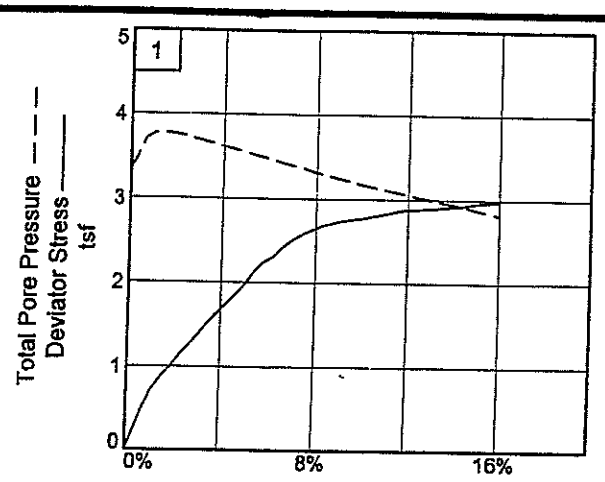
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #1

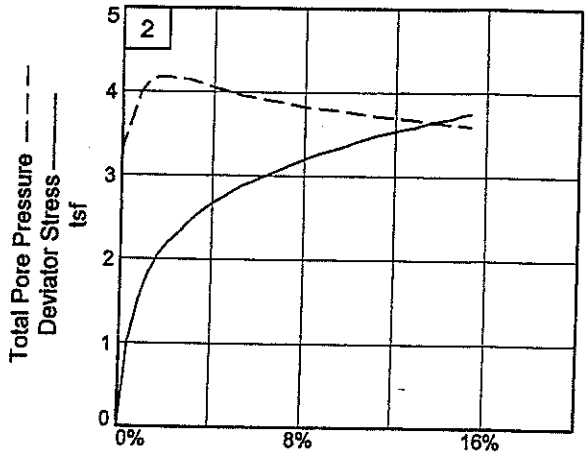
Proj. No.: H-08265 **Date:**

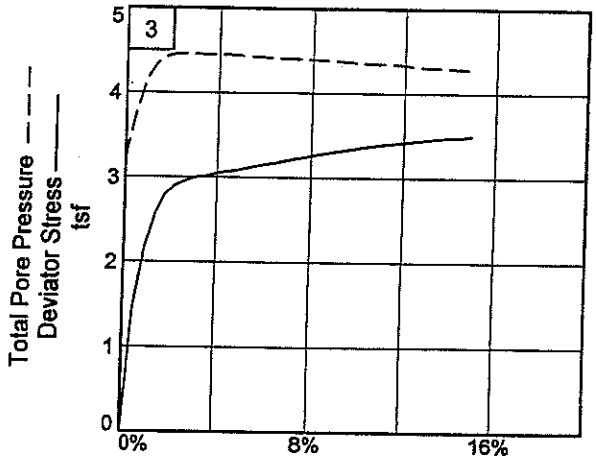
TRIAXIAL SHEAR TEST REPORT

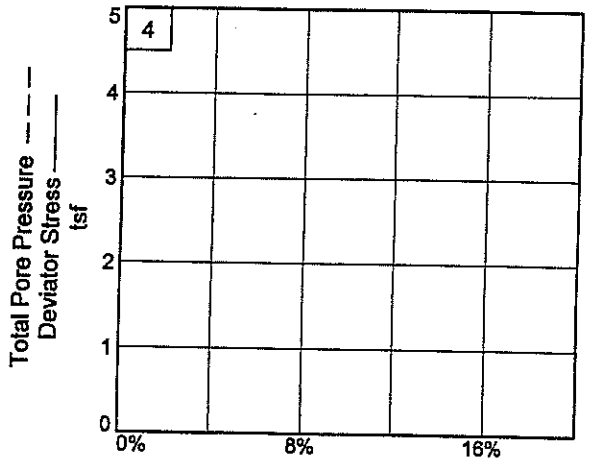
HOLCOMB FOUNDATION ENGINEERING CO.

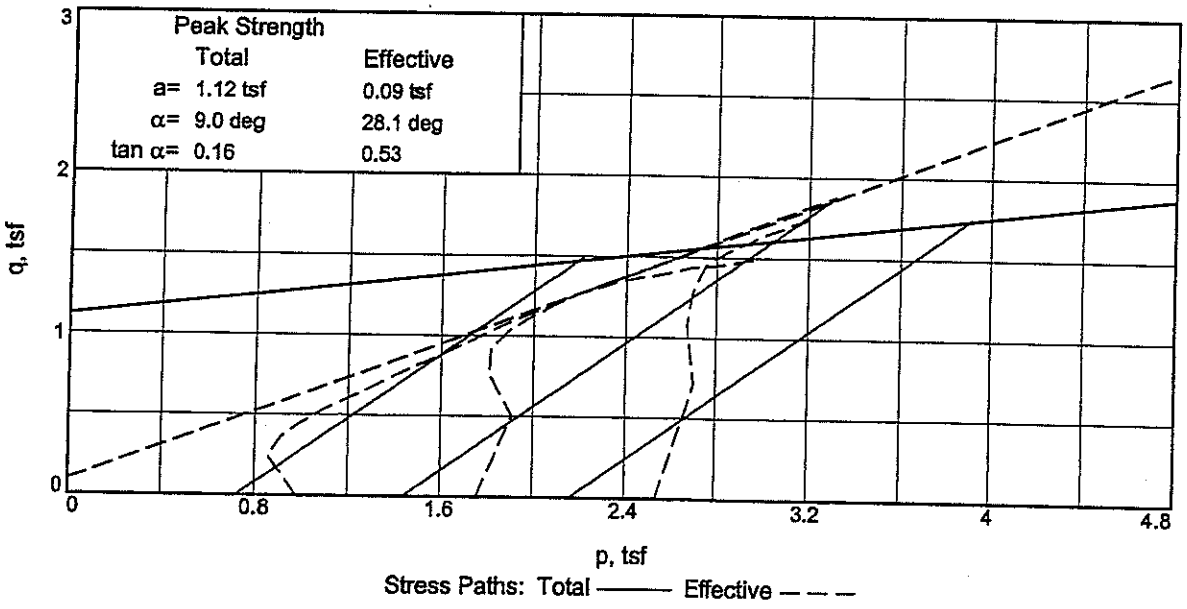
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #1
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC _____ **Checked By:** TH _____

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:27 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #1
Description: Brown Silty CLAY w/ sand
Remarks:
Location: N 426979.808 E 360391.363
Ground Elev: 469.13
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	215.200			1098.100
Moisture content: Dry soil+tare, gms.	202.100			935.000
Moisture content: Tare, gms.	135.000			104.200
Moisture, %	19.5	20.1	20.1	19.6
Moist specimen weight, gms.	1003.6			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.82	4.82	4.82	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	129.0	129.6	129.6	
Dry density, pcf	107.9	107.9	107.9	
Void ratio	0.5333	0.5333	0.5333	
Saturation, %	97.0	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.960 tsf **at reading no.** 27
Ult. Stress = 2.960 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	22.50	0.0	0.0	0.000	0.979	0.979	1.00	46.40	0.979	0.000
1	0.0330	64.10	41.6	0.7	0.483	0.612	1.095	1.79	51.50	0.854	0.242
2	0.0530	84.90	62.4	1.1	0.722	0.547	1.269	2.32	52.40	0.908	0.361
3	0.0740	99.00	76.5	1.5	0.881	0.547	1.428	2.61	52.40	0.988	0.440
4	0.0940	110.70	88.2	1.9	1.011	0.554	1.566	2.82	52.30	1.060	0.506
5	0.1150	124.80	102.3	2.4	1.168	0.583	1.751	3.00	51.90	1.167	0.584
6	0.1350	135.70	113.2	2.8	1.287	0.612	1.899	3.10	51.50	1.255	0.643
7	0.1560	149.80	127.3	3.2	1.441	0.641	2.081	3.25	51.10	1.361	0.720
8	0.1760	162.30	139.8	3.6	1.575	0.670	2.245	3.35	50.70	1.457	0.788
9	0.1960	173.90	151.4	4.0	1.699	0.706	2.404	3.41	50.20	1.555	0.849
10	0.2170	185.60	163.1	4.5	1.822	0.734	2.556	3.48	49.80	1.645	0.911
11	0.2370	197.20	174.7	4.9	1.943	0.763	2.706	3.55	49.40	1.735	0.971
12	0.2580	213.70	191.2	5.3	2.116	0.799	2.916	3.65	48.90	1.857	1.058
13	0.2780	225.20	202.7	5.8	2.234	0.828	3.062	3.70	48.50	1.945	1.117
14	0.2990	232.20	209.7	6.2	2.300	0.864	3.164	3.66	48.00	2.014	1.150
15	0.3190	243.80	221.3	6.6	2.417	0.900	3.317	3.69	47.50	2.108	1.208
16	0.3400	254.30	231.8	7.0	2.520	0.929	3.448	3.71	47.10	2.189	1.260
17	0.3600	261.20	238.7	7.5	2.583	0.958	3.541	3.70	46.70	2.249	1.292
18	0.3800	266.70	244.2	7.9	2.631	0.994	3.624	3.65	46.20	2.309	1.315
19	0.4010	272.50	250.0	8.3	2.680	1.022	3.703	3.62	45.80	2.363	1.340
20	0.4420	280.30	257.8	9.2	2.738	1.087	3.826	3.52	44.90	2.456	1.369
21	0.4830	285.40	262.9	10.0	2.766	1.145	3.911	3.42	44.10	2.528	1.383
22	0.5240	292.80	270.3	10.9	2.817	1.195	4.013	3.36	43.40	2.604	1.409
23	0.5640	300.10	277.6	11.7	2.866	1.246	4.112	3.30	42.70	2.679	1.433
24	0.6050	304.50	282.0	12.5	2.884	1.296	4.180	3.23	42.00	2.738	1.442
25	0.6460	308.70	286.2	13.4	2.898	1.346	4.245	3.15	41.30	2.796	1.449
26	0.6870	313.60	291.1	14.2	2.919	1.390	4.308	3.10	40.70	2.849	1.459
27	0.7280	320.70	298.2	15.1	2.960	1.447	4.408	3.05	39.90	2.927	1.480
28	0.7690	325.50	303.0	16.0	2.978	1.505	4.483	2.98	39.10	2.994	1.489

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	238.700			1158.600
Moisture content: Dry soil+tare, gms.	224.500			992.700
Moisture content: Tare, gms.	134.900			102.600
Moisture, %	15.8	18.1	18.1	18.6
Moist specimen weight, gms.	1035.9			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.95	4.95	4.95	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	129.5	132.0	132.0	
Dry density, pcf	111.8	111.8	111.8	
Void ratio	0.4799	0.4799	0.4799	
Saturation, %	87.5	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.752 tsf **at reading no.** 27
Ult. Stress = 3.752 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	1.757	1.757	1.00	45.60	1.757	0.000
1	0.0190	111.50	86.5	0.4	1.008	1.404	2.412	1.72	50.50	1.908	0.504
2	0.0400	155.60	130.6	0.8	1.515	1.051	2.566	2.44	55.40	1.809	0.757
3	0.0600	183.10	158.1	1.2	1.826	0.900	2.726	3.03	57.50	1.813	0.913
4	0.0810	203.10	178.1	1.6	2.048	0.864	2.912	3.37	58.00	1.888	1.024
5	0.1010	216.40	191.4	2.0	2.192	0.864	3.056	3.54	58.00	1.960	1.096
6	0.1220	226.40	201.4	2.5	2.297	0.886	3.183	3.59	57.70	2.034	1.148
7	0.1420	237.20	212.2	2.9	2.410	0.893	3.303	3.70	57.60	2.098	1.205
8	0.1620	247.20	222.2	3.3	2.513	0.922	3.435	3.73	57.20	2.178	1.257
9	0.1830	256.30	231.3	3.7	2.605	0.958	3.562	3.72	56.70	2.260	1.302
10	0.2030	264.60	239.6	4.1	2.687	0.994	3.680	3.70	56.20	2.337	1.343
11	0.2240	271.30	246.3	4.5	2.750	1.022	3.772	3.69	55.80	2.397	1.375
12	0.2440	278.80	253.8	4.9	2.821	1.058	3.880	3.67	55.30	2.469	1.411
13	0.2650	286.30	261.3	5.4	2.892	1.087	3.979	3.66	54.90	2.533	1.446
14	0.2850	291.30	266.3	5.8	2.935	1.102	4.036	3.66	54.70	2.569	1.467
15	0.3060	297.10	272.1	6.2	2.985	1.123	4.108	3.66	54.40	2.616	1.492
16	0.3460	308.80	283.8	7.0	3.086	1.159	4.246	3.66	53.90	2.702	1.543
17	0.3870	320.40	295.4	7.8	3.184	1.202	4.386	3.65	53.30	2.794	1.592
18	0.4280	331.20	306.2	8.6	3.271	1.231	4.502	3.66	52.90	2.867	1.635
19	0.4690	339.50	314.5	9.5	3.329	1.253	4.582	3.66	52.60	2.917	1.664
20	0.5100	350.40	325.4	10.3	3.413	1.289	4.702	3.65	52.10	2.995	1.706
21	0.5510	360.40	335.4	11.1	3.485	1.318	4.803	3.65	51.70	3.060	1.743

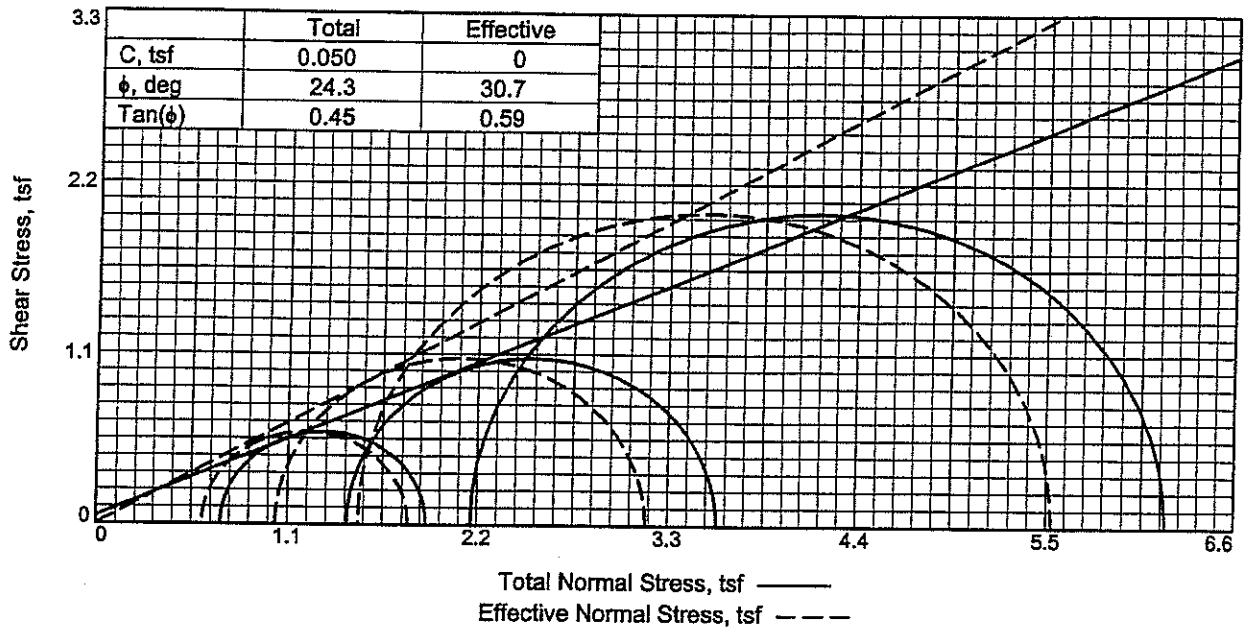
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	368.70	343.7	12.0	3.538	1.339	4.877	3.64	51.40	3.108	1.769
23	0.6330	377.00	352.0	12.8	3.589	1.361	4.950	3.64	51.10	3.156	1.795
24	0.6730	387.00	362.0	13.6	3.657	1.390	5.047	3.63	50.70	3.218	1.829
25	0.7140	394.50	369.5	14.4	3.697	1.418	5.116	3.61	50.30	3.267	1.849
26	0.7350	400.30	375.3	14.9	3.737	1.426	5.162	3.62	50.20	3.294	1.868
27	0.7550	403.60	378.6	15.3	3.752	1.440	5.192	3.61	50.00	3.316	1.876

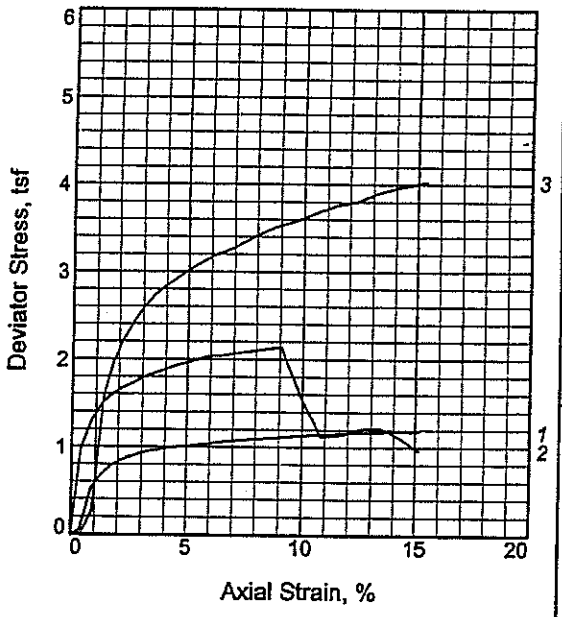
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	195.800			1096.200
Moisture content: Dry soil+tare, gms.	187.800			933.200
Moisture content: Tare, gms.	140.300			115.600
Moisture, %	16.8	19.2	19.2	19.9
Moist specimen weight, gms.	963.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.66	4.66	4.66	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.1	130.7	130.7	
Dry density, pcf	109.6	109.6	109.6	
Void ratio	0.5095	0.5095	0.5095	
Saturation, %	87.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.502 tsf **at reading no.** 25
Ult. Stress = 3.502 tsf **at reading no.** 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	29.10	0.0	0.0	0.000	2.534	2.534	1.00	44.80	2.534	0.000
1	0.0230	151.50	122.4	0.5	1.424	1.987	3.412	1.72	52.40	2.699	0.712
2	0.0430	214.70	185.6	0.9	2.151	1.591	3.742	2.35	57.90	2.667	1.075
3	0.0640	251.30	222.2	1.4	2.563	1.411	3.974	2.82	60.40	2.693	1.282
4	0.0840	272.10	243.0	1.8	2.791	1.332	4.123	3.10	61.50	2.727	1.395
5	0.1040	283.00	253.9	2.2	2.903	1.303	4.206	3.23	61.90	2.755	1.452
6	0.1250	288.80	259.7	2.7	2.956	1.303	4.259	3.27	61.90	2.781	1.478
7	0.1450	293.80	264.7	3.1	2.999	1.303	4.303	3.30	61.90	2.803	1.500
8	0.1660	296.30	267.2	3.5	3.014	1.310	4.324	3.30	61.80	2.817	1.507
9	0.1860	300.40	271.3	4.0	3.046	1.310	4.357	3.32	61.80	2.834	1.523
10	0.2070	303.80	274.7	4.4	3.070	1.310	4.380	3.34	61.80	2.845	1.535
11	0.2270	306.30	277.2	4.9	3.084	1.318	4.402	3.34	61.70	2.860	1.542

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
12	0.2480	310.40	281.3	5.3	3.115	1.325	4.440	3.35	61.60	2.882	1.557
13	0.2680	313.70	284.6	5.7	3.137	1.332	4.469	3.36	61.50	2.900	1.568
14	0.2880	317.10	288.0	6.2	3.160	1.339	4.499	3.36	61.40	2.919	1.580
15	0.3090	320.40	291.3	6.6	3.181	1.346	4.527	3.36	61.30	2.937	1.590
16	0.3500	327.90	298.8	7.5	3.232	1.354	4.586	3.39	61.20	2.970	1.616
17	0.3910	335.40	306.3	8.4	3.282	1.368	4.650	3.40	61.00	3.009	1.641
18	0.4320	342.00	312.9	9.3	3.320	1.382	4.702	3.40	60.80	3.042	1.660
19	0.4720	348.70	319.6	10.1	3.359	1.404	4.763	3.39	60.50	3.083	1.679
20	0.5130	355.40	326.3	11.0	3.396	1.411	4.807	3.41	60.40	3.109	1.698
21	0.5540	361.20	332.1	11.9	3.422	1.418	4.840	3.41	60.30	3.129	1.711
22	0.5950	367.00	337.9	12.8	3.447	1.447	4.894	3.38	59.90	3.171	1.723
23	0.6360	372.80	343.7	13.6	3.471	1.454	4.925	3.39	59.80	3.190	1.735
24	0.6770	377.80	348.7	14.5	3.485	1.469	4.954	3.37	59.60	3.211	1.743
25	0.6970	381.20	352.1	15.0	3.502	1.469	4.970	3.38	59.60	3.220	1.751





Sample No.		1	2	3
Initial	Water Content,	22.3	21.7	19.3
	Dry Density, pcf	105.1	107.5	112.9
	Saturation,	102.8	106.4	109.9
	Void Ratio	0.5747	0.5392	0.4659
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.85	4.72	4.67
At Test	Water Content,	21.7	20.3	17.6
	Dry Density, pcf	105.1	107.5	112.9
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5747	0.5392	0.4659
	Diameter, in.	2.80	2.80	2.80
	Height, in.	4.85	4.72	4.67
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.18	2.14	4.03
Total Pore Pr., tsf		3.71	4.01	4.26
Ult. Stress, tsf		1.18	0.97	4.03
Total Pore Pr., tsf		3.71	4.58	4.26
$\bar{\sigma}_1$ Failure, tsf		1.80	3.17	5.53
$\bar{\sigma}_3$ Failure, tsf		0.61	1.03	1.50

Type of Test: CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Silty CLAY w/ sand

Assumed Specific Gravity= 2.65
Remarks:
- Location: N 426915.196 E 362865.063
  Ground Elev. 470.51

Plate _____

Client: Mach Mine

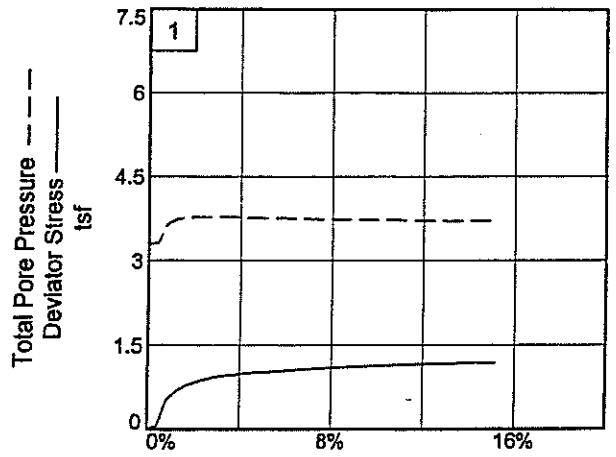
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #2

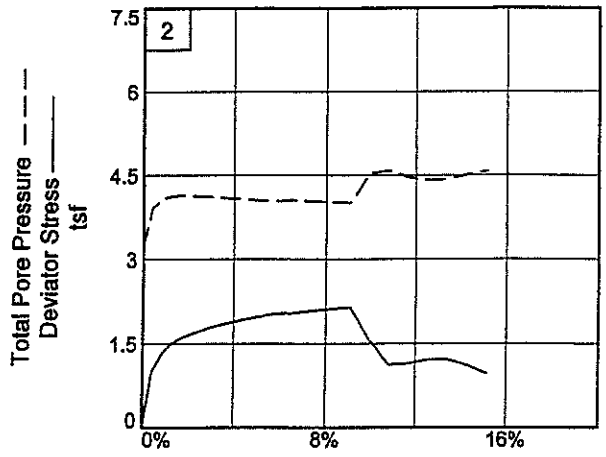
Proj. No.: H-08265 **Date:**

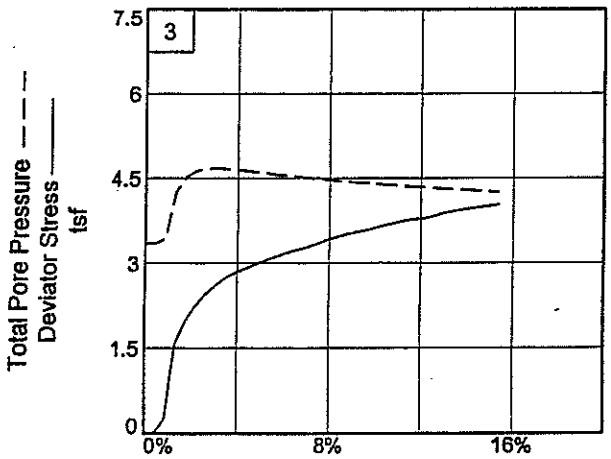
TRIAXIAL SHEAR TEST REPORT

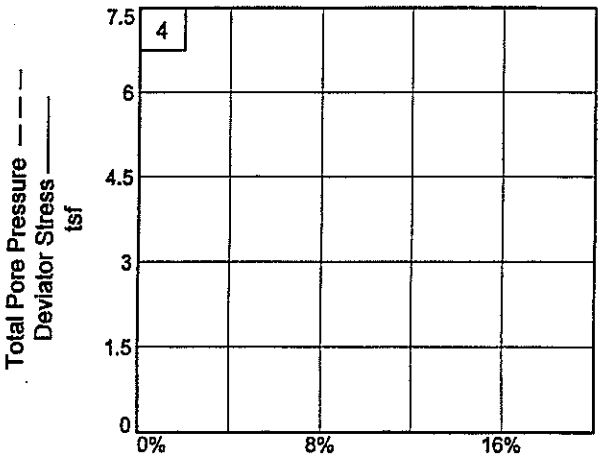
HOLCOMB FOUNDATION ENGINEERING CO.

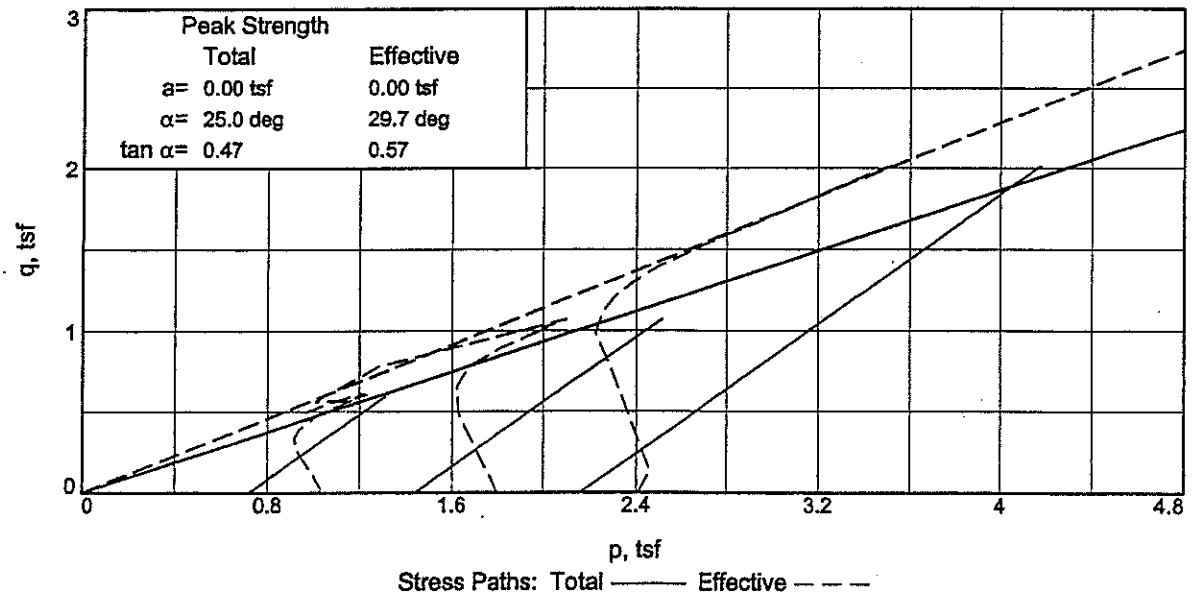
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #2
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:31 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #2
Description: Brown Silty CLAY w/ sand
Remarks:
N 426915.196 E362865.063
Ground Elev. 470.51
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	174.500			1130.900
Moisture content: Dry soil+tare, gms.	154.600			962.700
Moisture content: Tare, gms.	65.300			140.100
Moisture, %	22.3	21.7	21.7	20.4
Moist specimen weight, gms.	1007.9			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.85	4.85	4.85	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.5	127.8	127.8	
Dry density, pcf	105.1	105.1	105.1	
Void ratio	0.5747	0.5747	0.5747	
Saturation, %	102.8	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.185 tsf **at reading no.** 25
Ult. Stress = 1.181 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	24.10	0.0	0.0	0.000	1.030	1.030	1.00	45.70	1.030	0.000
1	0.0190	29.10	5.0	0.4	0.052	1.008	1.060	1.05	46.00	1.034	0.026
2	0.0400	69.10	45.0	0.8	0.522	0.670	1.191	1.78	50.70	0.931	0.261
3	0.0600	82.40	58.3	1.2	0.673	0.583	1.256	2.15	51.90	0.920	0.337
4	0.0810	91.50	67.4	1.7	0.775	0.554	1.329	2.40	52.30	0.942	0.387
5	0.1010	97.40	73.3	2.1	0.839	0.547	1.386	2.53	52.40	0.967	0.420
6	0.1220	101.50	77.4	2.5	0.882	0.547	1.429	2.61	52.40	0.988	0.441
7	0.1420	105.70	81.6	2.9	0.926	0.540	1.466	2.72	52.50	1.003	0.463
8	0.1620	108.20	84.1	3.3	0.951	0.547	1.498	2.74	52.40	1.022	0.475
9	0.1830	109.90	85.8	3.8	0.965	0.547	1.513	2.76	52.40	1.030	0.483
10	0.2030	112.40	88.3	4.2	0.989	0.554	1.544	2.78	52.30	1.049	0.495
11	0.2240	114.00	89.9	4.6	1.003	0.554	1.557	2.81	52.30	1.056	0.501
12	0.2440	114.80	90.7	5.0	1.007	0.562	1.569	2.79	52.20	1.065	0.504
13	0.2650	116.50	92.4	5.5	1.021	0.562	1.583	2.82	52.20	1.072	0.511
14	0.2850	118.20	94.1	5.9	1.036	0.562	1.597	2.84	52.20	1.079	0.518
15	0.3060	119.80	95.7	6.3	1.048	0.569	1.617	2.84	52.10	1.093	0.524
16	0.3260	121.50	97.4	6.7	1.062	0.576	1.638	2.84	52.00	1.107	0.531
17	0.3670	124.00	99.9	7.6	1.080	0.583	1.663	2.85	51.90	1.123	0.540
18	0.4080	126.50	102.4	8.4	1.097	0.583	1.680	2.88	51.90	1.132	0.548
19	0.4490	129.00	104.9	9.3	1.113	0.590	1.704	2.89	51.80	1.147	0.557
20	0.4890	131.50	107.4	10.1	1.129	0.598	1.727	2.89	51.70	1.162	0.565
21	0.5300	134.00	109.9	10.9	1.145	0.598	1.742	2.92	51.70	1.170	0.572
22	0.5710	136.50	112.4	11.8	1.160	0.605	1.764	2.92	51.60	1.185	0.580
23	0.6120	138.10	114.0	12.6	1.165	0.605	1.770	2.93	51.60	1.187	0.582
24	0.6530	139.80	115.7	13.5	1.171	0.612	1.783	2.91	51.50	1.197	0.585
25	0.6940	142.30	118.2	14.3	1.185	0.612	1.797	2.94	51.50	1.204	0.592
26	0.7140	142.30	118.2	14.7	1.179	0.612	1.791	2.93	51.50	1.201	0.589
27	0.7350	143.10	119.0	15.1	1.181	0.612	1.793	2.93	51.50	1.202	0.590

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	164.100			1116.300
Moisture content: Dry soil+tare, gms.	145.000			945.500
Moisture content: Tare, gms.	56.800			119.600
Moisture, %	21.7	20.3	20.3	20.7
Moist specimen weight, gms.	997.1			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	4.72	4.72	4.72	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	130.8	129.3	129.3	
Dry density, pcf	107.5	107.5	107.5	
Void ratio	0.5392	0.5392	0.5392	
Saturation, %	106.4	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.141 tsf **at reading no.** 18
Ult. Stress = 0.967 tsf **at reading no.** 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	39.10	0.0	0.0	0.000	1.800	1.800	1.00	45.00	1.800	0.000
1	0.0190	123.20	84.1	0.4	0.979	1.138	2.117	1.86	54.20	1.627	0.490
2	0.0400	152.30	113.2	0.8	1.312	0.965	2.277	2.36	56.60	1.621	0.656
3	0.0600	168.90	129.8	1.3	1.498	0.914	2.413	2.64	57.30	1.664	0.749
4	0.0810	178.10	139.0	1.7	1.597	0.900	2.497	2.77	57.50	1.699	0.799
5	0.1010	184.80	145.7	2.1	1.667	0.907	2.574	2.84	57.40	1.741	0.834
6	0.1220	190.60	151.5	2.6	1.726	0.914	2.640	2.89	57.30	1.777	0.863
7	0.1420	196.40	157.3	3.0	1.784	0.922	2.706	2.94	57.20	1.814	0.892
8	0.1620	201.40	162.3	3.4	1.833	0.936	2.769	2.96	57.00	1.852	0.916
9	0.1830	205.60	166.5	3.9	1.871	0.950	2.822	2.97	56.80	1.886	0.936
10	0.2030	209.70	170.6	4.3	1.909	0.958	2.867	2.99	56.70	1.912	0.954
11	0.2240	213.90	174.8	4.7	1.947	0.972	2.919	3.00	56.50	1.945	0.973
12	0.2440	217.20	178.1	5.2	1.975	0.986	2.961	3.00	56.30	1.974	0.987
13	0.2650	221.40	182.3	5.6	2.012	0.994	3.006	3.02	56.20	2.000	1.006
14	0.2850	224.70	185.6	6.0	2.039	1.001	3.040	3.04	56.10	2.020	1.020
15	0.3060	225.50	186.4	6.5	2.038	0.979	3.017	3.08	56.40	1.998	1.019
16	0.3460	230.50	191.4	7.3	2.074	1.001	3.075	3.07	56.10	2.038	1.037
17	0.3870	235.50	196.4	8.2	2.108	1.015	3.123	3.08	55.90	2.069	1.054
18	0.4280	240.50	201.4	9.1	2.141	1.030	3.171	3.08	55.70	2.100	1.071
19	0.4690	187.30	148.2	9.9	1.561	0.504	2.065	4.10	63.00	1.284	0.780
20	0.5100	146.50	107.4	10.8	1.120	0.454	1.574	3.47	63.70	1.014	0.560
21	0.5510	149.00	109.9	11.7	1.135	0.576	1.711	2.97	62.00	1.143	0.567

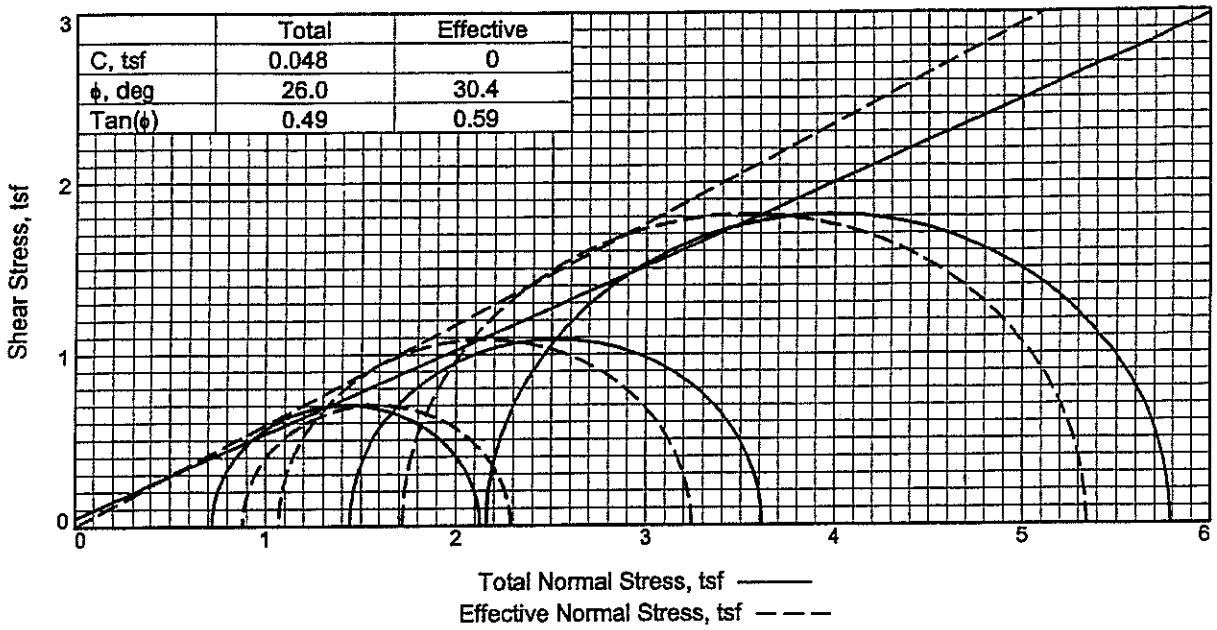
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	157.30	118.2	12.5	1.209	0.626	1.835	2.93	61.30	1.231	0.604
23	0.6330	159.80	120.7	13.4	1.222	0.605	1.827	3.02	61.60	1.216	0.611
24	0.6730	149.80	110.7	14.3	1.110	0.526	1.635	3.11	62.70	1.080	0.555
25	0.7140	136.50	97.4	15.1	0.967	0.461	1.427	3.10	63.60	0.944	0.483

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	197.400			1113.000
Moisture content: Dry soil+tare, gms.	172.200			956.600
Moisture content: Tare, gms.	41.800			104.200
Moisture, %	19.3	17.6	17.6	18.3
Moist specimen weight, gms.	1015.4			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	4.67	4.67	4.67	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	134.7	132.7	132.7	
Dry density, pcf	112.9	112.9	112.9	
Void ratio	0.4659	0.4659	0.4659	
Saturation, %	109.9	100.0	100.0	

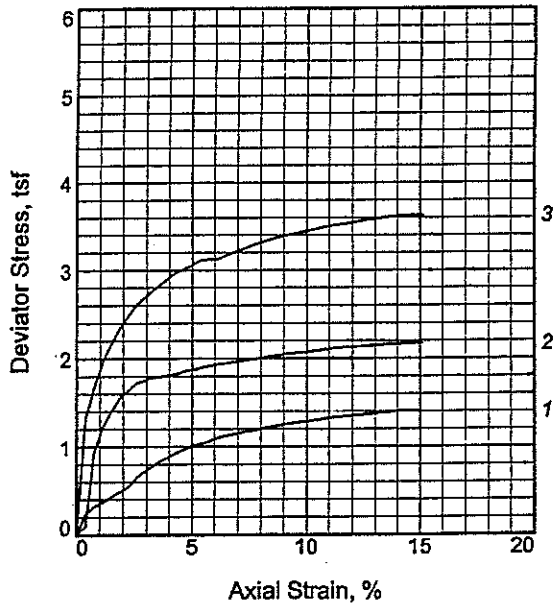
Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.029 tsf **at reading no.** 25
Ult. Stress = 4.029 tsf **at reading no.** 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0190	29.10	0.0	0.0	0.000	2.412	2.412	1.00	46.50	2.412	0.000
1	0.0400	30.80	1.7	0.5	0.012	2.405	2.417	1.01	46.60	2.411	0.006
2	0.0600	53.30	24.2	0.9	0.266	2.326	2.591	1.11	47.70	2.458	0.133
3	0.0810	164.80	135.7	1.3	1.566	1.505	3.070	2.04	59.10	2.288	0.783
4	0.1010	200.60	171.5	1.8	1.970	1.238	3.209	2.59	62.80	2.223	0.985
5	0.1220	224.70	195.6	2.2	2.237	1.138	3.374	2.97	64.20	2.256	1.118
6	0.1420	243.80	214.7	2.6	2.444	1.094	3.539	3.23	64.80	2.317	1.222
7	0.1620	258.80	229.7	3.1	2.604	1.087	3.691	3.39	64.90	2.389	1.302
8	0.1830	272.10	243.0	3.5	2.742	1.094	3.836	3.51	64.80	2.465	1.371
9	0.2030	281.30	252.2	3.9	2.833	1.109	3.941	3.55	64.60	2.525	1.416
10	0.2240	288.80	259.7	4.4	2.903	1.130	4.034	3.57	64.30	2.582	1.452
11	0.2440	297.10	268.0	4.8	2.983	1.152	4.135	3.59	64.00	2.643	1.491
12	0.2650	305.40	276.3	5.3	3.060	1.166	4.227	3.62	63.80	2.697	1.530
13	0.2850	312.10	283.0	5.7	3.120	1.195	4.316	3.61	63.40	2.755	1.560

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
14	0.3060	319.60	290.5	6.2	3.188	1.210	4.397	3.64	63.20	2.804	1.594
15	0.3460	330.40	301.3	7.0	3.276	1.253	4.529	3.62	62.60	2.891	1.638
16	0.3870	345.40	316.3	7.9	3.407	1.289	4.696	3.64	62.10	2.992	1.703
17	0.4280	357.90	328.8	8.8	3.508	1.325	4.832	3.65	61.60	3.079	1.754
18	0.4690	367.80	338.7	9.6	3.578	1.346	4.925	3.66	61.30	3.136	1.789
19	0.5100	380.30	351.2	10.5	3.674	1.375	5.050	3.67	60.90	3.212	1.837
20	0.5510	392.00	362.9	11.4	3.759	1.404	5.163	3.68	60.50	3.284	1.880
21	0.5920	399.50	370.4	12.3	3.799	1.426	5.225	3.66	60.20	3.325	1.900
22	0.6330	412.80	383.7	13.2	3.896	1.447	5.343	3.69	59.90	3.395	1.948
23	0.6730	422.80	393.7	14.0	3.958	1.469	5.427	3.69	59.60	3.448	1.979
24	0.7140	431.10	402.0	14.9	4.000	1.490	5.491	3.68	59.30	3.491	2.000
25	0.7350	436.10	407.0	15.3	4.029	1.505	5.533	3.68	59.10	3.519	2.014



	Total	Effective
C, tsf	0.048	0
ϕ, deg	26.0	30.4
Tan(ϕ)	0.49	0.59



Sample No.		1	2	3
Initial	Water Content,	18.2	19.2	18.6
	Dry Density, pcf	105.3	108.0	111.2
	Saturation,	84.6	95.6	100.8
	Void Ratio	0.5714	0.5315	0.4884
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.20	5.55	4.99
At Test	Water Content,	21.6	20.1	18.4
	Dry Density, pcf	105.3	108.0	111.2
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.5714	0.5315	0.4884
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.20	5.55	4.99
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.41	2.17	3.63
Total Pore Pr., tsf		3.44	3.97	4.04
Ult. Stress, tsf		1.41	2.17	3.63
Total Pore Pr., tsf		3.44	3.97	4.04
$\bar{\sigma}_1$ Failure, tsf		2.29	3.24	5.35
$\bar{\sigma}_3$ Failure, tsf		0.88	1.07	1.72

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Sandy CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426872.850 E 364429.708
Ground Elev. 476.96

Plate _____

Client: Mach Mine

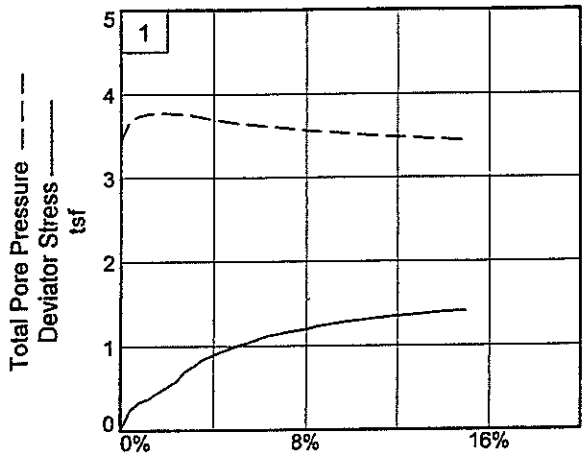
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #3

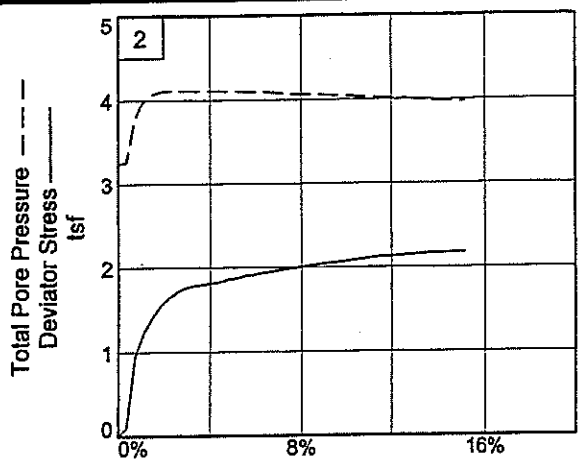
Proj. No.: H-08265 **Date:**

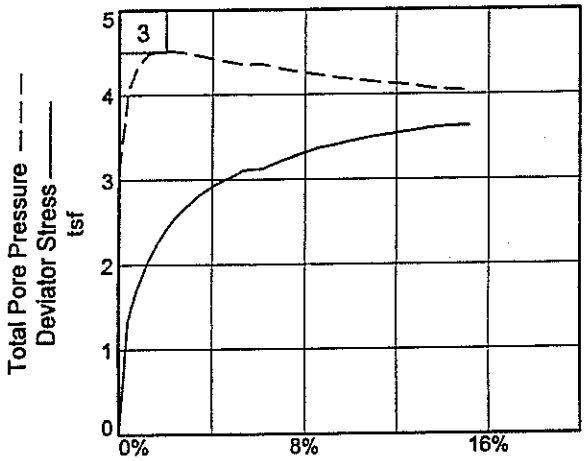
TRIAXIAL SHEAR TEST REPORT

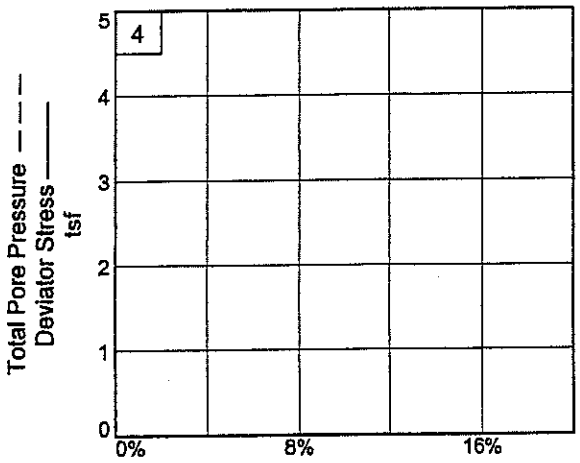
HOLCOMB FOUNDATION ENGINEERING CO.

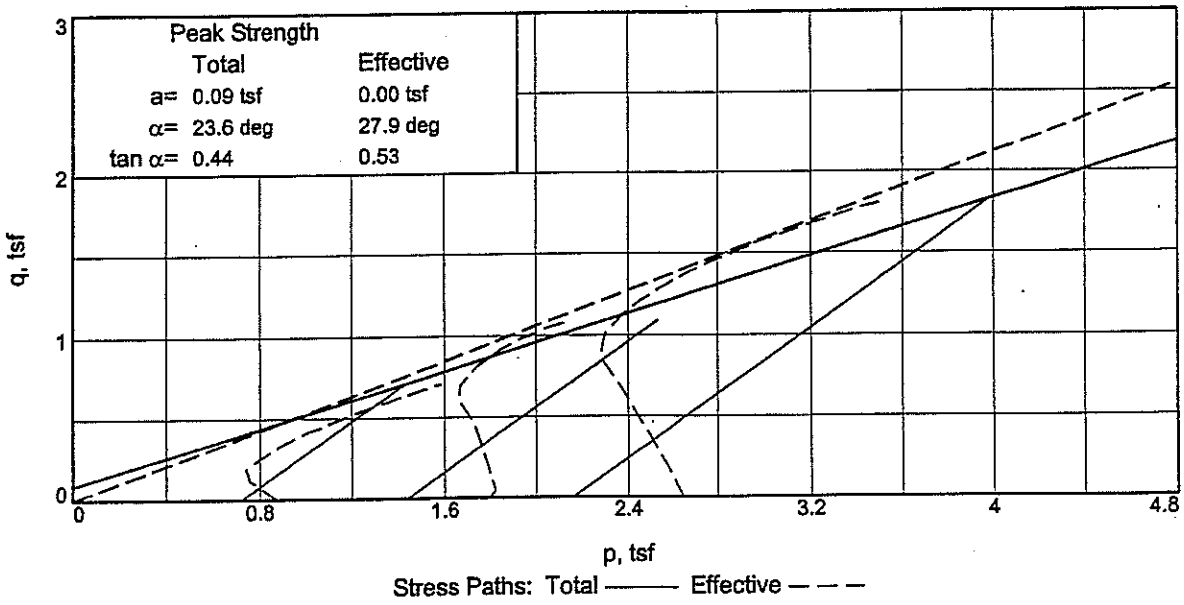
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #3
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC _____ **Checked By:** TH _____

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:33 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #3
Description: Brown Mottled Gray Sandy CLAY
Remarks:
Location: N 426872.850 E 364429.708
Ground Elev. 476.957
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	292.100			1169.300
Moisture content: Dry soil+tare, gms.	258.000			998.300
Moisture content: Tare, gms.	71.000			115.600
Moisture, %	18.2	21.6	21.6	19.4
Moist specimen weight, gms.	1045.2			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.20	5.20	5.20	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	124.5	128.0	128.0	
Dry density, pcf	105.3	105.3	105.3	
Void ratio	0.5714	0.5714	0.5714	
Saturation, %	84.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.407 tsf **at reading no.** 28
Ult. Stress = 1.407 tsf **at reading no.** 28

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	51.60	0.0	0.0	0.000	0.878	0.878	1.00	47.80	0.878	0.000
1	0.0200	71.60	20.0	0.4	0.233	0.641	0.874	1.36	51.10	0.757	0.116
2	0.0410	79.90	28.3	0.8	0.328	0.583	0.912	1.56	51.90	0.747	0.164
3	0.0610	85.70	34.1	1.2	0.374	0.554	0.929	1.67	52.30	0.741	0.187
4	0.0820	92.40	40.8	1.6	0.443	0.547	0.990	1.81	52.40	0.769	0.221
5	0.1020	98.20	46.6	2.0	0.501	0.547	1.048	1.92	52.40	0.798	0.250
6	0.1230	104.90	53.3	2.4	0.575	0.554	1.129	2.04	52.30	0.842	0.287
7	0.1430	112.40	60.8	2.8	0.691	0.562	1.253	2.23	52.20	0.907	0.346
8	0.1640	119.00	67.4	3.2	0.763	0.576	1.339	2.33	52.00	0.958	0.382
9	0.1840	125.70	74.1	3.5	0.836	0.598	1.433	2.40	51.70	1.015	0.418
10	0.2040	129.80	78.2	3.9	0.878	0.619	1.498	2.42	51.40	1.058	0.439
11	0.2250	134.80	83.2	4.3	0.931	0.634	1.564	2.47	51.20	1.099	0.465
12	0.2450	139.00	87.4	4.7	0.974	0.655	1.629	2.49	50.90	1.142	0.487
13	0.2660	143.10	91.5	5.1	1.015	0.670	1.685	2.52	50.70	1.177	0.508
14	0.2860	145.60	94.0	5.5	1.039	0.677	1.715	2.53	50.60	1.196	0.519
15	0.3070	149.80	98.2	5.9	1.080	0.691	1.772	2.56	50.40	1.231	0.540
16	0.3270	153.10	101.5	6.3	1.112	0.706	1.818	2.58	50.20	1.262	0.556
17	0.3680	158.10	106.5	7.1	1.157	0.727	1.884	2.59	49.90	1.306	0.579
18	0.4090	162.30	110.7	7.9	1.193	0.756	1.949	2.58	49.50	1.352	0.596
19	0.4500	167.30	115.7	8.7	1.236	0.770	2.006	2.60	49.30	1.388	0.618
20	0.4910	171.40	119.8	9.5	1.268	0.785	2.053	2.62	49.10	1.419	0.634
21	0.5320	174.80	123.2	10.2	1.293	0.806	2.099	2.60	48.80	1.453	0.647
22	0.5720	178.90	127.3	11.0	1.325	0.821	2.145	2.61	48.60	1.483	0.662
23	0.6130	182.30	130.7	11.8	1.348	0.835	2.183	2.61	48.40	1.509	0.674
24	0.6540	184.80	133.2	12.6	1.361	0.842	2.204	2.62	48.30	1.523	0.681
25	0.6950	188.10	136.5	13.4	1.383	0.857	2.239	2.61	48.10	1.548	0.691
26	0.7360	191.40	139.8	14.2	1.403	0.864	2.267	2.62	48.00	1.566	0.702
27	0.7560	192.20	140.6	14.6	1.405	0.871	2.276	2.61	47.90	1.574	0.702
28	0.7770	193.10	141.5	15.0	1.407	0.878	2.285	2.60	47.80	1.582	0.704

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	180.600			1279.200
Moisture content: Dry soil+tare, gms.	163.200			1088.900
Moisture content: Tare, gms.	72.500			115.600
Moisture, %	19.2	20.1	20.1	19.6
Moist specimen weight, gms.	1154.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.55	5.55	5.55	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	128.7	129.7	129.7	
Dry density, pcf	108.0	108.0	108.0	
Void ratio	0.5315	0.5315	0.5315	
Saturation, %	95.6	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.174 tsf **at reading no.** 28
Ult. Stress = 2.173 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0010	21.60	0.0	0.0	0.000	1.800	1.800	1.00	45.00	1.800	0.000
1	0.0220	30.00	8.4	0.4	0.091	1.778	1.870	1.05	45.30	1.824	0.046
2	0.0420	102.40	80.8	0.7	0.938	1.260	2.198	1.74	52.50	1.729	0.469
3	0.0620	126.50	104.9	1.1	1.213	1.058	2.272	2.15	55.30	1.665	0.607
4	0.0830	143.10	121.5	1.5	1.400	0.972	2.372	2.44	56.50	1.672	0.700
5	0.1030	156.50	134.9	1.8	1.548	0.943	2.492	2.64	56.90	1.717	0.774
6	0.1240	164.80	143.2	2.2	1.637	0.929	2.566	2.76	57.10	1.747	0.819
7	0.1440	172.30	150.7	2.6	1.717	0.929	2.646	2.85	57.10	1.787	0.858
8	0.1650	176.40	154.8	3.0	1.757	0.929	2.685	2.89	57.10	1.807	0.878
9	0.1850	179.80	158.2	3.3	1.788	0.929	2.717	2.93	57.10	1.823	0.894
10	0.2060	181.40	159.8	3.7	1.800	0.936	2.736	2.92	57.00	1.836	0.900
11	0.2260	183.10	161.5	4.1	1.812	0.929	2.741	2.95	57.10	1.835	0.906
12	0.2460	185.60	164.0	4.4	1.833	0.929	2.762	2.97	57.10	1.845	0.916
13	0.2670	188.90	167.3	4.8	1.862	0.936	2.798	2.99	57.00	1.867	0.931
14	0.2870	190.60	169.0	5.2	1.874	0.936	2.810	3.00	57.00	1.873	0.937
15	0.3080	193.90	172.3	5.5	1.903	0.943	2.846	3.02	56.90	1.895	0.952
16	0.3490	198.10	176.5	6.3	1.934	0.943	2.878	3.05	56.90	1.910	0.967
17	0.3900	202.20	180.6	7.0	1.964	0.958	2.921	3.05	56.70	1.939	0.982
18	0.4300	206.40	184.8	7.7	1.994	0.972	2.966	3.05	56.50	1.969	0.997
19	0.4710	210.60	189.0	8.5	2.023	0.979	3.002	3.07	56.40	1.991	1.011
20	0.5120	214.70	193.1	9.2	2.050	0.986	3.036	3.08	56.30	2.011	1.025
21	0.5530	218.00	196.4	9.9	2.068	0.994	3.062	3.08	56.20	2.028	1.034

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5940	222.20	200.6	10.7	2.095	1.008	3.103	3.08	56.00	2.055	1.047
23	0.6350	226.40	204.8	11.4	2.121	1.022	3.144	3.07	55.80	2.083	1.061
24	0.6760	228.90	207.3	12.2	2.129	1.030	3.159	3.07	55.70	2.094	1.065
25	0.7170	232.20	210.6	12.9	2.145	1.037	3.182	3.07	55.60	2.109	1.072
26	0.7580	235.50	213.9	13.6	2.160	1.051	3.211	3.05	55.40	2.131	1.080
27	0.7980	238.00	216.4	14.4	2.167	1.058	3.225	3.05	55.30	2.142	1.083
28	0.8190	239.70	218.1	14.7	2.174	1.066	3.240	3.04	55.20	2.153	1.087
29	0.8390	240.50	218.9	15.1	2.173	1.066	3.239	3.04	55.20	2.152	1.087

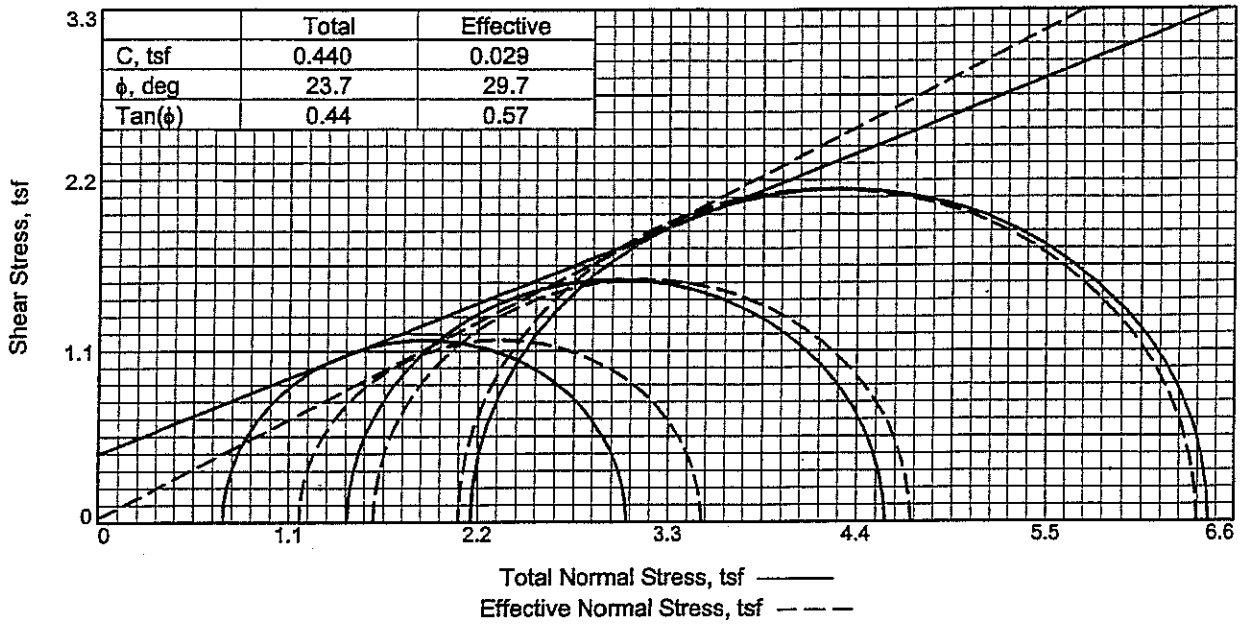
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	324.600			1159.400
Moisture content: Dry soil+tare, gms.	287.300			994.700
Moisture content: Tare, gms.	86.600			104.100
Moisture, %	18.6	18.4	18.4	18.5
Moist specimen weight, gms.	1063.3			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	4.99	4.99	4.99	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	131.8	131.6	131.6	
Dry density, pcf	111.2	111.2	111.2	
Void ratio	0.4884	0.4884	0.4884	
Saturation, %	100.8	100.0	100.0	

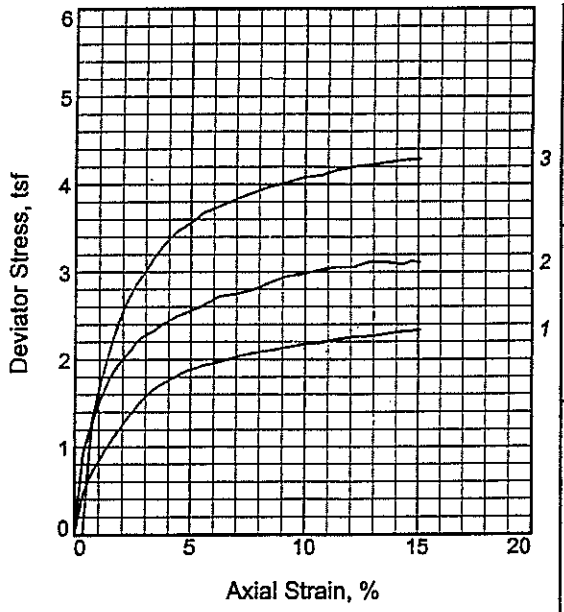
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.626 tsf **at reading no.** 27
Ult. Stress = 3.626 tsf **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	31.60	0.0	0.0	0.000	2.650	2.650	1.00	43.20	2.650	0.000
1	0.0190	145.60	114.0	0.4	1.328	1.714	3.042	1.77	56.20	2.378	0.664
2	0.0400	181.40	149.8	0.8	1.738	1.411	3.149	2.23	60.40	2.280	0.869
3	0.0600	206.40	174.8	1.2	2.019	1.289	3.308	2.57	62.10	2.298	1.010
4	0.0810	226.40	194.8	1.6	2.241	1.253	3.494	2.79	62.60	2.373	1.120
5	0.1010	242.20	210.6	2.0	2.413	1.246	3.658	2.94	62.70	2.452	1.206
6	0.1220	256.30	224.7	2.4	2.563	1.253	3.816	3.05	62.60	2.534	1.282
7	0.1420	267.10	235.5	2.8	2.675	1.267	3.943	3.11	62.40	2.605	1.338
8	0.1620	276.30	244.7	3.2	2.768	1.289	4.057	3.15	62.10	2.673	1.384
9	0.1830	285.50	253.9	3.7	2.860	1.310	4.170	3.18	61.80	2.740	1.430

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
10	0.2030	292.90	261.3	4.1	2.931	1.339	4.270	3.19	61.40	2.805	1.466
11	0.2240	299.60	268.0	4.5	2.993	1.361	4.354	3.20	61.10	2.857	1.497
12	0.2440	305.40	273.8	4.9	3.045	1.382	4.427	3.20	60.80	2.905	1.523
13	0.2650	312.10	280.5	5.3	3.106	1.404	4.510	3.21	60.50	2.957	1.553
14	0.2850	314.80	283.2	5.7	3.122	1.404	4.526	3.22	60.50	2.965	1.561
15	0.3060	316.20	284.6	6.1	3.124	1.397	4.521	3.24	60.60	2.959	1.562
16	0.3460	327.10	295.5	6.9	3.216	1.454	4.670	3.21	59.80	3.062	1.608
17	0.3870	337.10	305.5	7.8	3.295	1.498	4.793	3.20	59.20	3.145	1.648
18	0.4280	346.20	314.6	8.6	3.363	1.526	4.890	3.20	58.80	3.208	1.682
19	0.4690	353.70	322.1	9.4	3.412	1.562	4.975	3.18	58.30	3.269	1.706
20	0.5100	361.20	329.6	10.2	3.460	1.584	5.044	3.18	58.00	3.314	1.730
21	0.5510	368.70	337.1	11.0	3.507	1.613	5.119	3.17	57.60	3.366	1.753
22	0.5920	374.50	342.9	11.9	3.534	1.634	5.168	3.16	57.30	3.401	1.767
23	0.6330	381.20	349.6	12.7	3.569	1.656	5.225	3.16	57.00	3.441	1.785
24	0.6730	387.80	356.2	13.5	3.603	1.692	5.295	3.13	56.50	3.494	1.802
25	0.7140	392.80	361.2	14.3	3.619	1.706	5.326	3.12	56.30	3.516	1.810
26	0.7350	395.30	363.7	14.7	3.626	1.714	5.340	3.12	56.20	3.527	1.813
27	0.7550	397.00	365.4	15.1	3.626	1.721	5.347	3.11	56.10	3.534	1.813

	Total	Effective
C, tsf	0.440	0.029
ϕ, deg	23.7	29.7
Tan(ϕ)	0.44	0.57





Sample No.		1	2	3
Initial	Water Content,	20.3	19.1	18.4
	Dry Density, pcf	110.4	111.5	111.9
	Saturation,	108.2	104.8	102.0
	Void Ratio	0.4984	0.4831	0.4778
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.54	5.55	5.54
At Test	Water Content,	18.8	18.2	18.0
	Dry Density, pcf	110.4	111.5	111.9
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.4984	0.4831	0.4778
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.54	5.55	5.54
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		2.34	3.12	4.29
Total Pore Pr., tsf		3.16	3.45	3.67
Ult. Stress, tsf		2.34	3.11	4.29
Total Pore Pr., tsf		3.16	3.46	3.67
$\bar{\sigma}_1$ Failure, tsf		3.50	4.71	6.38
$\bar{\sigma}_3$ Failure, tsf		1.16	1.59	2.09

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown Mottled Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 426851.754 E 365685.028
Ground Elev. 480.56

Plate _____

Client: Mach Mine

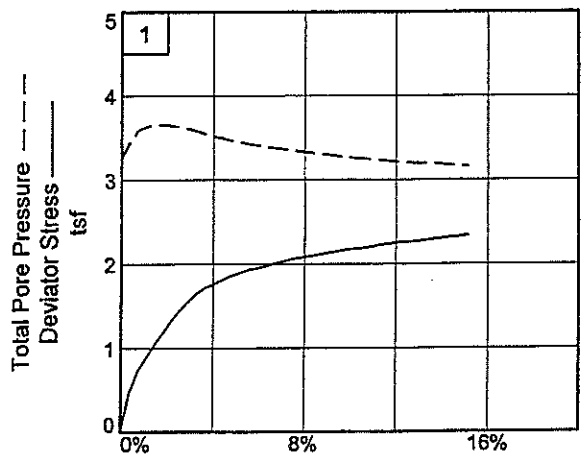
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #4

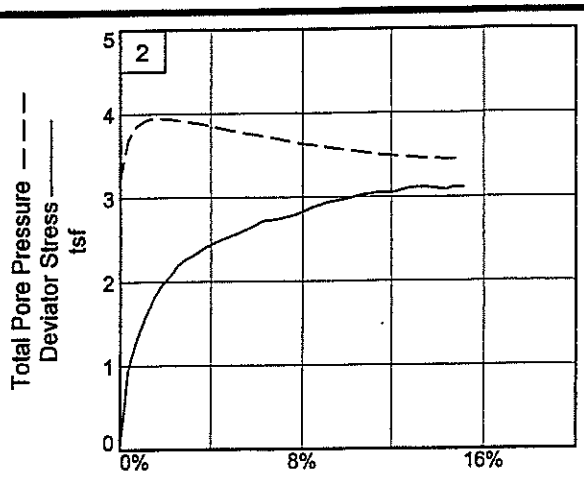
Proj. No.: H-08265 **Date:**

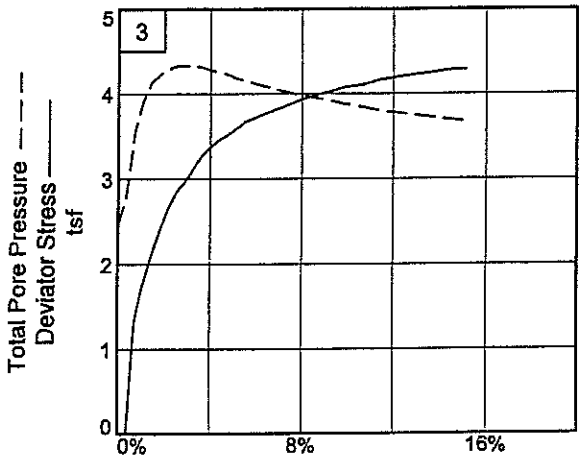
TRIAXIAL SHEAR TEST REPORT

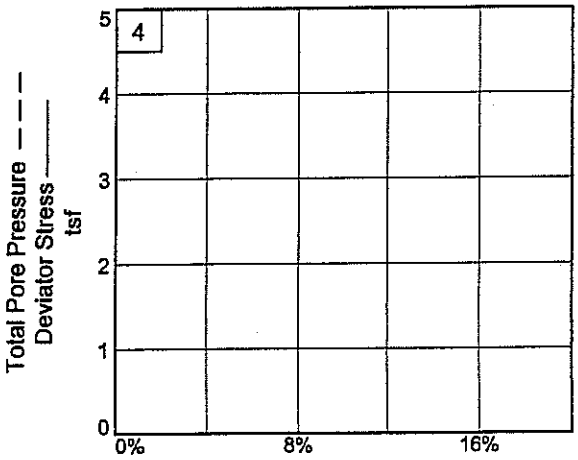
HOLCOMB FOUNDATION ENGINEERING CO.

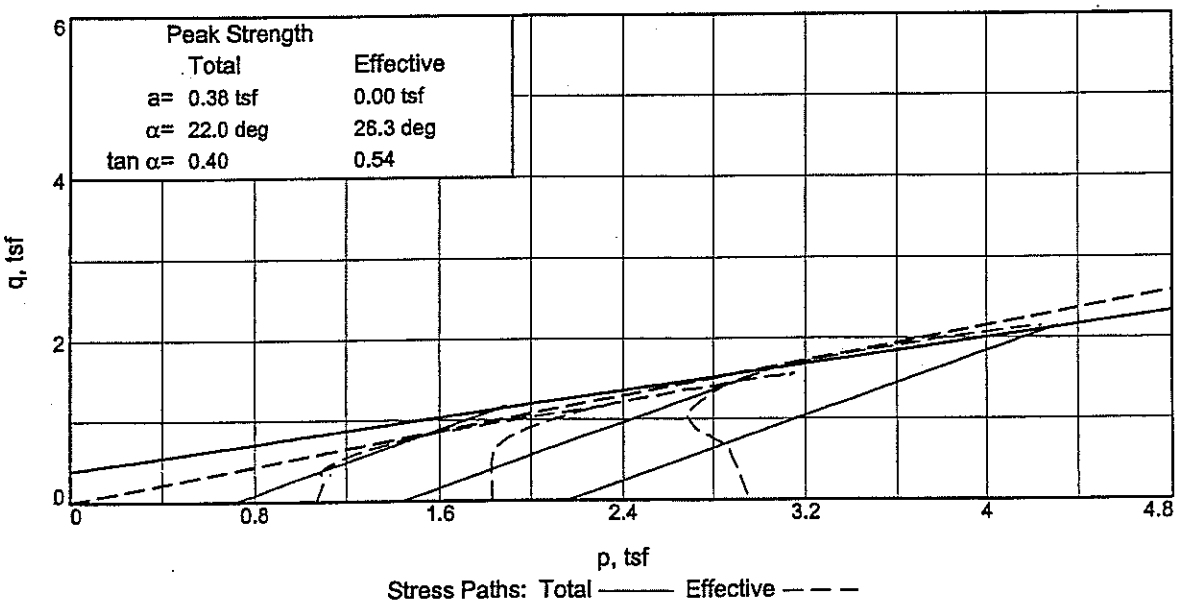
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #4
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:35 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #4
Description: Brown Mottled Gray Silty CLAY
Remarks:
Location: N 426851.754 E 365685.028
Ground Elev. 480.56
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	231.100			1298.800
Moisture content: Dry soil+tare, gms.	199.100			1101.600
Moisture content: Tare, gms.	41.800			102.500
Moisture, %	20.3	18.8	18.8	19.7
Moist specimen weight, gms.	1189.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.54	5.54	5.54	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.9	131.2	131.2	
Dry density, pcf	110.4	110.4	110.4	
Void ratio	0.4984	0.4984	0.4984	
Saturation, %	108.2	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.338 tsf **at reading no.** 29
Ult. Stress = 2.338 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.80	0.0	0.0	0.000	1.073	1.073	1.00	45.10	1.073	0.000
1	0.0190	65.70	39.9	0.3	0.465	0.871	1.336	1.53	47.90	1.104	0.232
2	0.0400	87.40	61.6	0.7	0.715	0.734	1.449	1.97	49.80	1.092	0.358
3	0.0600	101.50	75.7	1.1	0.876	0.684	1.560	2.28	50.50	1.122	0.438
4	0.0810	115.70	89.9	1.5	1.036	0.662	1.698	2.56	50.80	1.180	0.518
5	0.1010	129.00	103.2	1.8	1.185	0.655	1.840	2.81	50.90	1.248	0.592
6	0.1220	142.30	116.5	2.2	1.332	0.670	2.002	2.99	50.70	1.336	0.666
7	0.1420	153.10	127.3	2.6	1.450	0.684	2.134	3.12	50.50	1.409	0.725
8	0.1620	163.10	137.3	2.9	1.558	0.713	2.271	3.19	50.10	1.492	0.779
9	0.1830	172.30	146.5	3.3	1.656	0.742	2.398	3.23	49.70	1.570	0.828
10	0.2030	178.10	152.3	3.7	1.716	0.770	2.486	3.23	49.30	1.628	0.858
11	0.2240	183.10	157.3	4.0	1.765	0.799	2.564	3.21	48.90	1.682	0.882
12	0.2440	188.10	162.3	4.4	1.814	0.821	2.635	3.21	48.60	1.728	0.907
13	0.2650	193.10	167.3	4.8	1.863	0.850	2.712	3.19	48.20	1.781	0.931
14	0.2850	196.40	170.6	5.1	1.892	0.864	2.756	3.19	48.00	1.810	0.946
15	0.3060	200.60	174.8	5.5	1.931	0.886	2.817	3.18	47.70	1.851	0.966
16	0.3460	205.60	179.8	6.2	1.971	0.922	2.893	3.14	47.20	1.907	0.986
17	0.3870	212.20	186.4	7.0	2.027	0.950	2.978	3.13	46.80	1.964	1.014
18	0.4280	218.00	192.2	7.7	2.074	0.979	3.053	3.12	46.40	2.016	1.037
19	0.4690	222.20	196.4	8.5	2.102	1.001	3.103	3.10	46.10	2.052	1.051
20	0.5100	227.20	201.4	9.2	2.138	1.022	3.161	3.09	45.80	2.091	1.069
21	0.5510	232.20	206.4	9.9	2.173	1.051	3.225	3.07	45.40	2.138	1.087
22	0.5920	235.50	209.7	10.7	2.190	1.066	3.256	3.06	45.20	2.161	1.095
23	0.6330	241.30	215.5	11.4	2.232	1.087	3.319	3.05	44.90	2.203	1.116
24	0.6730	245.50	219.7	12.2	2.257	1.109	3.366	3.04	44.60	2.237	1.128
25	0.7140	248.00	222.2	12.9	2.263	1.123	3.386	3.02	44.40	2.255	1.132
26	0.7550	253.00	227.2	13.6	2.295	1.123	3.418	3.04	44.40	2.270	1.147
27	0.7960	257.20	231.4	14.4	2.317	1.145	3.462	3.02	44.10	2.303	1.158
28	0.8170	258.80	233.0	14.7	2.323	1.152	3.475	3.02	44.00	2.313	1.161
29	0.8370	261.30	235.5	15.1	2.338	1.159	3.497	3.02	43.90	2.328	1.169

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	171.800			1310.000
Moisture content: Dry soil+tare, gms.	150.700			1115.500
Moisture content: Tare, gms.	40.200			115.700
Moisture, %	19.1	18.2	18.2	19.5
Moist specimen weight, gms.	1192.6			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.55	5.55	5.55	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.8	131.9	131.9	
Dry density, pcf	111.5	111.5	111.5	
Void ratio	0.4831	0.4831	0.4831	
Saturation, %	104.8	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 3.121 tsf **at reading no.** 28
Ult. Stress = 3.107 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	29.10	0.0	0.0	0.000	1.829	1.829	1.00	44.60	1.829	0.000
1	0.0190	109.00	79.9	0.3	0.931	1.361	2.292	1.68	51.10	1.826	0.466
2	0.0400	139.80	110.7	0.7	1.285	1.195	2.480	2.08	53.40	1.838	0.643
3	0.0600	163.90	134.8	1.1	1.559	1.123	2.682	2.39	54.40	1.903	0.780
4	0.0810	183.90	154.8	1.5	1.784	1.094	2.878	2.63	54.80	1.986	0.892
5	0.1010	198.90	169.8	1.8	1.949	1.094	3.044	2.78	54.80	2.069	0.975
6	0.1220	209.70	180.6	2.2	2.065	1.102	3.167	2.87	54.70	2.134	1.033
7	0.1420	221.40	192.3	2.6	2.191	1.116	3.307	2.96	54.50	2.212	1.096
8	0.1620	228.90	199.8	2.9	2.268	1.130	3.399	3.01	54.30	2.264	1.134
9	0.1830	234.70	205.6	3.3	2.325	1.152	3.477	3.02	54.00	2.314	1.162
10	0.2030	241.30	212.2	3.7	2.391	1.166	3.557	3.05	53.80	2.362	1.195
11	0.2240	247.20	218.1	4.0	2.447	1.195	3.643	3.05	53.40	2.419	1.224
12	0.2440	252.20	223.1	4.4	2.494	1.210	3.704	3.06	53.20	2.457	1.247
13	0.2650	256.30	227.2	4.8	2.530	1.231	3.761	3.05	52.90	2.496	1.265
14	0.2850	260.50	231.4	5.1	2.567	1.253	3.820	3.05	52.60	2.536	1.283
15	0.3060	265.50	236.4	5.5	2.612	1.274	3.886	3.05	52.30	2.580	1.306
16	0.3460	277.10	248.0	6.2	2.719	1.310	4.030	3.08	51.80	2.670	1.360
17	0.3870	281.30	252.2	7.0	2.743	1.346	4.090	3.04	51.30	2.718	1.372
18	0.4280	287.90	258.8	7.7	2.793	1.390	4.183	3.01	50.70	2.786	1.396
19	0.4690	297.90	268.8	8.4	2.878	1.418	4.296	3.03	50.30	2.857	1.439
20	0.5100	306.30	277.2	9.2	2.944	1.447	4.391	3.03	49.90	2.919	1.472
21	0.5510	311.30	282.2	9.9	2.972	1.476	4.448	3.01	49.50	2.962	1.486

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.5920	318.70	289.6	10.7	3.025	1.505	4.530	3.01	49.10	3.017	1.513
23	0.6330	323.70	294.6	11.4	3.052	1.534	4.586	2.99	48.70	3.060	1.526
24	0.6730	326.20	297.1	12.1	3.053	1.555	4.608	2.96	48.40	3.082	1.527
25	0.7140	334.60	305.5	12.9	3.113	1.570	4.683	2.98	48.20	3.126	1.556
26	0.7550	337.10	308.0	13.6	3.112	1.584	4.696	2.96	48.00	3.140	1.556
27	0.7960	337.10	308.0	14.3	3.085	1.591	4.676	2.94	47.90	3.134	1.543
28	0.8170	342.00	312.9	14.7	3.121	1.591	4.712	2.96	47.90	3.151	1.560
29	0.8370	342.00	312.9	15.1	3.107	1.584	4.691	2.96	48.00	3.138	1.554

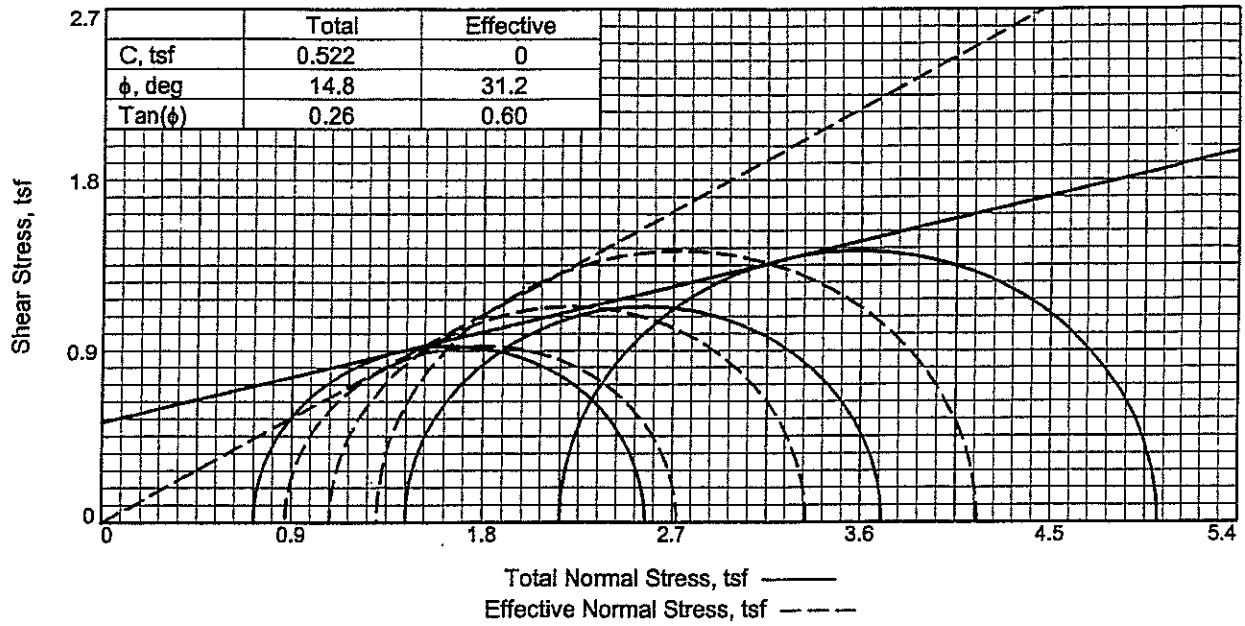
Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	313.400			1293.600
Moisture content: Dry soil+tare, gms.	274.900			1108.600
Moisture content: Tare, gms.	65.500			107.600
Moisture, %	18.4	18.0	18.0	18.5
Moist specimen weight, gms.	1186.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.54	5.54	5.54	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	132.5	132.1	132.1	
Dry density, pcf	111.9	111.9	111.9	
Void ratio	0.4778	0.4778	0.4778	
Saturation, %	102.0	100.0	100.0	

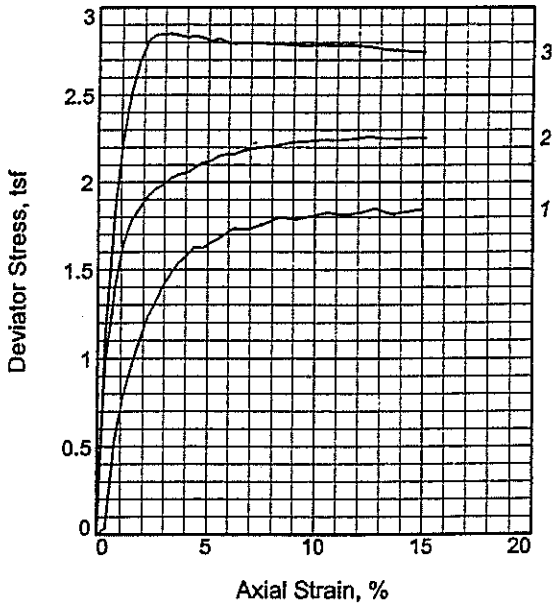
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 4.287 tsf **at reading no.** 29
Ult. Stress = 4.287 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	36.60	0.0	0.0	0.000	3.298	3.298	1.00	34.20	3.298	0.000
1	0.0190	36.60	0.0	0.3	0.000	2.959	2.959	1.00	38.90	2.959	0.000
2	0.0400	150.60	114.0	0.7	1.323	2.203	3.527	1.60	49.40	2.865	0.662
3	0.0600	188.90	152.3	1.1	1.762	1.843	3.605	1.96	54.40	2.724	0.881
4	0.0810	218.90	182.3	1.5	2.100	1.627	3.728	2.29	57.40	2.677	1.050
5	0.1010	248.00	211.4	1.8	2.427	1.526	3.953	2.59	58.80	2.740	1.213
6	0.1220	270.50	233.9	2.2	2.675	1.469	4.144	2.82	59.60	2.806	1.337
7	0.1420	287.10	250.5	2.6	2.854	1.433	4.287	2.99	60.10	2.860	1.427
8	0.1620	298.80	262.2	2.9	2.976	1.433	4.409	3.08	60.10	2.921	1.488
9	0.1830	314.60	278.0	3.3	3.143	1.433	4.576	3.19	60.10	3.004	1.572

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
10	0.2030	327.90	291.3	3.7	3.281	1.447	4.729	3.27	59.90	3.088	1.641
11	0.2240	337.90	301.3	4.0	3.381	1.483	4.864	3.28	59.40	3.174	1.690
12	0.2440	346.20	309.6	4.4	3.461	1.505	4.966	3.30	59.10	3.235	1.730
13	0.2650	352.90	316.3	4.8	3.522	1.534	5.055	3.30	58.70	3.294	1.761
14	0.2850	360.40	323.8	5.1	3.591	1.577	5.168	3.28	58.10	3.373	1.796
15	0.3060	368.70	332.1	5.5	3.669	1.606	5.274	3.28	57.70	3.440	1.834
16	0.3460	378.70	342.1	6.2	3.750	1.663	5.414	3.25	56.90	3.538	1.875
17	0.3870	388.60	352.0	7.0	3.828	1.714	5.542	3.23	56.20	3.628	1.914
18	0.4280	398.60	362.0	7.7	3.906	1.764	5.670	3.21	55.50	3.717	1.953
19	0.4690	407.80	371.2	8.5	3.973	1.800	5.773	3.21	55.00	3.786	1.986
20	0.5100	415.30	378.7	9.2	4.021	1.836	5.857	3.19	54.50	3.846	2.010
21	0.5510	423.60	387.0	9.9	4.075	1.879	5.954	3.17	53.90	3.917	2.038
22	0.5920	429.40	392.8	10.7	4.102	1.915	6.017	3.14	53.40	3.966	2.051
23	0.6330	438.60	402.0	11.4	4.164	1.958	6.122	3.13	52.80	4.040	2.082
24	0.6730	445.20	408.6	12.1	4.197	1.980	6.177	3.12	52.50	4.079	2.099
25	0.7140	451.10	414.5	12.9	4.222	2.009	6.231	3.10	52.10	4.120	2.111
26	0.7550	456.90	420.3	13.6	4.245	2.038	6.282	3.08	51.70	4.160	2.122
27	0.7960	463.60	427.0	14.4	4.276	2.066	6.342	3.07	51.30	4.204	2.138
28	0.8170	466.00	429.4	14.7	4.281	2.074	6.354	3.06	51.20	4.214	2.140
29	0.8370	468.50	431.9	15.1	4.287	2.088	6.375	3.05	51.00	4.232	2.144

	Total	Effective
C, tsf	0.522	0
ϕ, deg	14.8	31.2
Tan(ϕ)	0.26	0.60





Sample No.		1	2	3
Initial	Water Content,	25.7	23.5	21.2
	Dry Density, pcf	98.3	102.6	104.8
	Saturation,	99.9	101.9	97.2
	Void Ratio	0.6824	0.6120	0.5788
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.59	5.53	5.56
At Test	Water Content,	25.7	23.1	21.8
	Dry Density, pcf	98.3	102.6	104.8
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.6824	0.6120	0.5788
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.59	5.53	5.56
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, tsf		3.60	3.60	3.60
Cell Pressure, tsf		4.32	5.04	5.76
Fail. Stress, tsf		1.85	2.26	2.85
Total Pore Pr., tsf		3.45	3.96	4.46
Ult. Stress, tsf		1.84	2.25	2.74
Total Pore Pr., tsf		3.43	3.94	4.48
$\bar{\sigma}_1$ Failure, tsf		2.72	3.34	4.15
$\bar{\sigma}_3$ Failure, tsf		0.87	1.08	1.30

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown To Gray Silty CLAY

Assumed Specific Gravity= 2.65
Remarks:
Location: N 427055.027 E 367932.856
Ground Elev. 527.60

Plate _____

Client: Mach Mine

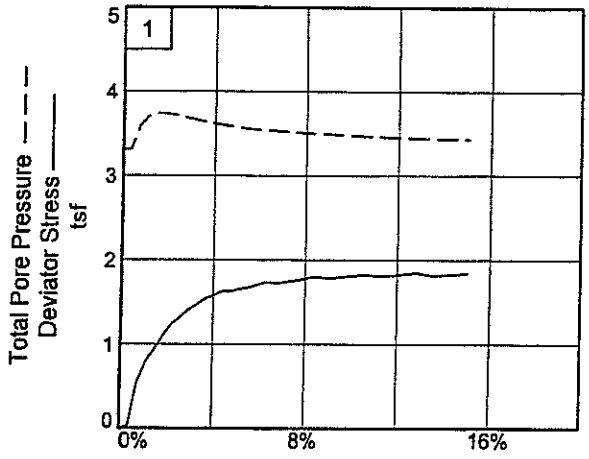
Project: Pipeline Project
Mach Mine
Location: Shelby Tube Sample #5

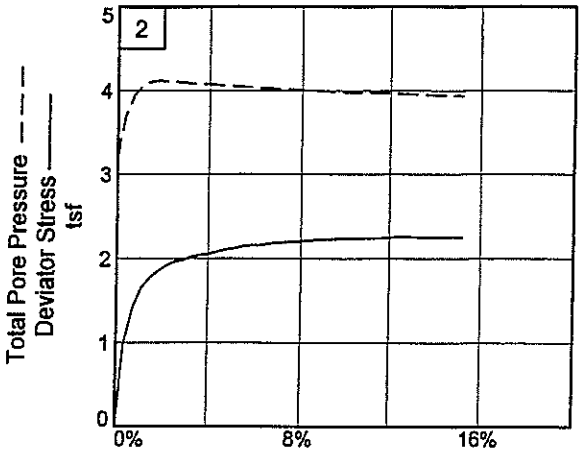
Proj. No.: H-08265 **Date:**

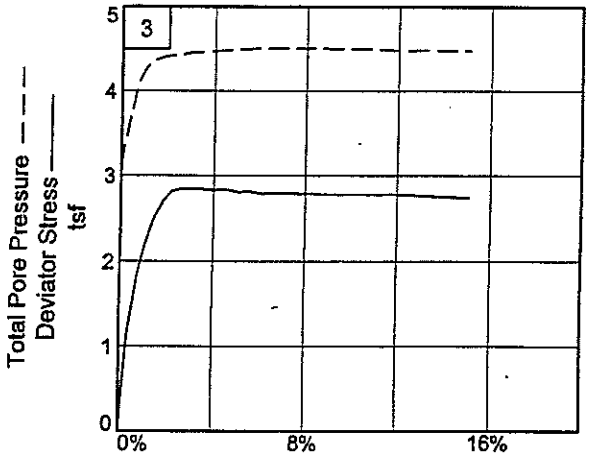
TRIAXIAL SHEAR TEST REPORT

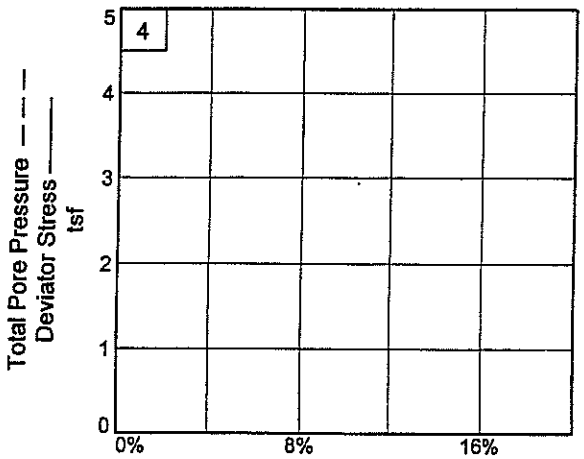
HOLCOMB FOUNDATION ENGINEERING CO.

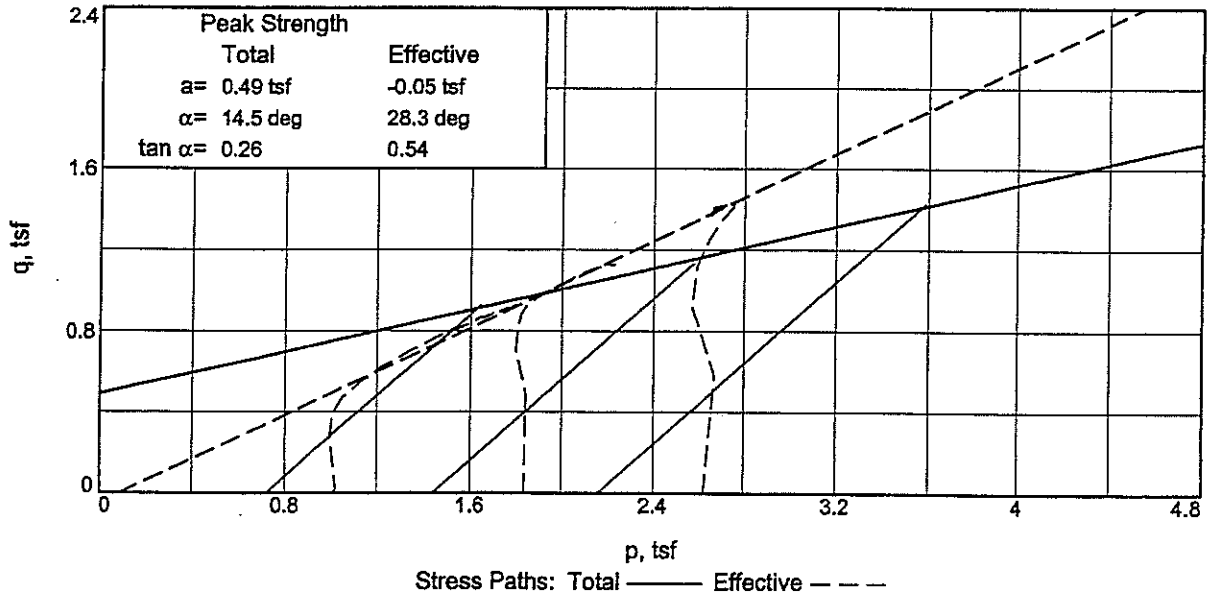
Tested By: LC **Checked By:** TH











Client: Mach Mine
Project: Pipeline Project
Location: Shelby Tube Sample #5
Project No.: H-08265

Plate _____

HOLCOMB FOUNDATION ENGINEERING CO.

Tested By: LC **Checked By:** TH

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

12/11/2009
11:36 AM

Date:
Client: Mach Mine
Project: Pipeline Project
Mach Mine
Johnston City, Illinois
Location: Shelby Tube Sample #5
Description: Brown To Gray Silty CLAY
Remarks:
Location: N 427055.027 E 367932.856
Ground Elev. 527.60
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	492.700			1235.100
Moisture content: Dry soil+tare, gms.	410.600			991.300
Moisture content: Tare, gms.	91.400			107.600
Moisture, %	25.7	25.7	25.7	27.6
Moist specimen weight, gms.	1116.4			
Diameter, in.	2.80	2.80	2.80	
Area, in.^{2}	6.16	6.16	6.16	
Height, in.	5.59	5.59	5.59	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	123.6	123.7	123.7	
Dry density, pcf	98.3	98.3	98.3	
Void ratio	0.6824	0.6824	0.6824	
Saturation, %	99.9	100.0	100.0	

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 60.00 psi (4.320 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 0.720 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 1.850 tsf **at reading no.** 25
Ult. Stress = 1.845 tsf **at reading no.** 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	21.60	0.0	0.0	0.000	1.008	1.008	1.00	46.00	1.008	0.000
1	0.0200	25.00	3.4	0.4	0.034	1.008	1.042	1.03	46.00	1.025	0.017
2	0.0410	68.20	46.6	0.7	0.541	0.727	1.268	1.74	49.90	0.998	0.270
3	0.0610	89.00	67.4	1.1	0.780	0.619	1.399	2.26	51.40	1.009	0.390
4	0.0820	103.20	81.6	1.5	0.940	0.583	1.523	2.61	51.90	1.053	0.470
5	0.1020	117.30	95.7	1.8	1.099	0.583	1.682	2.88	51.90	1.132	0.549
6	0.1230	129.80	108.2	2.2	1.237	0.598	1.835	3.07	51.70	1.216	0.619
7	0.1430	137.30	115.7	2.6	1.318	0.619	1.937	3.13	51.40	1.278	0.659
8	0.1640	145.60	124.0	2.9	1.407	0.641	2.048	3.20	51.10	1.344	0.704
9	0.1840	151.50	129.9	3.3	1.469	0.662	2.131	3.22	50.80	1.397	0.734
10	0.2040	158.10	136.5	3.7	1.538	0.684	2.222	3.25	50.50	1.453	0.769
11	0.2250	162.30	140.7	4.0	1.579	0.706	2.285	3.24	50.20	1.495	0.789
12	0.2450	167.30	145.7	4.4	1.629	0.720	2.349	3.26	50.00	1.534	0.814
13	0.2660	167.30	145.7	4.8	1.623	0.734	2.357	3.21	49.80	1.546	0.811
14	0.2860	170.60	149.0	5.1	1.653	0.749	2.402	3.21	49.60	1.575	0.827
15	0.3070	173.10	151.5	5.5	1.674	0.763	2.437	3.19	49.40	1.600	0.837
16	0.3480	179.80	158.2	6.2	1.735	0.778	2.512	3.23	49.20	1.645	0.867
17	0.3880	180.60	159.0	6.9	1.730	0.792	2.522	3.18	49.00	1.657	0.865
18	0.4290	184.80	163.2	7.7	1.762	0.806	2.568	3.18	48.80	1.687	0.881
19	0.4700	189.70	168.1	8.4	1.800	0.821	2.621	3.19	48.60	1.721	0.900
20	0.5110	189.70	168.1	9.1	1.786	0.828	2.614	3.16	48.50	1.721	0.893
21	0.5520	193.10	171.5	9.9	1.807	0.842	2.650	3.15	48.30	1.746	0.904
22	0.5930	196.40	174.8	10.6	1.827	0.850	2.677	3.15	48.20	1.763	0.913
23	0.6340	196.40	174.8	11.3	1.812	0.857	2.669	3.11	48.10	1.763	0.906
24	0.6750	198.90	177.3	12.1	1.823	0.864	2.687	3.11	48.00	1.775	0.911
25	0.7160	203.10	181.5	12.8	1.850	0.871	2.722	3.12	47.90	1.796	0.925
26	0.7560	201.40	179.8	13.5	1.818	0.878	2.696	3.07	47.80	1.787	0.909
27	0.7970	203.90	182.3	14.3	1.828	0.878	2.706	3.08	47.80	1.792	0.914
28	0.8180	205.60	184.0	14.6	1.837	0.878	2.715	3.09	47.80	1.797	0.918
29	0.8380	207.20	185.6	15.0	1.845	0.886	2.730	3.08	47.70	1.808	0.922

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	232.400			1241.700
Moisture content: Dry soil+tare, gms.	200.100			1014.200
Moisture content: Tare, gms.	62.800			103.000
Moisture, %	23.5	23.1	23.1	25.0
Moist specimen weight, gms.	1132.5			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.53	5.53	5.53	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	126.8	126.3	126.3	
Dry density, pcf	102.6	102.6	102.6	
Void ratio	0.6120	0.6120	0.6120	
Saturation, %	101.9	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 70.00 psi (5.040 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 1.440 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.264 tsf **at reading no.** 27
Ult. Stress = 2.254 tsf **at reading no.** 31

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	33.30	0.0	0.0	0.000	1.836	1.836	1.00	44.50	1.836	0.000
1	0.0190	117.30	84.0	0.3	0.979	1.354	2.332	1.72	51.20	1.843	0.489
2	0.0400	154.80	121.5	0.7	1.410	1.094	2.505	2.29	54.80	1.800	0.705
3	0.0600	175.60	142.3	1.1	1.646	0.986	2.632	2.67	56.30	1.809	0.823
4	0.0810	187.30	154.0	1.5	1.774	0.936	2.710	2.90	57.00	1.823	0.887
5	0.1010	194.70	161.4	1.8	1.853	0.922	2.774	3.01	57.20	1.848	0.926
6	0.1220	201.40	168.1	2.2	1.922	0.929	2.851	3.07	57.10	1.890	0.961
7	0.1420	205.60	172.3	2.6	1.963	0.936	2.899	3.10	57.00	1.917	0.981
8	0.1620	208.10	174.8	2.9	1.984	0.943	2.927	3.10	56.90	1.935	0.992
9	0.1830	212.20	178.9	3.3	2.023	0.958	2.980	3.11	56.70	1.969	1.011
10	0.2030	214.70	181.4	3.7	2.043	0.958	3.001	3.13	56.70	1.979	1.022
11	0.2240	216.40	183.1	4.1	2.054	0.965	3.019	3.13	56.60	1.992	1.027
12	0.2440	219.70	186.4	4.4	2.083	0.972	3.055	3.14	56.50	2.014	1.042
13	0.2650	223.00	189.7	4.8	2.112	0.986	3.098	3.14	56.30	2.042	1.056
14	0.2850	224.70	191.4	5.2	2.123	0.986	3.109	3.15	56.30	2.048	1.061
15	0.3060	228.00	194.7	5.5	2.151	0.994	3.144	3.16	56.20	2.069	1.075
16	0.3260	229.70	196.4	5.9	2.161	1.001	3.162	3.16	56.10	2.081	1.081
17	0.3460	230.50	197.2	6.3	2.162	1.008	3.170	3.14	56.00	2.089	1.081
18	0.3670	233.00	199.7	6.6	2.180	1.008	3.188	3.16	56.00	2.098	1.090
19	0.3870	234.70	201.4	7.0	2.190	1.022	3.212	3.14	55.80	2.117	1.095
20	0.4080	236.40	203.1	7.4	2.200	1.022	3.222	3.15	55.80	2.122	1.100
21	0.4490	238.80	205.5	8.1	2.208	1.037	3.245	3.13	55.60	2.141	1.104

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
22	0.4890	242.20	208.9	8.8	2.227	1.044	3.271	3.13	55.50	2.157	1.113
23	0.5300	244.70	211.4	9.6	2.235	1.058	3.293	3.11	55.30	2.176	1.117
24	0.5710	247.20	213.9	10.3	2.243	1.066	3.308	3.10	55.20	2.187	1.121
25	0.6120	248.80	215.5	11.1	2.241	1.066	3.306	3.10	55.20	2.186	1.120
26	0.6530	251.30	218.0	11.8	2.248	1.073	3.321	3.10	55.10	2.197	1.124
27	0.6940	254.70	221.4	12.6	2.264	1.080	3.344	3.10	55.00	2.212	1.132
28	0.7350	255.50	222.2	13.3	2.253	1.087	3.340	3.07	54.90	2.214	1.126
29	0.7760	257.20	223.9	14.0	2.250	1.094	3.345	3.06	54.80	2.220	1.125
30	0.8170	259.80	226.5	14.8	2.257	1.102	3.359	3.05	54.70	2.230	1.128
31	0.8370	260.50	227.2	15.1	2.254	1.102	3.356	3.05	54.70	2.229	1.127

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	241.200			1257.100
Moisture content: Dry soil+tare, gms.	211.700			1046.900
Moisture content: Tare, gms.	72.700			107.600
Moisture, %	21.2	21.8	21.8	22.4
Moist specimen weight, gms.	1141.7			
Diameter, in.	2.80	2.80	2.80	
Area, in.²	6.16	6.16	6.16	
Height, in.	5.56	5.56	5.56	
Net decrease in height, in.		0.00	0.00	
Wet Density, pcf	127.0	127.7	127.7	
Dry density, pcf	104.8	104.8	104.8	
Void ratio	0.5788	0.5788	0.5788	
Saturation, %	97.2	100.0	100.0	

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 30%
Consolidation cell pressure = 80.00 psi (5.760 tsf)
Consolidation back pressure = 50.00 psi (3.600 tsf)
Consolidation effective confining stress = 2.160 tsf
Strain rate, in./min. = 0.00
Fail. Stress = 2.851 tsf **at reading no.** 9
Ult. Stress = 2.745 tsf **at reading no.** 31

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
0	0.0000	25.00	0.0	0.0	0.000	2.621	2.621	1.00	43.60	2.621	0.000
1	0.0190	124.80	99.8	0.3	1.163	2.088	3.251	1.56	51.00	2.669	0.581
2	0.0400	183.10	158.1	0.7	1.835	1.649	3.484	2.11	57.10	2.566	0.918
3	0.0600	218.00	193.0	1.1	2.232	1.469	3.701	2.52	59.60	2.585	1.116
4	0.0810	243.00	218.0	1.5	2.512	1.390	3.902	2.81	60.70	2.646	1.256
5	0.1010	260.50	235.5	1.8	2.704	1.354	4.057	3.00	61.20	2.705	1.352
6	0.1220	271.30	246.3	2.2	2.817	1.339	4.156	3.10	61.40	2.748	1.408
7	0.1420	274.60	249.6	2.6	2.844	1.332	4.176	3.14	61.50	2.754	1.422

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. psi	P tsf	Q tsf
8	0.1620	275.50	250.5	2.9	2.844	1.310	4.154	3.17	61.80	2.732	1.422
9	0.1830	277.10	252.1	3.3	2.851	1.303	4.154	3.19	61.90	2.729	1.425
10	0.2030	277.10	252.1	3.7	2.840	1.296	4.136	3.19	62.00	2.716	1.420
11	0.2240	277.10	252.1	4.0	2.829	1.289	4.118	3.20	62.10	2.703	1.415
12	0.2440	278.80	253.8	4.4	2.837	1.282	4.119	3.21	62.20	2.700	1.419
13	0.2650	278.80	253.8	4.8	2.826	1.274	4.101	3.22	62.30	2.688	1.413
14	0.2850	278.00	253.0	5.1	2.807	1.260	4.067	3.23	62.50	2.663	1.403
15	0.3060	280.50	255.5	5.5	2.823	1.260	4.083	3.24	62.50	2.672	1.412
16	0.3260	279.60	254.6	5.9	2.803	1.253	4.055	3.24	62.60	2.654	1.401
17	0.3460	279.60	254.6	6.2	2.792	1.253	4.045	3.23	62.60	2.649	1.396
18	0.3670	281.30	256.3	6.6	2.799	1.253	4.052	3.23	62.60	2.652	1.400
19	0.3870	282.10	257.1	7.0	2.797	1.253	4.050	3.23	62.60	2.651	1.399
20	0.4080	283.00	258.0	7.3	2.795	1.253	4.048	3.23	62.60	2.651	1.398
21	0.4490	284.60	259.6	8.1	2.790	1.253	4.043	3.23	62.60	2.648	1.395
22	0.4890	286.30	261.3	8.8	2.787	1.253	4.040	3.22	62.60	2.646	1.393
23	0.5300	287.90	262.9	9.5	2.781	1.260	4.041	3.21	62.50	2.651	1.391
24	0.5710	290.40	265.4	10.3	2.785	1.260	4.045	3.21	62.50	2.652	1.392
25	0.6120	292.10	267.1	11.0	2.779	1.260	4.039	3.21	62.50	2.650	1.390
26	0.6530	294.60	269.6	11.7	2.782	1.274	4.057	3.18	62.30	2.666	1.391
27	0.6940	296.30	271.3	12.5	2.776	1.282	4.058	3.17	62.20	2.670	1.388
28	0.7350	297.10	272.1	13.2	2.761	1.274	4.036	3.17	62.30	2.655	1.381
29	0.7760	298.80	273.8	14.0	2.755	1.282	4.036	3.15	62.20	2.659	1.377
30	0.8170	300.40	275.4	14.7	2.747	1.282	4.029	3.14	62.20	2.655	1.374
31	0.8370	301.30	276.3	15.1	2.745	1.282	4.026	3.14	62.20	2.654	1.372

(58)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/13/12 CHKD BY: DATE:
PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**
PROJECT NO. **B12-495-1413** SHEET **1** OF **17**
DESCRIPTION **DTE Gas Line Consolidation Analysis**
File: Mach DTE_C1.xls, hlo, rev.12/11/2012

Determine: The DTE gas pipeline was under mined in the spring of 2011 by Longwall Panel No. 4 of the Mach #1 Mine. Strain gauges were placed on the pipeline at that time and the strains due to mine subsidence determined. Now it is proposed to place slurry impounding embankments of coarse coal refuse over the pipeline. Find out the additional strain that will occur to the pipeline due to foundation consolidation under the refuse embankments.

Soil Boring No. D1 was made was made adjacent to the pipe line on 06/08/2012 and an undisturbed sample was obtained for consolidation testing (see the Soil Borings and Testing appendix of this report).

References:

(1) "Test Report, , Prepared for Holcomb Foundation Engineering Company ..., Incremental Consolidation Test, ASTM D2435", GEOTECHNOLOGY, INC., June 29, 2012, 23 pages.
(2) "Soil Borings and Laboratory Tests, Pond Creek #1 Refuse Disposal Area, Williamson County, Illinois, Holcomb Foundation Engineering Co., July 11, 2012.
(3) "Basic Soil Mechanics (Course SM-10", Chapter 13, "Consolidation", and Chapter 14, "Settlement Analysis", SCS, USDA, January 1966 (Rev. 89/69).

Most Critical Location:

A total of 16 soil borings (Boring D1 and Borings BP1 to BP15) were taken along the gas pipeline during June 2012. The depth to bedrock in these borings ranged from ranged from 9' to 15'. Considering that Longwall Panel No. 3 stopped near the western end of the current Refuse Disposal Areas Nos. 2 and 3, that some of the highest pipe strain due to longwall subsidence should have occurred near the longwall stop location, and that a new impounding coarse refuse embankment will be built over the longwall stop area; evaluate the foundation consolidation under the gas pipeline due to future planned embankment construction. This information will then be used to estimate the additional strain on the pipeline.

Evaluation of Consolidation Test Results:

See accompanying "1-D Consolidation Test: Incremental, ASTM 2435, Project No. J019144.02, Boring D-1, Sample: - Depth 10', Geotechnology, Inc. for lab rebound & compression curve. Analyze test data and construct virgin curve.

The sample was taken from a Shelby tube 10.0' below the ground surface
The initial wet density of the sample was 125 pcf, no groundwater was present in the borehole
P_o = effective overburden pressure on sample = (10' x 125 pcf)/2000 lb/ton = 0.625 tsf
$P_{c(min)}$ = 1.7 tsf > P_o, therefore soil is preconsolidated
$P_{c(max)}$ = 2.7 tsf

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
· Beckley, WV

BY: HLO DATE: 07/20/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-495-1413 SHEET 2 OF 17
DESCRIPTION DTE Gas Line Consolidation Analysis
File: Mach DTE_C2.xls, hlo, rev. 12/11/2012

Evaluation of Consolidation Test Results: (continued)

C_c = Compression Index = $(e_1 - e_2)/\log_{10}[(P_{c(max)} + \Delta P)/P_{c(max)})]$
= $(0.627 - 0.343)/\log_{10}[(100/2.7)] = 0.181$ (for P > 2.7 tsf)

C_s = Recompression Index = $(e_o - e_1)/\log_{10}[(P_o + \Delta P)/P_o)]$
= $(0.652 - 0.627)/[\log_{10}(1.9/0.625)] = 0.052$ (for P < 2.7 tsf)

Consolidation Under Gas Pipeline

The most strain and settlement under the refuse embankment will occur after the refuse embankment and impoundment is abandoned and the foundation soil drainage due to compression has fully occurred.

Soil Properties and Densities

At Borehole D1, beside the pipeline on the west side of the site, the total hole depth to bedrock was 15.0'. The foundation soil ranges from a USCS classification of CH to CL. The wet density of the consolidation test sample was 126 pcf. No groundwater was found in Borehole D1. For final settlement conditions, use moist unit weights.

Boring D-4 into consolidated slurry in the Phase 2 slurry cell found that it's average dry density was 65 pcf at an average moisture content of 59%, giving a moist unit weight of 103 pcf.

The coarse coal refuse from Boring D-4 had an average dry unit weight of 107 pcf and an average moisture content of 8%, giving a moist unit weight of 116 pcf. This is refuse which was used to place a cover over the fine coal refuse slurry.

Recent in-place density test of the coarse coal refuse being used to construct the impounding embankments have an moist density of up to 130 pcf.

Use the above moist unit weights in the consolidation analysis.
Assume the post mine subsidence depth to bedrock from the ground surface is 15 feet.

Subsidence Equations:

(from "Principles of Geotechnical Engineering", Das, B.M., 7th Edition, Cengage Learning, Section 11.8)

$S_c = [C_s H/(1 + e_o)][\log(\sigma'_o + \Delta\sigma')/\sigma'_o)]$ (Eq. 11.33) (when $\sigma'_o + \Delta\sigma' \leq \sigma'_c$)

(40)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/23/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-495-1413 SHEET 3 OF 17
DESCRIPTION DTE Gas Line Consolidation Analysis
File: Mach DTE_C3.xls, hlo, rev.12/11/2012

Subsidence Equations: (continued)

$$S_c = [C_s H/(1 + e_o)][\log(\sigma'_c/\sigma'_o)] + [C_c H/(1 + e_o)][\log((\sigma'_o + \Delta\sigma')/\sigma'_o)] \quad \text{(Eq. 11.34) (when } \sigma'_o + \Delta\sigma' > \sigma'_c\text{)}$$

Or, since the virgin e -vs- σ'_v curve is given, find Δe from the curve for the appropriate range of pressures and use :

$$S_c = H[\Delta e/(1 + e_o)] \quad \text{(Eq. 11.29)}$$

S_c = Primary settlement of soil layer
H = soil layer thickness under consideration
e_o =Void ratio of soil sample at pressure σ'_o
σ'_c = Preconsolidation pressure of soil sample
σ'_o = Present consolidation pressure of soil sample
$\Delta\sigma'$ = Change in consolidation pressure on soil sample
log = log to the base 10
C_s = Recompression index = 0.052 (for reconstructed virgin curve)
C_c = Compression Index = 0.181 (for reconstructed virgin curve)
Δe = change in void ratio of soil sample from σ'_o to $(\sigma'_o + \Delta\sigma')$

Consolidation Computations

Since the foundation thickness is relatively thin compared to the width and height of the embankment, and embankment loading influence line charts are based on an infinite depth of compressible material, conservatively compute the consolidation based on the weight of the embankment vertically above the point in question.

Phase 8 Embankment - West Side

Use Boring D1, foundation soil thickness to bedrock = 15'.
See table on Sheet 4 for subsided pipe and ground surface elevations due to longwall Panel #3.
Compute foundation consolidation from bottom of gas pipeline to top of bedrock

Examination of the June 2012 topo reveals that some surface grading has occurred post mine subsidence between Phase 2 and 3 (Pipe line stations 2+40 to Dwina road. Since the best available data indicates that the depth to bedrock from the ground surface is 15' and that the gas pipe line was originally buried in a trench 5' deep. For the purposes of the foundation settlement analysis under the pipe, assume the H = compressible layer depth = 15' - 5' = 10'.

GEOTECHNOLOGY INC
FROM THE GROUND UP

61 R11252

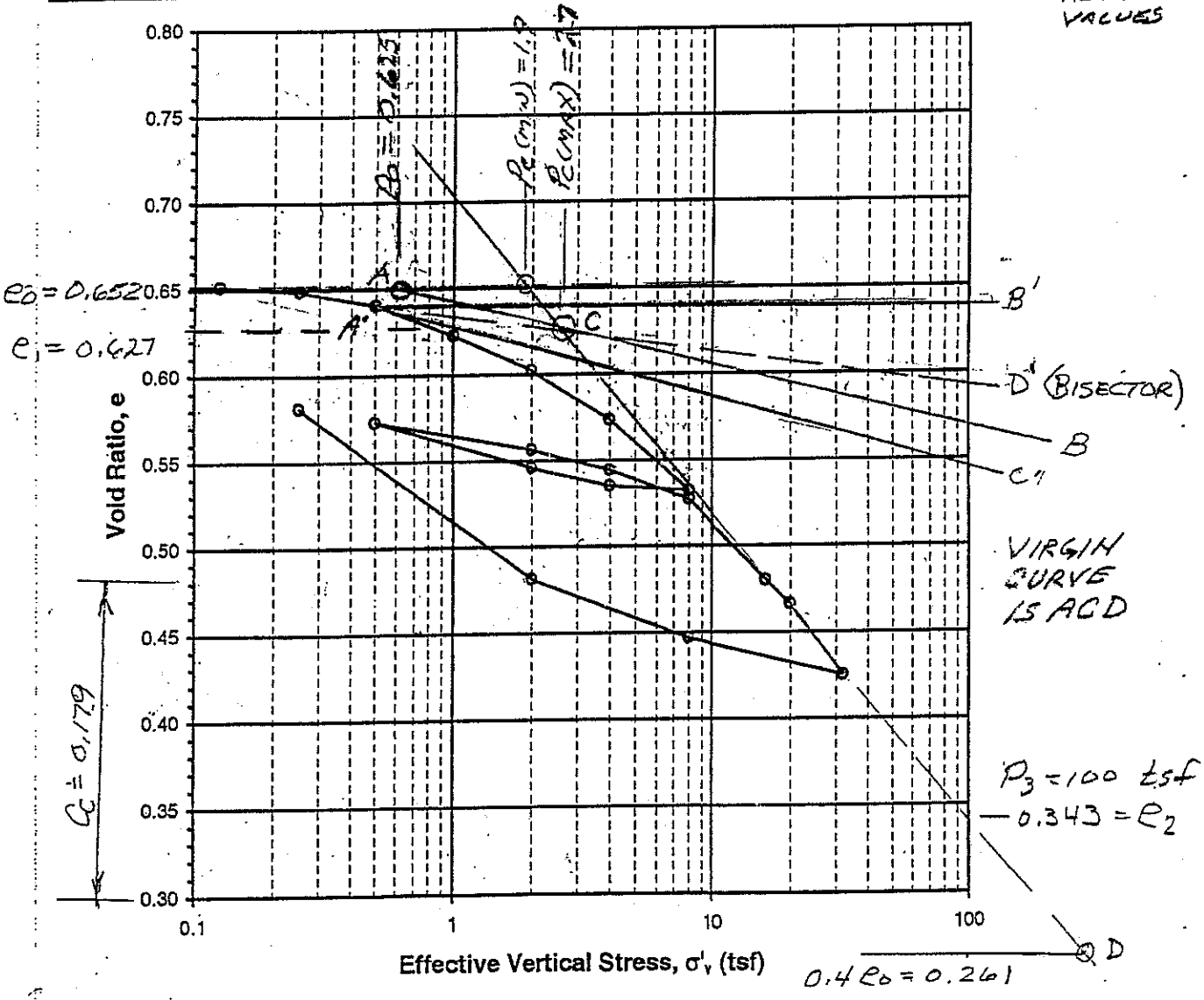
SHEET 4 OF 17

Liquid Limit=_____ Plastic Limit=_____ Plastic Index =_____ USCS:_____

Compression Index, C_c = 0.144 Void Ratio, e_o = 0.652

Recompression Index, C_r = 0.038 Preconsolidation Pressure = 1.9 tsf

SEE BELOW CONSTRUCTION FOR REVISED VALUES



1-D CONSOLIDATION TEST: INCREMENTAL

ASTM D 2435

Project No.: J019144.02

Boring: D-1

Sample: - Depth: 10 ft.

BY: HJO 7/23/12

TPC 8-2-12

(62)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	06/20/12	CHKD BY:		DATE:
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan					
PROJECT NO.	B12-295-1413	SHEET	5	OF	17	
DESCRIPTION	DTE Gas Line Consolidation Analysis					
File: Mach DTE_9a.xls, hlo, rev. 12/18/2012						

Embankment Staging Information -

Embankment Stage	Crest Elev.	End of Stage Slurry Elev	Reference Drawing
DTE Impoundment	502	486.8	B12-495-E1
Phase 7 and 2 - 3 Connector	538	525.1	B12-495-M5
Phase 8 & Buttress Plan	588	581.2	B12-495-M6
East of Dwina Stage 1	500	479.8	B12-495-M5
East of Dwina Stage 2	538	529.8	B12-495-M7
East of Dwina Stage 3	588	579.2	B12-495-M8
East of Dwina Stage 4	626	619.2	B12-495-M13

See Section E-E on Drawing Nos. B12-495-M10 and -M13 for maximum embankment over pipeline on western end.

See Section I-I on Drawing Nos. B12-495-M5 and -M11 for maximum embankment over pipeline on eastern end.

See Drawing No. B12-495-M13 for gas pipeline stationing.

North edge of Longwall Panel No. 4 is at N 426,160.

See following sheets 9 through 13 for subsided ground and pipeline elevation determinations.

(63)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 07/25/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO.: B12-495-1413 SHEET 6 OF 17
DESCRIPTION: DTE Gas Line Consolidation Analysis
File: Mach DTE_C4.xls, hlo, rev. 12/12/2012

Consolidation Computations - Phase 8 Embankment - West Side (Continued)

Gas Pipeline Station	Subsided Ground Elev.	Embankment Fill Height (ft.)	Embankment Loading - Δσ'	tsf
2+40	470.7	0	0	
3+35.7	468.6	33.4	(130 pcf x 33.4 ft)/2000 lb/ton =	2.17
3+56	468.3	33.7	(130 x 33.7)/2000 =	2.19
4+66.1	469.4	68.6	(130 x 68.6/2000 =	4.46
4+86.4	468.8	69.2	(130 x 69.2)/2000 =	4.50
6+04.6	469.1	107.0	(130 x 107)/2000 =	6.96
6+39.2	468.3	119.7	[130(62 + 45.7) + 103 x 12]/2000 =	7.62
6+69.8	467.7	120.3	[130(62 + 36.3] + 103 x 22]/2000 =	7.52
7+40	466.3	121.7	[116 x 7+130(37.7+17)+103x60]/2000 =	7.05
7+95.9	465.2	122.8	(116 x 7+130x20+103x95.8)/2000 =	6.64
8+59.3	464.0	124.0	(116 x 7 + 103 x 117)/2000 =	6.43

Embankment/impoundment loading on foundation will remain 6.43 tsf ± until gas pipeline station 19+24 ± (CCR embankment over Dwina Road begins)

Gas Pipeline Station	H (ft.)	Δσ' tsf	Recom-pression (ft.)	Com-pression (ft.)	Total Consolidation Under Gas Line (ft.)
2+40	10.0	0	0	0	0
3+35.7	10.0	2.17	0.169	0.00	0.17
3+56	10.0	2.19	0.171	0.00	0.17
4+66.1	10.0	4.46	0.20	0.27	0.47
4+86.4	10.0	4.50	0.20	0.25	0.45
6+04.6	10.0	6.96	0.20	0.46	0.66
6+39.2	10.0	7.62	0.20	0.50	0.70
6+69.8	10.0	7.52	0.20	0.49	0.69
7+40	10.0	7.05	0.20	0.46	0.66
7+95.9	10.0	6.64	0.20	0.43	0.63
8+59.3	10.0	6.43	0.20	0.42	0.62

e_o = 0.652
σ_o' = 0.625 tsf
σ_c' = 2.7 tsf
} For recompression

e_o = 0.627
σ_o' = 2.7 tsf
σ_c' = 2.7 tsf
} For compression

The above table gives the estimated foundation consolidation under the gas pipeline at the west side of the Phase 8 planned embankment construction.

(64)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/08/12 CHKD BY: DATE:
PROJECT NAME: **Williamson - East of Dwina -Expansion Plan**
PROJECT NO. **B12-495-1413** SHEET 7 OF 17
DESCRIPTION **DTE Gas Line Consolidation Analysis**
File: Mach DTE_C7.xls, hlo, rev.12/12/2012

Phase 8 Embankment - Southeast Corner

Use Borings BP1 through BP14 and GW-28 for soil thickness to bedrock. These borings were made post mine subsidence. The depth of the gas pipe line was measured post-subsidence from gas pipeline stations 52+17 to 53+57.

See Sheets 11, 12, and 14 to 17 for estimated subsided pipe and ground surface elevations due to longwall Panel #3.

See Sheet 13 for measured depth to bedrock and pipe cover along the pipeline east of Dwina Road.

Compute foundation consolidation from bottom of gas pipeline to top of bedrock

Gas Pipeline Station	Subsided Ground Elev.	Embankment Fill Height (ft.)	Embankment Loading - Δσ'	tsf
5220	472.0	0	-	0
5212	*473.4*	5.6	(130 pcf x 5.6 ft)/2000 lb/ton =	0.37
5192	475.5	3.5	(130 pcf x 3.5 ft)/2000 lb/ton =	0.23
5166	477.9	10.4	(130 pcf x 10.4 ft)/2000 lb/ton =	0.67
5142	*479.0*	16.7	(130 pcf x 16.7 ft)/2000 lb/ton =	1.08
5112	*480.7*	15.0	(130 pcf x 15.0 ft)/2000 lb/ton =	0.98
5072	*483.0*	26.0	(130 pcf x 26.0 ft)/2000 lb/ton =	1.69
5025	485.7	38.9	(130 pcf x 38.9 ft)/2000 lb/ton =	2.53
4985	*488.1*	49.9	(130 pcf x 49.9 ft)/2000 lb/ton =	3.24
4978	*488.5*	49.6	(130 pcf x 49.6 ft)/2000 lb/ton =	3.22
4955	*489.5*	48.5	(130 pcf x 48.5 ft)/2000 lb/ton =	3.15
4883	*491.5*	70.1	(130 pcf x 70.1 ft)/2000 lb/ton =	4.56
4830	*494.0*	86.0	(130 pcf x 86.0 ft)/2000 lb/ton =	5.59
4787	*493.0*	86.5	(130 pcf x 86.5 ft)/2000 lb/ton =	5.63
4740	*491.9*	87.1	(130 pcf x 87.1 ft)/2000 lb/ton =	5.66
4692	*493.3*	87.7	(130 pcf x 87.7 ft)/2000 lb/ton =	5.70
4645	*494.1*	88.3	(130 pcf x 88.3 ft)/2000 lb/ton =	5.74
4599	*497.0*	88.9	(130 pcf x 88.9 ft)/2000 lb/ton =	5.78
4552	*498.7*	89.5	(130 pcf x 89.5 ft)/2000 lb/ton =	5.82
4456	498.6	90.7	(130 pcf x 90.7 ft)/2000 lb/ton =	5.90
4400	*496.6*	91.4	(130 pcf x 91.4 ft)/2000 lb/ton =	5.94

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/16/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-495-1413 SHEET 8 OF 17
DESCRIPTION DTE Gas Line Consolidation Analysis
File: Mach DTE_C8.xls, hlo, rev. 12/12/2012

Phase 8 Embankment - Southeast Corner (Continued)

H = Depth to Bedrock - Gas Line Cover - 8.625" (see Sheet 13 for depth to bedrock values)

Gas Pipeline Station	H (ft.)	Δσ' tsf	Recom-pression (ft.)	Com-pression (ft.)	Total Consolidation Under Gas Line (ft.)
52+20	6.1	0	0	0	0
52+12	6.0	0.37	0.10	0	0.10
51+92	5.6	0.23	0.10	0	0.10
51+66	5.0	0.67	0.10	0	0.10
51+42	4.6	1.08	0.09	0	0.09
51+12	4.0	0.98	0.08	0	0.08
50+72	8.5	1.69	0.17	0	0.17
50+25	9.3	2.53	0.19	0	0.19
49+85	7.6	3.24	0.19	0.07	0.25
49+78	6.0	3.22	0.19	0.05	0.24
49+55	6.0	3.15	0.19	0.04	0.23
48+83	7.4	4.56	0.19	0.19	0.37
48+30	7.8	5.59	0.19	0.27	0.46
47+87	6.9	5.63	0.19	0.24	0.43
47+40	6.0	5.66	0.19	0.21	0.40
46+92	6.0	5.70	0.19	0.22	0.40
46+45	6.0	5.74	0.19	0.22	0.40
45+99	6.0	5.78	0.19	0.22	0.41
45+52	6.0	5.82	0.19	0.22	0.41
44+56	6.0	5.90	0.19	0.23	0.41
44+00	6.0	5.94	0.19	0.23	0.41

As can be seen from the consolidation numbers above, the most critical differential foundation consolidation under the gas pipeline occurs on the western end of the refuse facility (see Sheet 6)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/02/12	CHKD BY:	DATE:
PROJECT NAME:	Williamson - East of Dwina, Expansion Plan				
PROJECT NO.	B12-495-1413	SHEET	9	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis				
	File: Mach DTE_C6.xls, hlo, rev.12/12/2012				

Predicted Foundation Consolidation Under Gas Pipeline - West End Refuse Embankment Phase 8

Summary of Results

Gas Line Station (ft.)	Original Top of Pipe Elev. msl)	Mine Subsidence (ft.)	Subsided Top of Pipe Elev. (msl)	Foundation Consolidation (ft)	Total Vertical Pipe Movement (ft.)	Final Top of Pipe Elev. (ft.)
200	465.16	0	465.16	0	0.00	465.16
240	*465.02*	0	*465.02*	0	0.00	*465.02*
253	464.98	0	464.98	*0.02*	*0.02*	464.96
300	464.34	0	464.34	*0.11*	*0.11*	*464.23*
335.7	*462.47*	0	*462.47*	0.17	0.17	*462.30*
349	461.78	0	461.78	0.17	0.17	461.61
356	*462.01*	0	*462.00*	0.17	0.17	*461.83*
397	463.33	0	463.33	*0.28*	*0.28*	*463.05*
442	463.88	0	463.88	*0.40*	*0.40*	*463.48*
466.1	*464.12*	0	*464.12*	0.47	0.47	*463.65*
486.4	*464.32*	*0.18*	*464.14*	0.45	*0.63*	*463.51*
502	464.48	0.31	464.17	*0.48*	*0.79*	*463.69*
539	*464.71*	*0.90*	*463.81*	*0.54*	*1.44*	*463.27*
581	464.98	1.57	463.41	*0.62*	*2.19*	*462.79*
604.6	*465.38*	*2.07*	463.32	0.66	*2.73*	*462.66*
609	465.46	2.16	463.30	*0.67*	*2.83*	*462.63*
639.2	*465.21*	*3.15*	*462.10*	*0.70*	*3.85*	*461.40*
658	465.05	3.76	461.29	*0.69*	*4.45*	*460.60*
669.8	*465.03*	*3.86*	*461.16*	0.69	*4.55*	*460.47*
704	464.96	4.16	460.80	*0.68*	*4.84*	*460.12*
740	*464.32*	*4.51*	459.81	0.66	*5.17*	*459.15*
752	464.10	4.62	459.48	*0.65*	*5.27*	*458.83*
795.9	*463.32*	*4.81*	*458.52*	0.63	*5.44*	*457.89*
799	463.27	4.82	458.45	*0.63*	*5.45*	*457.82*
847	461.35	4.84	456.51	*0.62*	*5.46*	*455.89*
859.3	*460.89*	*4.82*	456.07	0.62	*5.44*	*455.45*
895	459.57	4.76	454.81	0.62	*5.38*	454.19

Note: Numbers in italics are interpolated or include interpolated numbers

67

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/16/12	CHKD BY:	DATE:
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan				
PROJECT NO.	B12-495-1413	SHEET	10	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis				
File: Mach DTE_C9.xls, hlo, rev.12/11/2012					

Predicted Foundation Consolidation Under Gas Pipeline -SE Corner Embankment Phase 8

Summary of Results

Gas Line Station (ft.)	Original Top of Pipe Elev. msl)	Mine Subsidence (ft.)	Subsided Top of Pipe Elev. (msl)	Foundation Consolidation (ft)	Total Vertical Pipe Movement (ft.)	Final Top of Pipe Elev. (ft.)
52+20	-	5.28	*468.41*	0.00	5.28	*468.41*
52+12	-	5.28	*469.19*	0.10	5.38	*469.09*
51+92	-	5.28	471.29	0.10	5.38	*471.19*
51+66	-	5.28	473.60	0.10	5.38	*473.50*
51+42	-	5.28	*475.49*	0.09	5.37	*475.40*
51+12	*481.93*	5.28	*476.75*	0.08	5.36	*476.67*
50+72	486.94	5.28	481.66	0.17	5.45	*481.49*
50+25	489.98	5.30	*484.68*	0.19	5.49	*484.49*
49+85	*488.82*	5.30	*483.52*	0.25	5.55	*483.27*
49+78	491.34	5.30	486.04	0.24	5.54	*485.80*
49+55	*491.92*	5.38	*486.54*	0.23	5.61	*486.31*
48+83	493.64	5.50	488.14	0.37	5.87	*487.77*
48+30	*494.03*	5.58	488.55	0.46	6.04	*488.09*
47+87	493.35	5.59	487.76	0.43	6.02	*487.33*
47+40	493.94	5.63	488.31	0.40	6.03	*487.91*
46+92	495.13	5.75	489.38	0.40	6.15	*488.98*
46+45	496.15	5.75	490.40	0.40	6.15	*490.00*
45+99	498.45	5.75	492.70	0.41	6.16	*492.29*
45+52	500.98	5.75	495.23	0.41	6.16	*494.82*
44+56	501.01	5.74	495.27	0.41	6.15	*494.86*
44+00	498.99	5.71	493.28	0.41	6.12	*492.87*

Note: Numbers in italics are interpolated or include interpolated numbers

(68)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	06/11/12	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.	B12-495-1413			SHEET	11	OF	17
DESCRIPTION	DTE Gas Consolidation Analysis						
File: Mach DTE_9.xls, hlo, rev. 12/12/2012							

Ground and Gas Pipeline Profiles - Post mine Subsidence - West End Phase 2-3 Connector

Gas Line Station (ft.)	Original Ground Elev. (ft.)	Shortest ⊥ Distance to LW Panel Edge (ft.)	Subsid-ence (ft.)	Subsided Ground Elev. (ft.)	Original Top of Pipe Elev. (ft)	Subsided Top of Pipe Elev. (ft.)	Remarks
16	-	-488	0	-	465.00	465.00	
60	-	-	-	468.8	-	-	June 2012 spot topo elev.
64	-	-441	0	-	464.87	464.87	
87	-	-418	0	-	462.99	462.99	Sag in gas pipeline
111	-	-395	0	-	463.43	463.43	
142	-	-	-	470	-	-	June 2012 topo contour elev.
156	-	-350	0	-	464.63	464.63	
180	-	-	-	472	-	-	June 2012 topo contour elev.
200	-	-307	0	-	465.16	465.16	
240	-	-	0	-	-	-	West toe of embankment, 2012 topo
253	-	-255	0	-	464.98	464.98	
274	-	-	-	470	-	-	June 2012 topo contour elev.
294	-	-	0	469.2	-	-	June 2012 spot topo elev.
300	-	-209	0	-	464.34	464.34	
349	-	-161	0	-	461.78	461.78	
380	-		0	468	-	-	June 2012 topo contour elev.
397	-	-114	0	-	463.33	463.33	
442	-	-70	0	-	463.88	463.88	
445	-	-	-	468	-	-	June 2012 contour topo elev.
502	-	-11	0.31	-	464.48	464.17	
513	-	0	0.37	-	-	-	LW Panel #3 pullout line
539	-	26	0.75	-	464.54	463.79	Used subsidence for points 71 - 74
550	-	-	-	470	-	-	June 2012 contour topo elev.
581	470	67	1.57	468.4	464.98	463.41	Used subsidence for points 71 - 74
609	-	94	2.16	-	465.46	463.3	Used subsidence for points 27 - 14
658	-	142	3.76	-	465.05	461.29	Used subsidence for points 27 - 14
704	-	187	4.16	-	464.96	460.8	Used subsidence for points 27 - 14
752	-	235	4.62	-	464.10	459.48	Used subsidence for points 13 &14
799	-	281	4.82	-	463.27	458.45	Used subsidence for points 6 - 12
847	-	328	4.84	-	461.35	456.51	Used subsidence for points 6 - 12
895	-	375	4.76	-	459.57	454.81	Used subsidence for points 6 - 12
912	-	392	4.73	-	459.07	454.34	Sag in gas pipeline
941	-	420	4.68	-	460.01	455.33	Used subsidence for point 6
1034	-	-	-	460.6	-	-	June 2012 spot topo elev.

69

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 08/06/12 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO. B12-495-1413 SHEET 12 OF 17

DESCRIPTION DTE Gas Line Consolidation Analysis

File: Mach DTE_9-1.xls, hlo, rev. 12/12/2012

Ground and Gas Pipeline Profiles - Post mine Subsidence -SE Corner Embankment Phase 8

Gas Line Station (ft.)	Original Ground Elev. (msl	Shortest Distance to LW Panel Edge (ft.)	Subsidence (ft.)	Subsided Ground Elev. (msl)		Original Top of Pipe Elev. (msl)	Subsided Top of Pipe Elev. (msl)	Remarks
5357	-	-	-	463.54		-	459.29	Post-subsidence surveyed elev.
5324	-	-	-	465.61		-	461.36	Post-subsidence surveyed elev.
5283	-	-	-	467.38		-	463.47	Post-subsidence surveyed elev.
5269	-	-	-	468.50		-	464.33	Post-subsidence surveyed elev.
5252	-	-	-	*469.75*		-	*465.74*	Ditch elev. 469.0
5243	-	-	-	470.41		-	466.49	Post-subsidence surveyed elev.
5232	-	-	-	*471.43*			*467.41*	Ditch elev. 469.0
5217	-	-	-	472.83		-	468.66	Post-subsidence surveyed elev.
5212	-	-	-	*473.36*		-	*469.19*	Embankment elev. 479.0
5192	-	-	-	475.46		-	471.29	Embankment elev. 479.0
5166	-	-	-	477.85		478.46	473.60	Post-subsidence surveyed elev.
5142	-	-	-	*479.03*		-	*475.49*	Embankment elev. 495.7
5128	485.0	720	5.28	*479.7*		-	-	Original topo spot ground elevation
5119	*485.5*	720	5.28	*480.2*		482.58	477.30	Used subsidence for Points 45-46
5112	*485.9*	720	5.28	*480.7*		*481.93*	*476.65*	Embankment elev. 495.67
5072	*488.3*	720	5.28	*483.0*		486.94	481.66	Used subsidence for Points 45-46
5025	*491.0*	721	5.30	*485.7*		489.98	*484.68*	Used subsidence for Points 45-46
4985	*493.4*	721	5.30	*488.1*		*488.82*	*483.52*	Embankment elev. 538
4978	*493.8*	721	5.30	*488.5*		491.34	486.04	Used subsidence for Points 45-46
4962	494.7	721	5.30	489.4		-	-	Original topo spot ground elevation
4955	*494.9*	722	5.38	*489.5*		*491.92*	*486.54*	Embankment elev. 538
4930	-	724	5.46	-		492.55	487.09	Used subsidence for Points 45-46
4883	*497.0*	725	5.50	*491.5*		493.64	488.14	Original pipe elevation
4850	498	727	5.55	492.5		-	-	Original topo contour ground elev.
4835	-	-	-	-		494.11	-	Original pipe elevation
4830	*497.8*	728	5.58	*492.2*		*494.03*	488.45	Embankment elev. 580
4787	-	729	5.59	-		493.35	487.76	Original pipe elevation
4740	497.5	730	5.63	*491.9*		493.94	488.31	Original pipe elevation
4692	499.0	733	5.75	*493.3*		495.13	489.38	Original pipe elevation
4645	499.8	735	5.75	*494.1*		496.15	490.40	Original pipe elevation
4599	502.7	737	5.75	*497.0*		498.45	492.70	Original pipe elevation
4552	504.4	740	5.75	*498.7*		500.98	495.23	Original pipe elevation
4505	504.5	742	5.75	*498.8*		501.28	495.53	Original topo spot elevation
4456	504.3	744	5.74	*498.6*		501.01	495.27	Original pipe elevation
4409	502.7	747	5.71	*497.0*		499.34	493.63	Original pipe elevation
4400	502.3	747	5.71	*496.6*		498.99	493.28	Embankment bench elev. 588
4361	500.8	749	5.69	*495.1*		497.49	491.80	Original pipe elevation

70

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	08/13/12	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.	B12-495-1413			SHEET	13	OF	17
DESCRIPTION	DTE Gas Line Consolidation Analysis						
	File: Mach DTE_9-2.xls, hlo, rev.12/12/2012						

Ground and Gas Pipeline Profiles - Post Mine Subsidence - SE Corner Embankment Phase 8

Gas line soil cover, depth to bedrock, and subsided ground elevations along gas pipeline stationing

Gas Line Station (ft.)	Borehole or Point No.	Subsided Ground Elev. (msl)	Depth to Bedrock (ft.)	Remarks
5353	B3	-	12	B3 is 29' north of gas line, gas line cover is 51"
5324	J451	465.61	*11.3*	gas line cover is 51", post-subsidence surveyed ground elev.
5313	BP5	-	11	BP5 is 46' south of the gas line
5283	J450	467.38	*11.6*	gas line cover is 47", post-subsidence surveyed ground elev.
5269	J449	468.50	*11.9*	gas line cover is 50", post-subsidence surveyed ground elev.
5265	BP6	-	12	BP 6 is 47' south of the gas line
5252	-	*469.8*	*12*	Sediment Ditch bottom elev. 469.0, outside edge
5243	J448	470.41	*12*	gas line cover is 47", post-subsidence surveyed ground elev.
5232	B2	*471.4*	12	Sediment Ditch bottom elev. 469.0, inside edge, B2 is 23' north of the gas line
5217	BP7/J447	472.83	11	gas line cover is 50", post-subsidence surveyed ground elev.
5212	-	*473.4*	*10.9*	Embankment outside edge of bench elev. 479.0
5192	J446	475.46	*10.5*	Embankment inside edge of bench elev. 479.0, gas line cover is 50"
5166	BP8/J445	477.85	10	gas line cover is 51", BP 8 is 40' south of the gas line
5142	-	*479.0*	*9.6*	Embankment outside edge of bench elev. 495.7
5112	BP9	*480.7*	9	Embankment inside edge of bench elev. 495.7, BP9 is 39' south of gas line
5072	-	*483.0*	*13.5*	Original gas line survey location
5059	BP10	-	15	BP10 is 43' south of the gas line
5025	-	485.7	*14.3*	Original gas line survey location
5010	BP11	-	14	BP11 is 41' south of the gas line
4985	-	*488.1*	*12.6*	Embankment outside edge bench elev. 538
4978	-	*488.5*	*11.0*	Original gas line survey location
4955	BP12	*489.5*	11	Embankment inside edge bench elev. 538, BP12 is 39' south of the gas line
4907	BP13	-	12	BP13 is 42' south of the gas line
4883	-	491.5	*12.4*	Original gas line survey location
4850	-	492.5	*12.9*	Original topo contour ground elev.
4840	BP14	-	13	BP13 is 42' south of the gas line
4830	-	*492.2*	*12.8*	Embankment elev. 580
4787	-	*492.3*	*11.9*	Original gas line survey location
4740	BP15	*491.9*	11	Original gas line survey location
4692	-	*493.3*	11	Original gas line survey location
4645	-	*494.1*	11	Original gas line survey location
4599	-	*497.0*	11	Original gas line survey location
4552	-	*498.7*	11	Original gas line survey location
4456	-	498.6	11	Original gas line survey location
4409	-	*497.0*	11	Boring C-1 at station 42+50 also has bedrock at 11'
4400	-	*496.6*	11	Embankment bench elev. 588

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	8/8/2011	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.:	B12-495-1413			SHEET	14	OF	17
DESCRIPTION:	Subsidence Baseline - North-South Line on East Crest and North Slope of Phase 2						

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25,				March 2, 2011 Data						
Point #	Northing	Easting	Elevation	Point #	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft
1	426719.9107	360018.6730	491.728	3021101	426719.982	360018.503	487.02	0.07	-0.17	-4.71
2	426695.2703	360019.8605	496.256	3021102	426695.384	360019.704	491.52	0.11	-0.16	-4.73
3	426670.4275	360021.1434	494.665	3021103	426670.505	360021.041	489.96	0.08	-0.10	-4.70
4	426645.2540	360022.4474	493.744	3021104	426645.319	360022.143	489.13	0.07	-0.30	-4.61
5	426592.1332	360024.9538	496.976	3021105	426592.240	360024.739	492.33	0.11	-0.21	-4.65
6	426570.5179	360026.3034	500.712	3021106	426570.644	360026.132	496.03	0.13	-0.17	-4.68
7	426545.4953	360027.5461	503.321	3021107	426545.639	360027.374	498.60	0.14	-0.17	-4.72
8	426520.4934	360028.8517	505.191	3021108	426520.630	360028.674	500.43	0.14	-0.18	-4.76
9	426495.6080	360030.0683	505.450	3021109	426495.760	360029.947	500.65	0.15	-0.12	-4.80
10	426470.5878	360031.3480	505.071	3021110	426470.710	360031.253	500.22	0.12	-0.09	-4.85
11	426445.6565	360032.6524	504.887	3021111	426445.781	360032.575	500.03	0.12	-0.08	-4.86
12	426420.7708	360033.8930	504.987	3021112	426420.897	360033.854	500.19	0.13	-0.04	-4.80
13	426395.6957	360035.2969	503.390	3021113	426395.873	360035.223	498.73	0.18	-0.07	-4.66

March 2, 2011 is the final survey date for this subsidence pinline.

File: PinPoints(1-13).xls
Rev. 12/11/12, hlo

R11262

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	8/8/2011	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.:	B12-495-1413			SHEET	15	OF	17
DESCRIPTION:	Baseline - East of Northeast Line on East End of North Slope of Phase 2						

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25, 2011				March 14, 2011 Data						
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	North Distance From South Panel Edge- ft
14	426370.7701	360036.6723	499.318	426370.911	360036.528	494.75	0.14	-0.14	-4.57	221
15	426361.5685	360013.3246	502.989	426361.784	360013.113	498.45	0.22	-0.21	-4.54	212
16	426352.2762	359990.2042	504.222	426352.545	359989.949	499.78	0.27	-0.26	-4.44	202
17	426333.7608	359943.7031	504.670	426334.220	359943.359	500.57	0.46	-0.34	-4.10	184
18	426324.4877	359920.4504	505.191	426325.057	359920.040	501.20	0.57	-0.41	-3.99	174
19	426315.1771	359897.3310	505.647	426315.849	359896.868	501.74	0.67	-0.46	-3.91	165
20	426305.9136	359873.9982	505.995	426306.666	359873.449	502.09	0.75	-0.55	-3.90	156
21	426296.7287	359850.7578	506.104	426297.493	359850.286	502.27	0.76	-0.47	-3.83	147
22	426287.4709	359827.5596	506.695	426288.314	359827.146	503.00	0.84	-0.41	-3.70	137
23	426278.2247	359804.3451	506.973	426279.123	359804.008	503.50	0.90	-0.34	-3.48	128
24	426268.8649	359781.1768	507.302	426269.899	359780.932	504.12	1.03	-0.24	-3.18	119
25	426259.5715	359757.9131	507.259	426260.685	359757.663	504.48	1.11	-0.25	-2.78	110
26	426250.3285	359734.7090	507.055	426251.481	359734.428	504.68	1.15	-0.28	-2.37	100
27	426241.2263	359711.4219	507.236	426242.399	359711.163	505.23	1.17	-0.26	-2.01	91
28	426231.9559	359688.2576	507.200	426233.115	359688.031	505.55	1.16	-0.23	-1.65	82
29	426222.6980	359665.0069	506.935	426223.800	359664.726	505.62	1.10	-0.28	-1.32	73

Notes : March 14, 2011 is the final survey date for this subsidence pinline
The south edge of Panel No. 3 runs east-west on N 426,150.

File: PinPoints(14-29)R.xls
rev. 12/12/2012, hlo

R11263

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY:	HLO	DATE:	6/18/2012	CHKD BY:		DATE:	
PROJECT NAME:	Williamson - East of Dwina - Expansion Plan						
PROJECT NO.:	B12-495-1413			SHEET	16	OF	17
DESCRIPTION:	Baseline "H" - Easterly - Westerly Line on South Crest of Phase 3						

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25, 2011				April 5, 2011 Data						North Distance From South
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	Panel Edge - ft
41	426845.7081	358349.6385	502.643	426845.208	358349.684	497.53	-0.50	0.05	-5.11	696
42	426850.5251	358373.9329	502.258	426850.038	358373.731	497.06	-0.49	-0.20	-5.19	701
43	426855.8123	358398.1280	503.157	426855.298	358397.722	497.89	-0.51	-0.41	-5.27	706
44	426860.8552	358423.5055	503.137	426860.332	358423.018	497.90	-0.52	-0.49	-5.23	711
45	426866.1608	358447.2328	502.900	426865.664	358446.789	497.68	-0.50	-0.44	-5.22	716
46	426870.8456	358472.4792	503.025	426870.335	358472.133	497.72	-0.51	-0.35	-5.30	721
47	426875.1704	358497.2750	503.464	426874.635	358497.112	497.97	-0.54	-0.16	-5.50	725
48	426879.8172	358521.4775	503.638	426879.307	358521.162	498.01	-0.51	-0.32	-5.63	730
49	426882.8554	358546.0150	503.542	426882.316	358545.639	497.80	-0.54	-0.38	-5.75	733
50	426886.7078	358570.6605	503.066	426886.150	358570.189	497.31	-0.56	-0.47	-5.75	737
51	426891.8012	358594.9990	502.607	426891.224	358594.567	496.86	-0.58	-0.43	-5.75	742
52	426896.1595	358619.7378	502.623	426895.618	358619.215	496.90	-0.54	-0.52	-5.72	746
53	426900.5154	358644.1971	502.522	426899.986	358643.651	496.85	-0.53	-0.55	-5.68	751
54	426906.6990	358670.1668	502.643	426906.127	358669.635	497.02	-0.57	-0.53	-5.62	757
55	426912.1325	358693.5654	503.041	426911.545	358693.006	497.44	-0.59	-0.56	-5.60	762
56	426916.9026	358717.7688	503.382	426916.292	358717.181	497.75	-0.61	-0.59	-5.63	767
57	426921.7875	358742.4041	502.960	426921.092	358741.901	497.30	-0.70	-0.50	-5.66	772

Note : April 5 is the final survey date for this subsidence pinline

The south edge of Panel No. 3 runs E-W on N 426150

File: PinPoints(41-57)R.xls

rev. 12/12/2012, hlo

R11264

74

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 6/14/2012 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO.: B05-495-1413 SHEET 17 OF 17

DESCRIPTION: Bascline "G", North-South Line on East Crest of Phase 3 Longwall Panel No. 3

Data for 74 Pin Monitoring at Pond Creek Mine

Baseline Data Average: Shot On January 21 & 25, 2011				March 2, 2011 Data						South Distance From North Panel Edge - ft
Point #	Northing	Easting	Elevation	Northing	Easting	Elevation	Δ North-ft	Δ East - ft	Δ Elev.-ft	
58	427199.6407	360028.9146	500.411	427199.607	360028.720	495.29	-0.03	-0.19	-5.12	400
59	427224.5358	360026.1533	500.980	427224.461	360025.974	495.74	-0.08	-0.18	-5.24	375
60	427249.5863	360023.7018	502.050	427249.480	360023.645	496.77	-0.11	-0.06	-5.28	350
61	427274.7897	360025.0566	503.185	427274.642	360025.016	497.85	-0.15	-0.04	-5.33	325
62	427299.3534	360024.9848	503.014	427299.137	360024.927	497.62	-0.22	-0.06	-5.39	301
63	427324.5774	360024.8801	503.320	427324.321	360024.786	497.99	-0.26	-0.09	-5.33	275
64	427349.6602	360024.2754	503.670	427349.352	360024.195	498.39	-0.31	-0.08	-5.28	250
65	427374.6456	360025.7748	504.209	427374.197	360025.791	498.97	-0.45	0.02	-5.24	225
66	427400.4026	360024.4149	504.250	427399.693	360024.431	499.13	-0.71	0.02	-5.12	200
67	427424.3185	360023.1859	504.307	427423.281	360023.166	499.52	-1.04	-0.02	-4.78	176
68	427449.8823	360022.4175	504.086	427448.541	360022.384	499.76	-1.34	-0.03	-4.33	150
69	427474.4033	360021.6317	503.570	427472.707	360021.618	499.98	-1.70	-0.01	-3.59	126
70	427499.8466	360019.9085	503.036	427498.111	360019.842	500.33	-1.74	-0.07	-2.71	100
71	427524.8346	360017.6149	503.016	427523.356	360017.551	501.22	-1.48	-0.06	-1.79	75
72	427550.7951	360014.3475	502.936	427549.757	360014.321	501.78	-1.04	-0.03	-1.15	49
73	427574.7175	360010.3658	503.324	427574.039	360010.355	502.60	-0.68	-0.01	-0.73	25
74	427599.6555	360005.8279	502.913	427599.288	360005.815	502.54	-0.37	-0.01	-0.37	0

Notes: March 2, 2011 is the final survey date for this subsidence pinline.
The north edge of Panel No. 3 runs E-W on N427,600.

File: PInPoints(58-74)R.xls
rev. 12/12/2012, hlo

R11265

(76)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 05/30/12 CHKD BY: DATE:

PROJECT NAME: **Williamson - East of Dwina -Expansion Plan**

PROJECT NO. **B12-495-1413** SHEET 1 OF 11

DESCRIPTION **DTE Gas Line Antiseep Diaphragm Design**

File: Mach DTE_7.xls, hlo, rev. 12/13/2012

The gas line will be left in place where it will be eventually be under the two Phase 2-3 Connector Embankments, The East of Dwina Phases 1 through 4 Embankments, and the Stage 8 Buttress Embankment. Design a preventative measure for the possibility of the development of soil erosion along the pipe and to collect for treatment any contaminated seepage.

Reference: National Engineering Handbook, Part 628, Dams, Chapter 45, "Filter Diaphragms", NRCS, USDA, January 2007.

The DTE pipe line will exit perpendicular to slopes of the east and west Phase 2-3 Connector Embankments (see Drawing Nos. B12-218-E1 and B12-002-M5). After East of Dwina Phase 1 is built, and thereafter, the portion of the gas pipe line east of Dwina Road will be about 6 degrees off parallel to the Dwina Phases 1 through 4 and the Stage 8 and buttress embankments.

It should be noted that seepage along the gas pipeline is not anticipated to be a problem anywhere on this site because: 1) The pipe is trenched into a clay soil. Permeability tests on uncompacted samples of the soil indicate that it's vertical permeability ranges from 1×10^{-7} to 3×10^{-8} cm/sec, and 2) As soon as slurry is pumped into the impoundments the pool will become additionally sealed with a material which has in excess of 95% minus #200 sieve material.

Nevertheless, filter diaphragms will be designed for the locations the gas pipeline exits the embankments into the open to guard against the initial condition of the pools before slurry is deposited. The general guidelines in Ch. 45, referenced above, will be used for the design.

Due to the relative stiffness of the pipe, treat it as a rigid conduit as applies to diaphragm required size.

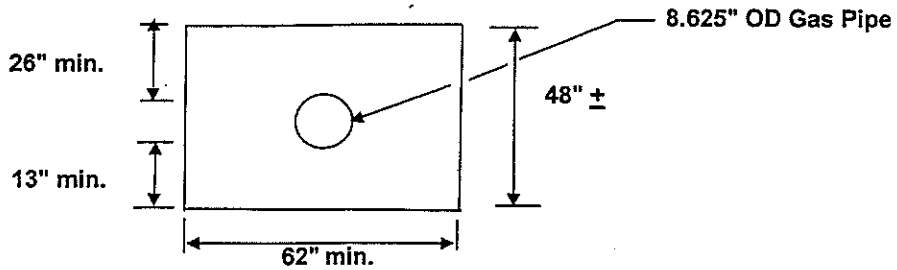
Assume $\delta < 0.7$, several feet of CL material to bedrock is below the bottom of the pipe.

Upward Vertical Collar Projection = 3 x Do = 3 x 8.625 = 25.9" (Fig. 45-A4)

Horizontal Collar Projection = 3 x Do = 25.9" (Fig. 45-A1)

Downward Vertical Collar Projection = 1.5 x Do = 1.5 x 8.625" = 12.9' (Pg. 4-A6)

Use collar size as follows:



Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 06/11/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-495-1413 SHEET 2 OF
DESCRIPTION DTE Gas Line Antiseep Diaphragm Design
File: Mach DTE_8.xls, hlo, rev. 12/13/2012

Filter Diaphragm Locations

Criteria: 1. Downstream of the center line of the dam when no cutoff trench is used, and
2. Upstream of a point where the embankment cover is at least half of the difference between the top of the diaphragm and the maximum potential reservoir water level.

Reservoir Water Levels:

Phase/Stage	Max. Water Elev.	Diaphragm Location
Phase 2-3 Connector*	535	E & W ends Phase 2-3 Connector
Phase 8 & Buttress Plan	585	West end Phase 2-3 Connector
East of Dwina Stage 4	623	Southeast side Dwina Stage 4

* Before East of Dwian Stage 1 is constructed.

(See Drawing No B12-495-M13, for Gas Pipeline Stations

West End Phase 2-3 Connector at the end of Phase 8

Diaphragm Location:
Top of diaphragm elevation = 466.0 at methane pipeline station 4+30
Head on top of diaphragm = 585 - 466 = 119'
One-half head = 59.5', embankment cover at 4+30 = 526.7 - 466.0 = 60.7' OK
Place diaphragm at pipeline station 4+30
Discharge any seepage along the pipeline collected by the diaphragm into the treatment ponds via a gravel drain along the pipeline from stations 4+30 to 2+40 and then a ditch beyond the toe of the dam.

Seepage Quantity:
$k'_{(embankment)} = 6 \times 10^{-4}$ cm/sec (use 6×10^{-2} cm/sec = 170.1 fpd)
Diaphragm Area = A = (62" x 48")/144 = 20.7 sf (minimum)
$i = \Delta h/\Delta l$, Δl = 8+59 - 4+30 =429', Δh = elev. 585 - elev. 466 = 119', i = 0.277
Q = k' x I x A = 170.1 fpd(0.277)20.7 sf = 975.3 cu-ft/day = 0.01113 cfs = 5.07 gpm

Assume the outlet drain is on a 1% slope, length - 190' to toe of dam
The drainfill aggregate available at the site has the following gradation:
1.5" to 3/8', 2/3's is 3/8" to 1', 1/3 is 1" to 1.5".
This is somewhat coarser than Gradation No. 15 (see Sheet 6)
$q/A \times 10^3$ = 0.8 fpd for minimum relative density
(See Sheet 7 - Figure C-15, SM Note No. 9. SCS, USDA, March 1984)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:

PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**

PROJECT NO. **B12-495-1413** SHEET 3 OF 11

DESCRIPTION **DTE Gas Line Antiseep Diaphragm Design**

File: Mach DTE_8a.xls, hlo, rev.12/13/2012

Filter Diaphragm Design (continued)

West End Phase 2-3 Connector at the end of Phase 8 (continued)

For a minimum outlet drain size of 4 sf: $Q = 0.8(10)^3$ fpd x 4 sf = 3,200 cu-ft/day
>> 975.3 cu-ft/day , OK for 1% grade

Try 0.5 % grade
$q/A \times 10^3 = 0.5$ fpd for minimum relative density
$Q = 0.5(10)^3 \times 4$ sf = 2,000 cu-ft/day, still >> 975.3 cu-ft/day, OK

Select a 2' x 2' outlet drain on a minimum slope of 0.5%

East End Phase 2-3 Connector at the end of Phase 8

This situtation is the mirrow image of the above West End, use the same design and put the outflow from the filter diaphragm into the sediment ditch. This diaphragm and its outlet channel will be abandoned when the East of Dwina Stage 1 slurry elevation overcomes the outlet drain discharge elevation and the existing sediment ditch on the east side of Phase 7.

East of Dwina Stages 1 through 4

The gas line runs almost parallel (6°) to the crest of the south East of Dwina embankments and does not penetrate those embankments into the slurry pool area. The pipe line will pass under the sediment ditch at the southeast corner of East of Dwina Phase 4. During East of Dwina Stage 1 construct a filter diaphragm and it's outlet drain using the same design as above - because the pipeline is nearly parallel to the embankment and does not lend itself to the seepage water quantity analysis given in the NRCS reference, and because the above design for the filter diaphragm and outlet channel has a flow capacity safety factor of at least 100.

Position the diaphragm on the gas line 190' west of the east toe East of Dwina Stage 4 at pipe line station 50+30. Extend the outlet drain as needed to exit in the east side sediment ditch.

(79)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:
PROJECT NAME: Mach Mining LLC, DTE Impoundment Plan
PROJECT NO. B12-218-1413 SHEET 4 OF 11
DESCRIPTION DTE Gas Line Antiseep Design
File: Mach DTE_8b.xls, hlo, rev. 12/19/2012

Filter Diaphragm Design (continued)

Select a Geotextile to Wrap the Gravel Diaphragm and Outlet Drain

Reference: "Geosynthetic Design and Construction Guidelines", Publication No. HI-95-038, Section 2, Geosynthetics in Subsurface Drainage Systems, Revised April 1998.

Assume steady state flow conditions

Retention Criteria:

AOS or $O_{95(geotextile)} \leq B\ D_{85(soil)}$ (EQ. 2-1)

$B = 1.8$; $O_{95} \leq 1.8\ D_{85}$ (for nonwoven geotextile and silts and clays (EQ. 2-4)

AOS or $O_{95} \leq 0.3$ mm (EQ. 2-5)

$D_{85} = 0.15$ mm (see attached Grain Size Analysis for Sample B-8874), PI = 24.1

1.8(0.15mm) = 0.27mm

Maximum AOS size = 0.30 mm for more than 50% passing #200 sieve & PI > 7.

Permeability/Permittivity Criteria:

$K_{geotextile} \geq k_{soil}$ (permeability requirements) (EQ. 2-7a)

$\Psi \geq 0.1\ sec^{-1}$ for > 50% passing #200 (EQ. 2-8c)

Clogging Resistance Criteria:

$O_{95(geotextile)} \geq 3\ D_{15(soil)}$ (EQ. 2-10)

Select Geotextile:

Try Propex's Geotex 501, nonwoven

AOS = 0.212mm < 0.27mm, OK

$\Psi = 1.4\ sec^{-1} > 0.1\ sec^{-1}$, OK (this is also equal to 110 gpm/ft^2)

The AOS (O_{95}) of the geotextile is obviously > 3 times the D_{15} of the soil, OK

Design inflow along gas pipeline = 5.07 gpm, therefore Geotex 601 will admit the anticipated inflow with a safety factor of over 20 per sq-ft of surface area (110/5.07 = 21.7).

Select Geotex 501 (or equilvalent) to provide a filter between the filter diaphragm and it's outlet drain and the foundation clayey soil.

(80)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: _____ DATE: _____

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

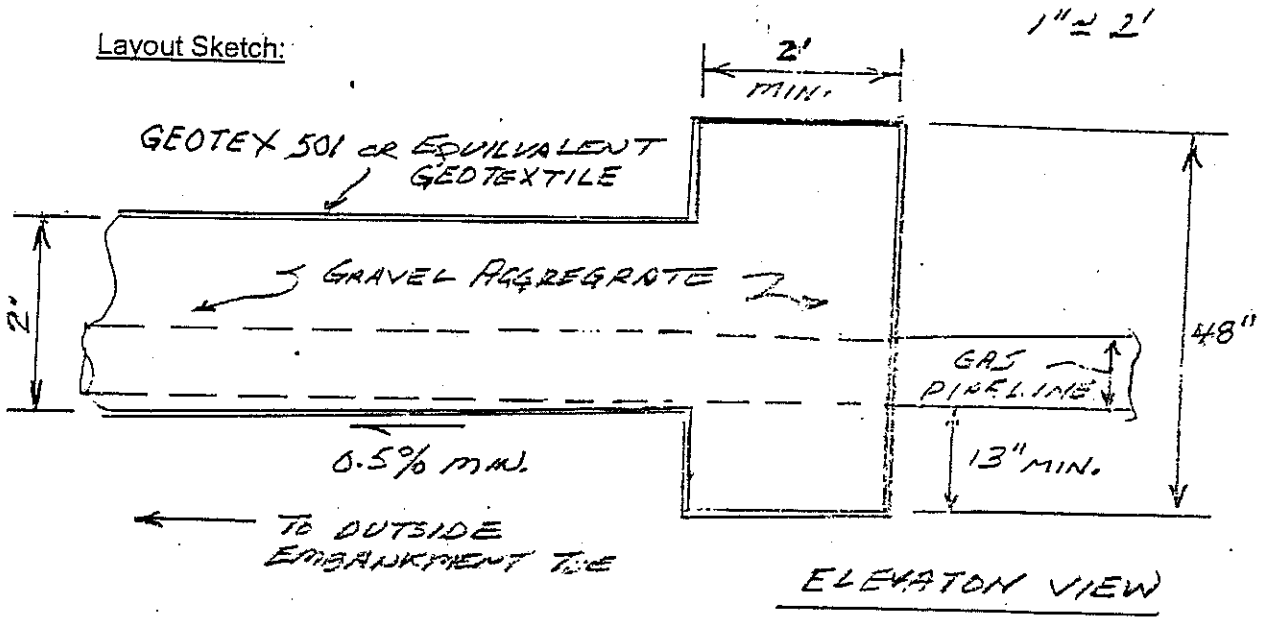
PROJECT NO. B12-485-1413 SHEET 5 OF 11

DESCRIPTION DTE Gas Line Antiseep Diaphragm Design

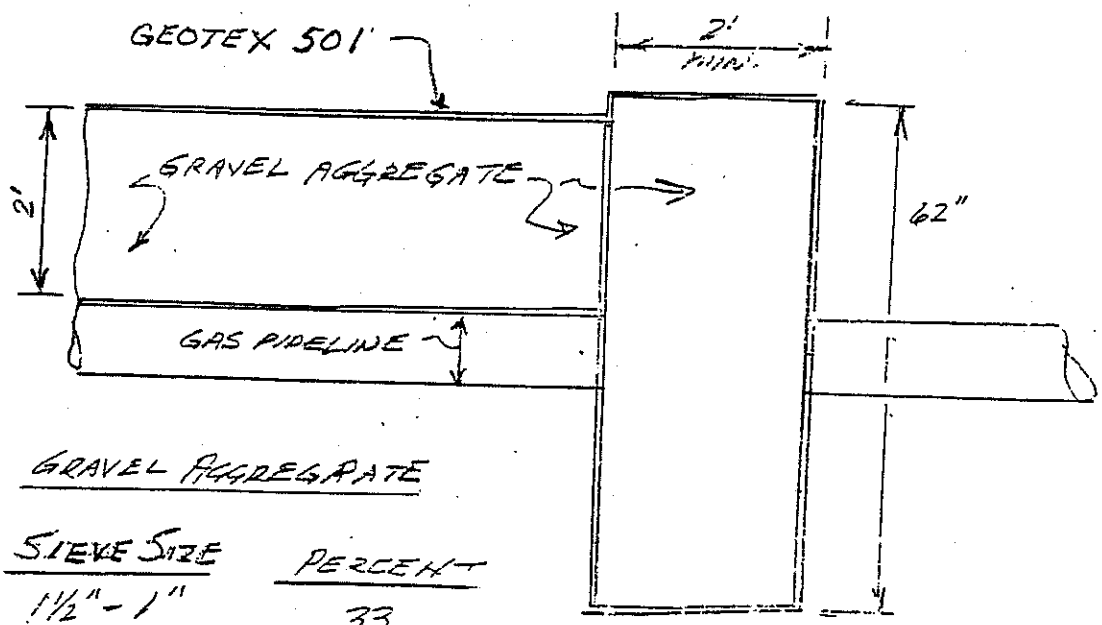
File: Mach DTE_8c.xls, hlo, rev. 12/13/2012

Filter Diaphragm Design (continued)

Layout Sketch:



OVERLAP GEOTEXTILE EDGES 12" MINIMUM



GRAVEL AGGREGATE

SIEVE SIZE	PERCENT
1½" - 1"	33
1" - 3/8"	67

Form SCS 130
5-65

4

SHEET 6 OF 11

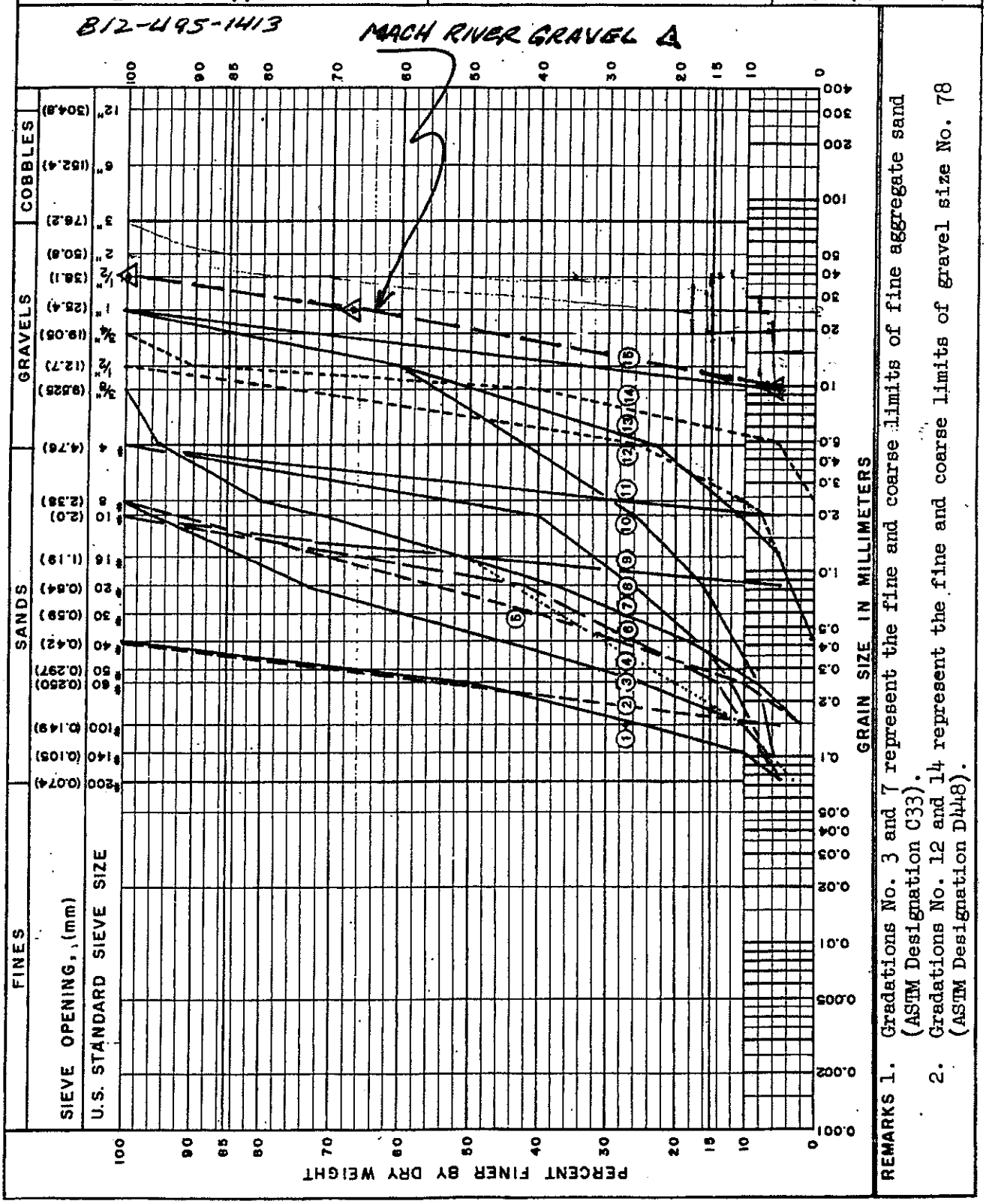
MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

PROJECT and STATE: WILLIAMSON - EAST OF DWIRA - EXPANSION PLAN

DESIGNED AT: ACI, BECKLEY, WV | BY: HJO | DATE: 12/13/2012

B12-U95-1413

MACH RIVER GRAVEL A



REMARKS 1. Gradations No. 3 and 7 represent the fine and coarse limits of fine aggregate sand (ASTM Designation C33).

2. Gradations No. 12 and 14 represent the fine and coarse limits of gravel size No. 78 (ASTM Designation D448).

Figure 1. Gradations of sands and gravels tested

(82)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:

PROJECT NAME: Williamson - East of Dwina - Expansion Plan

PROJECT NO. B12-485-1413 SHEET 7 OF 11

DESCRIPTION DTE Gas Line Antiseep Diaphragm Design

File: Mach DTE_8d.xls, hlo, rev. 12/13/2012

Filter Diaphragm Design (continued)

Gravel Permability

C - 20

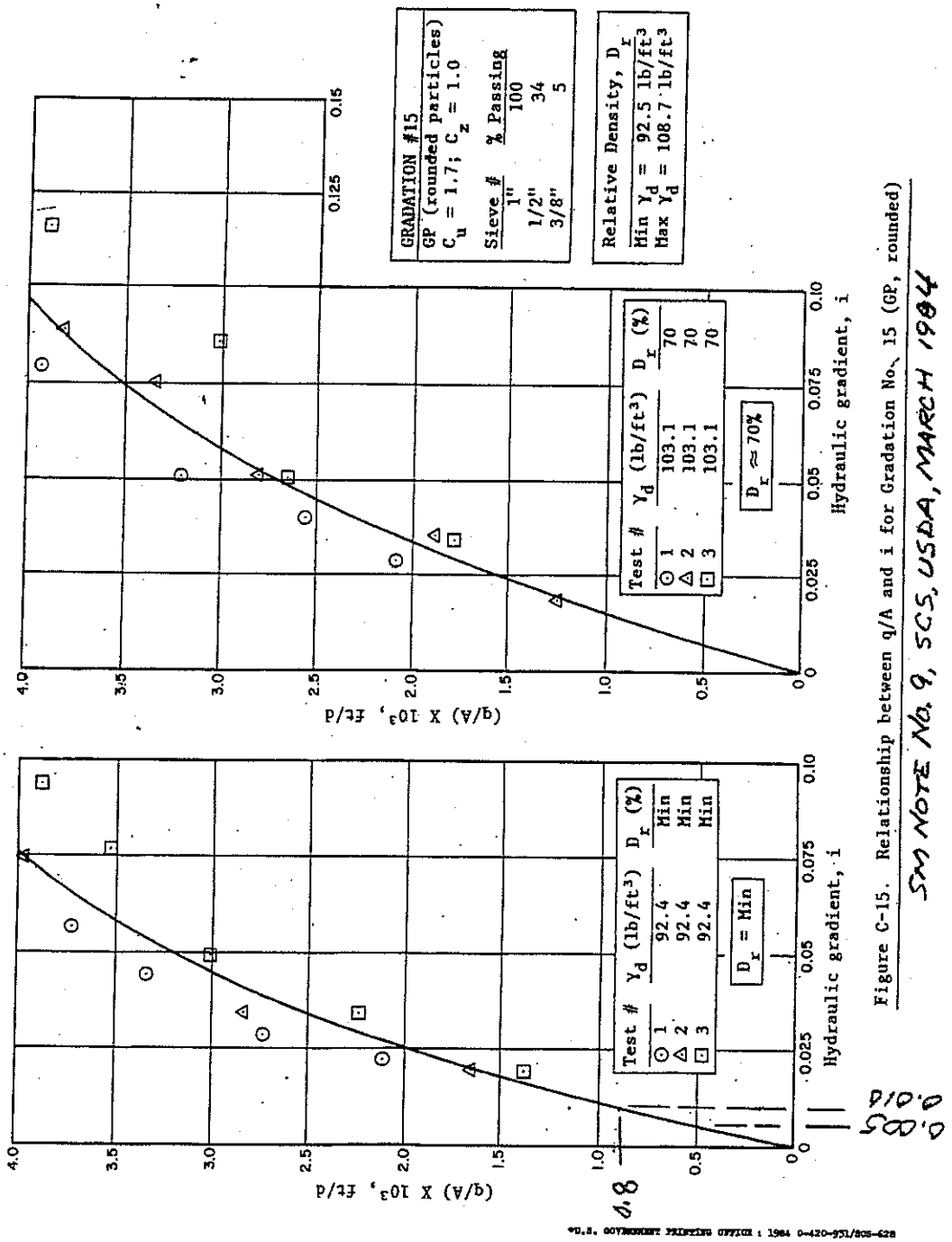


Figure C-15. Relationship between q/A and i for Gradation No. 15 (GP, rounded)

SM NOTE No. 9, SCS, USDA, MARCH 1984

0.10
0.08

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-420-951/808-628

(B3)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: _____ DATE: _____

PROJECT NAME: **Williamson - East of Dwina - Expansion Plan**

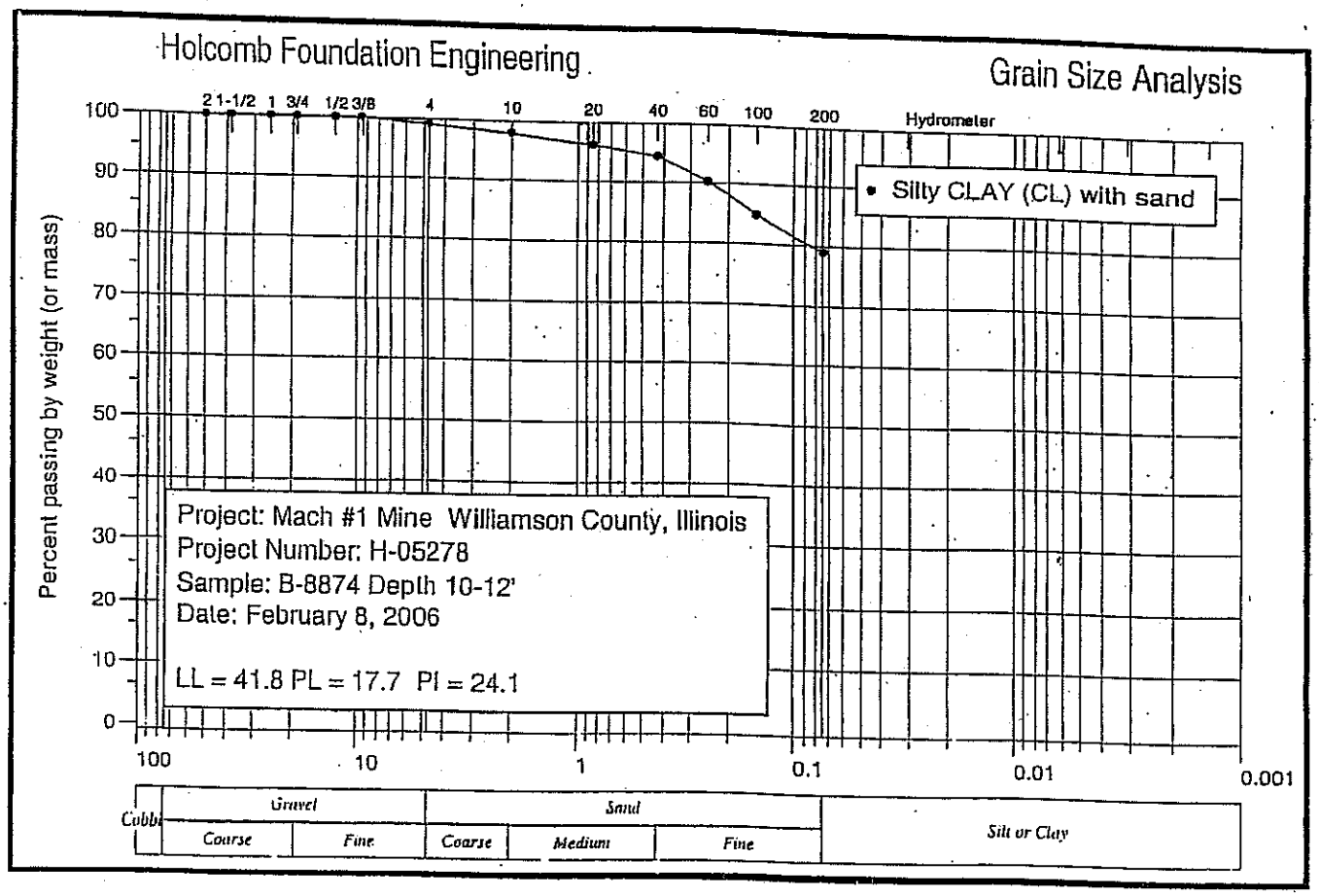
PROJECT NO. **B12-485-1413** SHEET **8** OF **11**

DESCRIPTION **DTE Gas Line Antiseep Diaphragm Design**

File: Mach DTE_8f.xls, hlo, rev. 12/13/2012

Filter Diaphragm Design (continued)

Base Soil Gradation Curve



(84)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-485-1413 SHEET 9 OF 11
DESCRIPTION DTE Gas Line Antiseep Diaphragm Design
File: Mach DTE_8e.xls, hlo, rev. 12/13/2012

Filter Diaphragm Design (continued)

Base Soil Gradation Table

Holcomb Foundation Engineering Company

Laboratory Testing Results

2/8/2006

Project: Mach # 1 Mine
Project No: H-05278

Sieve Analysis - ASTM C136-96a

Sample: Silty CLAY (CL)

Sieve Openings		US Standard	Weight	Percent	Percent
Inches	Millimeters	Sieve Size	Retained	Retained	Finer
1.5000	38.1000	1 -1/2"	0.0	0.0	100.0
1.0000	25.4000	1"	0.0	0.0	100.0
0.7500	19.1000	3/4"	0.0	0.0	100.0
0.5000	12.7000	1/2"	0.0	0.0	100.0
3.7500	9.5200	3/8"	0.0	0.0	100.0
0.1870	4.7600	No. 4	2.1	0.9	99.1
0.0790	2.0000	No. 10	4.6	2.0	98.0
0.0469	1.1800	No. 16	4.6	2.0	98.0
0.0331	0.8500	No. 20	8.6	3.8	96.2
0.0165	0.4200	No. 40	12.6	5.5	94.5
0.0117	0.2980	No. 50	12.6	5.5	94.5
0.0083	0.2500	No. 60	22.2	9.8	90.2
0.0059	0.1490	No. 100	34.6	15.2	84.8
0.0029	0.0740	No. 200	47.7	21.0	79.0

Total Weight in Grams 227.20

(85)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:
PROJECT NAME: Williamson - East of Dwina - Expansion Plan
PROJECT NO. B12-485-1413 SHEET 10 OF 11
DESCRIPTION DTE Gas Line Antiseep Diaphragm Design
File: Mach DTE_8g.xls, hlo, rev. 12/13/2012

Filter Diaphragm Design (continued) Base Soil Vertical Permabilities

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

Permeability Tests Results

Pond Creek Mine Refuse Disposal Area
Williamson County, Illinois

Date: 7/21/2009 Client: Williamson Energy
Marion, Illinois

Project No.: H-08283

Boring No.	Depth (Ft.)	Moisture Content (%) Before Test	Moisture Content (%) After Test	Dry Unit Weight (PCF)	Permeability (Cm./Sec.)
GW-12 GW-13 GW-13	16.0-18.5' 16.0-18.5' 26.0-28.5'	11.3	18.8	113.3	1 x 10-7*
GW-14 BH-6	16.0-18.5' 18.5-21.0'	14.4	18.4	110.2	1 x 10-7*
BH-4	13.5-16.0'	17.3	20.9	117.6	2 x 10-7
BH-5	18.5-21.0'	26.6	28.7	100.3	3 x 10-8

Permeability Tests performed in accordance with ASTM D-5084

* - Soil Samples Remolded at 95% Standard Proctor Dry Density

R11276

SHEET 11 OF 11 (86)

PROJECT NO.
EAZ-595-19113
MARCH MINING LLC
MARCH #1 MINE
COAL RESERVE
DISPOSAL AREA
NO. 2
EXPANSION OF
CROSS SECTION E-E
BTE GAS PIPELINE
NTS 12/13/12

——— GROUND LINE
——·—— GAS PIPELINE
356/382 STATION/ELEVATION
1"=50 HORIZ. & VERTICAL

600

550

500

450

400

ELEVATION - MSL

A — 42,585

Δh = 119'

X_m = 130 PCF CCR (POTENTIAL PHASE 7)

X_m = 130 PCF CCR (POTENTIAL PHASE 8)

X_m = 103 PCF FGD

X_m = 116 PCF COA COVER

PHASE 2-3 CONNECTOR

190'

FILTER DIAPHRAGM

2'x2' GRAVEL OUTLET DRAIN AT 0.5% MIN. SLOPE

AVE. DEPTH TO BEDROCK = 15'

Δl = 429'

GAS PIPELINE STATIONS

2+00 2+50 3+00 3+50 4+00 (4+30) 4+50

ACI PIPELINE STATIONS

5+00 5+50 6+00 6+50 7+00 7+50 8+00 8+50 9+00

DOCUMENT

62

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

Subject: Williamson Energy, LLC – Pond Creek Mine

Data: Log No. 5530-13

Reviewed by: D. Maschhoff **Date:** 3/17/15

Log No. 5530-13 ⇒ IBR No. 55 to OMM Permit No. 375

Log No. 5530-13

- IBR consisting of 2.13 acres located in Section 9 and 16, Township 8 South, Range 4 East, Williamson County.
- The IBR proposes underground installation of a buried pump discharge pipeline and electrical power line.
- A small area exemption is requested for this permit area. Silt fence and/or straw bales will be placed for drainage control.

* Action: Reference IEPA Log No. 5530-13 in renewed and modified NPDES permit for additional 2.31 acres for the installation of a buried pump discharge pipeline and electrical power line.

5530-113
Due date: 11-8-13
R11279

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

September 6, 2013

Mr. James Miller
Williamson Energy, LLC
P.O Box 99
Johnson City, IL 62951

RECEIVED
SEP 27 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Re: Permit No. 375
Incidental Boundary Revision No. 55

Dear Mr. Miller:

The appropriate Department technical staff have reviewed the proposed incidental boundary revision dated June 27, 2013, and supplemental information dated July 23, 2013, submitted by Williamson Energy, LLC for the Pond Creek mine. The request would add 2.31 acres to conduct Underground coal mining activities. The additional acres would be used for underground installation of a discharge pipeline and electrical power line.

The Department finds the permittee has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

1817.46(e) A sediment pond exemption is requested for an area delineated in the application. The regulations at 62 Ill. Adm. Code 1817.46(e) allow the Department to grant exemptions from the requirement to pass all disturbed drainage through a siltation structure when:

a. The disturbed drainage area within the total disturbed area is small; and

b. Alternate sediment control measures as described in Section 1817.45(b) are used in lieu of a siltation structure, and the permittee demonstrates that siltation structures are not necessary for drainage from the disturbed area to meet the effluent limitations and water quality standards for the receiving waters set forth in Section 1817.42.

The Department has determined that the area for which a sediment pond exemption is requested meets the criteria established in Section 1817.46(e) and hereby grants an exemption from the use of a sedimentation pond for this area.

1761.11(d) The proposed permit area is within one hundred (100) feet of the outside right-of-way line of public roads in Williamson County.

The proposed permit area is adjacent to the right-of-way of Thompsonville Road. The proposed activities in the permit area include installation of discharge pipeline and electrical power line.

5530 · / 13
Due date: 11-R13
RT1280

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

2.31 ACRES
INCIDENTAL BOUNDARY REVISION
FOR PERMIT NO. 375

WILLIAMSON COUNTY, IL
POND CREEK MINE NO. 1

June 27, 2013

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

June 27, 2013

Mr. Larry Crislip
Illinois Environmental Protection Agency
Mine Pollution Control Program
2309 West Main
Marion, IL 62959

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Underground Pipeline and Power Line Installation

Mr. Crislip:

Please find enclosed (2) copies of a 2.31 acre IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed underground installation of a discharge pipeline and probable electrical power line for the electric dewatering vertical turbine pump facility previously approved as IBR 49. Please refer to the enclosed material for details of the IBR.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 246 or (618) 889-8905.

Respectfully submitted,

James Miller

James Miller, PE
Authorized Representative
Williamson Energy, LLC

RECEIVED
SEP 27 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

June 27, 2013

Mr. Scott Fowler, Supervisor
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Underground Pipeline and Power Line Installation

Dear Mr. Fowler:

Please find enclosed an original and one copy of a 2.31 acre IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed underground installation of a discharge pipeline and probable electrical power line for the electric dewatering vertical turbine pump facility previously approved as IBR 49.

Please be advised that one copy of this IBR application has also been sent to Mr. Brad Murphy in the Benton office.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 246 or (618) 889-8905.

Sincerely,

James Miller

James Miller, P.E.
Authorized Representative
Williamson Energy, LLC

Cc: ILDNR/OMM Benton attn. B. Murphy (1) +.pdf
ILEPA Marion, attn. L. Crislip (2) +.pdf

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

June 27, 2013

Mr. Scott Fowler, Supervisor
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Underground Pipeline and Power Line Installation

Dear Mr. Fowler:

This letter authorizes Mr. James Miller and Mr. Mark Allaman permission to perform work on, receive comments and submit corrections on the above referenced application. Please send copies of any comments to Williamson Energy, LLC at the above address.

Thank you for your cooperation.

Sincerely,

Anthony Webb
Authorized Representative

Permit ID	375 IBR
Rev Date	6/27/13

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
One Natural Resources Way
Springfield, Illinois 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS PERMIT INCIDENTAL BOUNDARY REVISION IBR-1

PART I

(Application to be submitted 120 days (180 day for NPDES) prior to the desired effective date of the permit)

DATE: June 27, 2013

NOTICE

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill Rev Stat 1989, Ch. 961/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(I) (We) (The) Williamson Energy, LLC
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 99 Johnston City, IL 62951 [618] 983-3020
(Address) (Telephone Number)

hereby submits application for an Incidental Boundary Revision to Permit No. #375

Name of Mine: Pond Creek No. 1 Mine

MSHA ID No. 11-03141

I, Anthony Webb
(vice president or his duly authorized representative)

under penalty of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Signature Anthony Webb
Title: Authorized Agent

EXISTING PERMIT ACREAGE 662.77 ADDITIONAL ACRES REQUESTED 2.31

Permit ID 375 IBR
Rev Date 6/27/13

B) **Indicate the type of disturbance and associated acreage.**

Type of Disturbance	Acreage		
	Existing Permit	IBR	Total
Area Stripping	20.13		20.13
Mine Waste Areas	277.39		277.39
Processing Areas & Support Facilities	165.48	2.31	167.79
Access, Haul Roads & Transport Facilities	23.57		23.57
Soil Storage Areas	75.70		75.70
Diversions	32.85		32.85
Coal Recovery (Gob & Slurry)	0.00		0.00
Other	30.46		30.46
Not to be Disturbed	37.19		37.19
Total	662.77	2.31	665.08

2) A) **Provide the name and address of every legal or equitable owner of record of the proposed IBR area.**

RESPONSE: See Attachment I.2.A

B) **Provide the name and address of the owner of record of all surface and subsurface areas contiguous to any part of the proposed IBR area.**

RESPONSE: See Attachment I.2.A.

C) **Show the location of owners of record of those lands, both surface and subsurface, included in or contiguous to the proposed IBR area on the pre-mining land use map or another map, if necessary.**

RESPONSE: See Map 1, Identification of Interests

3) **Provide name and address of any holder of record of leasehold interest for the proposed IBR area.**

RESPONSE: Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

4) **Affidavits, Certifications**

A) **Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.**

RESPONSE: See Attachment I.2.A and I.4.A.

B) **Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit**

Permit ID 375 IBR
Rev Date 6/27/13

requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: See Attachment 1.4.B.

5) Areas Designated Unsuitable for Mining

A) Does proposed IBR area include:

1) Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?

Yes [ ] No [X]

2) National forest land?

Yes [ ] No [X]

3) Any land which will adversely affect any publicly owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per 62 Ill. Adm. Code 1761.11(a)(3) or Section 10, (B)(c) of the SCM-1?

Yes [ ] No [X]

If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1 Application.

4) Any public roads, which are to be removed, relocated or temporarily closed?

Yes [ ] No [X]

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

RESPONSE: Not Applicable.

B) Will the proposed IBR area be located:

1) Within 100 feet of the right-of-way line of any public road?

Yes [X] No [ ]

If yes, explain proposed procedure for complying with regulation Section 1761.12 (c), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

Permit ID 375 IBR
Rev Date 6/27/13

RESPONSE: All acreage included in the proposed IBR area is located within 100 feet of the right-of-way line of Thompsonville Road. However, the IBR area is proposed only for the underground installation of a pump discharge pipeline and probable electrical power line. After installation, these appurtenances are not expected to require maintenance or access, similarly to the public utilities that also parallel the public road. The Williamson County Highway Department has been provided with advanced notification of the intent to construct within 100 feet of the right-of-way and has issued a permit for construction within the right-of-way. Local landowner easements are recorded within the Office of the Williamson County Clerk and Recorder as referenced in Attachment I.2.A. The area within 100 feet of the Thompsonville Road right-of-way is requested for Department exception according to the process identified in Title 62 ILCS Section 1761.11(d)(2).

2) **Within 300 feet measured horizontally from any occupied dwelling?**

Yes [X] No [ ]

If yes, is waiver provided meeting requirements of Section 1761.15(b)?

RESPONSE: In accordance with the exception allowed in Section 1761.11(e)(1) and the procedure described in 1761.15(b), written waivers consenting to surface coal mining operations within 300 feet of an occupied dwelling are included. See Attachment I.5.B.

3) **Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?**

Yes [ ] No [X]

4) **Within 100 feet measured horizontally of a cemetery?**

Yes [ ] No [X]

C) **Are valid existing rights (per 1761.11) claimed for any part of the IBR area?**

Yes [ ] No [X]

If yes, provide documentation to substantiate claim.

RESPONSE: Not Applicable.

D) **Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.**

RESPONSE: Please refer to Attachment I.5.D for the draft copy of the newspaper notice. The notice will be published in The Daily American newspaper.

Permit ID 375 IBR
Rev Date 6/27/13

PART II

PREMINING INFORMATION

Pre-mining information is to be displayed on pre-mining land use map unless otherwise indicated.

1) **Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different than the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.**

RESPONSE: The IBR boundary will be delineated by using PVC and/or metal posts and will be located within eye sight of one another. All corners will be installed using Global Positioning System (GPS) referenced to the North American Datum of 1927 (NAD27) and Illinois State Plane Coordinate System (ISPCS) East Zone. A reference point to the IBR will be a National Geodetic Survey (NGS) monument located southeast of the IBR area near Shooting Club Lane as described immediately below:

NGS Horizontal Control Mark (HB1630)
Northing: 422,464.60
Easting: 376,078.24
Elevation: 600.32

NGS Reference Mark (HB1630 No. 4)
Northing: 422,462.34
Easting: 376,034.89
Elevation: 599.89

2) **Explain and locate areas where the IBR is contiguous to an existing permit.**

RESPONSE: The proposed IBR is contiguous to the current permitted boundary and it overlies the Shadow Area of UG Mining Permit #375. See Map 1, Identification of Interests for a delineation of the IBR boundary and the relationship of IBR boundary to the existing permit boundary.

3) **Give the acreage of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on pre-mining land use map existing land uses in the proposed permit area and adjacent to it. Include on the pre-mining land use map the location of all buildings and identify the current use of these buildings.**

Pre-Mine Land Use	Acreage		
	Existing Permit	IBR	Total
Cropland	523.81	0.00	523.81
Pasture Land	3.54	0.66	4.20
Grazing land	0.00	0.00	0.00
Forestry	106.99	0.68	107.67
Residential	4.32	0.45	4.77
Industrial/Commercial	3.47	0.00	3.47
Recreation	0.00	0.00	0.00
Fish & Wildlife Habitat	19.20	0.52	19.72
Developed Water Resources	1.44	0.00	1.44
Undeveloped Land	0.00	0.00	0.00
Total	662.77	2.31	665.08

RESPONSE: See Pre-Mining Land Use Map.

Permit ID 375 IBR
Rev Date 6/27/13

4) **Soils Information**

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes [X] No [ ]

If no, explain:

B) Delineate on the soils map(s) the area, which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

RESPONSE: No removal of overburden or deposition of overburden for the extraction of coal will occur on the IBR area. Proposed site disturbance is minimal and will include nominal open-cut channel excavation for buried pipeline and probable electric power line as well as some direct boring activity. After installation is complete, the area will be regraded and topsoil material will be replaced.

C) Are any of the identified map units correlated as prime farmland by NRCS criteria?

Yes [X] No [ ]

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: Negative determination to the NRCS prime farmland correlation is sought for all areas with the soil type identified as 301B because the areas have not historically been used for cropland. The mapped unit includes existing Federal Aid Secondary Route 1887 (Thompsonville Road).

D) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: See Attachment II.4.

E) Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.

RESPONSE: See Attachment II.4.

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes [ ] No [X]

If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 6/27/13

PART III

OPERATIONS PLAN

1) **Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.**

RESPONSE: The proposed IBR is intended only for underground installation of a buried pump discharge pipeline and probable electrical power line. Please see the attached Mining Operations Map for site layout.

2) **Surface Drainage Control**

A) 1) **Locate on the mining operations map or on a separate drainage map all proposed drainage control systems and show drainage patterns of all affected mining areas.**

RESPONSE: A small area exemption to the requirement for passing all drainage from disturbed areas through a siltation structure is requested as allowed under Title 62 IL Adm. Code 1817.46(e). During installation, disturbed area drainage will be controlled with proven alternate methods of drainage control which may include installation of silt fencing, straw bale containment check dams, earthen berms and/or mulched filter strips. Following completion of installation, the area will be regraded, topsoil will be replaced, and surface drainage will be controlled by well-established vegetative cover.

2) **Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?**

Yes [ ] No [X]

If yes, delineate how and where surface drainage will be collected and treated, and list the permit numbers and type of permit that the drainage control systems are operated under. If the above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: See Part III.2.A.1.

B) **Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?**

Yes [ ] No [X]

If no, please discuss.

RESPONSE: See Part III.2.A.1.

C) **Overland Flow Diversions and Sediment Ponds. Are either overland flow diversions or sediment ponds to be constructed?**

Yes [ ] No [X]

If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (Surface Drainage Control).

D) **Does a perennial or intermittent stream occur within the proposed IBR area?**

Yes [ ] No [X]

Permit ID 375 IBR
Rev Date 6/27/13

If yes, is an exception to the 100' buffer zone being requested or is a stream diversion being proposed. For an exception to the 100' buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

RESPONSE: Not Applicable.

3) **Roads and other activities**

A) **Are roads to be constructed in the IBR area?**

Yes [ ] No [X]

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: Not Applicable.

B) **If the operations involve other activities not specifically addressed above, complete applicable parts of the SCM-1 or UCM-1.**

RESPONSE: No other activities are proposed.

4) **Are any existing structures proposed for utilization in the IBR?**

Yes [ ] No [X]

If yes, complete Part IV.4 of the SCM-1.

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 6/27/13

PART IV

RECLAMATION PLAN

1) **Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.**

RESPONSE: When the buried pump discharge pipelines and power lines are no longer required at the site, they may be removed or abandoned depending on replacement value and/or landowner request. The original #375 permit provides more detail regarding soil conservation and reclamation practices. The original permit will be followed with regard to soil handling and replacement. Pre-mine topography and land use will remain as is currently present at the site.

2) **Post Mining Land Use**

A) **Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the post-mining land uses on the Post Mining Land Use Map. Acreage figures for post-mining land use must differentiate between mined and surface disturbance areas based on the mining line used in the pre-mining section of the application.**

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCrop	Prime	HCap	NonCrop	Prime	HCap	NonCrop
Cropland	8.56	3.45	2.46				8.56	3.45	2.46
Pasture Land		0.77	1.84		0.66			1.43	1.84
Grazing Land									
Forestry			13.36		0.68			0.68	13.36
Residential			0.11		0.45			0.45	0.11
Industrial/Commercial									
Recreation									
Fish & Wildlife Habitat (Herbacious)		2.76	42.37					2.76	42.37
Fish & Wildlife Habitat (Woody)		0.84	566.99		0.52			1.36	566.99
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.26						19.26
Undeveloped Land									
Total	8.56	7.82	646.39		2.31		8.56	10.13	646.39

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

Permit ID 375 IBR
Rev Date 6/27/13

3) **Pursuant to Section 1784.21 the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.**

RESPONSE: A survey of the Approved Shadow Area previously resulted in negative findings for the Indiana bat or its habitat, leading the U.S. Fish and Wildlife Service to grant clearance on 3/14/12 for a period of up to five years. More recently, mist net surveys were conducted by Alliance Consulting, Inc. during the period from May 15 - July 31, 2012 resulting in the capture of two adult male specimens and the location of multiple roost sites. All of the proposed IBR area is located within the Approved Shadow Area and none is located within the 2.5-mile roost tree buffer radius. As a result, the FWS concurred on 11/05/12 that a Protection and Enhancement Plan specific to this proposed IBR would not be warranted. A Protection and Enhancement Plan (PEP) was developed for Williamson Energy, LLC dated December 2012 detailing specific avoidance and minimization measures only required within the 2.5-mile roost tree buffer radius where the species was observed. A copy of the most recent correspondence with the U.S. Fish and Wildlife (FWS) dated January 30, 2013 is included as Attachment IV.3). Refer to the Pre-Mining Land Use Map 3 for an orthophotographic map of the site with the IBR boundary delineated.

Permit ID	375 IBR
Rev Date	6/27/13

Attachment List

Attachment I.2.A	Property Ownership Information
Attachment I.4.A	Real Estate Affidavit
Attachment I.4.B	Engineering Certification
Attachment I.5.B	Consent Waivers for Surface Coal Mining Operations
Attachment I.5.D	Newspaper Public Notice
Attachment II.4	Soils Information Chart
Attachment IV.3	Protection and Enhancement Plan/U.S. Fish and Wildlife Service Correspondance

Permit ID 375 IBR

Rev Date 6/27/13

PROPERTY INDEX NO.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	 Adjacent	APPLICANT CONTROL Ownership Percentage	 ROE Type	 Comments
04-09-300-013	New River Royalty 208 Public Square 4th Floor Benton, IL 62812	X		100%	Warranty Deed Dated: 4/8/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 484, Page 992.
04-09-300-015	James & Rebecca Isaacs 16494 Thompsonville Rd. Thompsonville, IL 62890	X		100%	Warranty Deed Dated: 4/26/2007	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 476, Page 816.
04-09-300-015	Williamson Energy, LLC P.O. Box 99 Johnston City, IL 62951	X		0%	Easement Dated: 10/10/2012	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 340, Page 914.
04-09-300-028	Charles Edwards 16749 Thompsonville Rd Thompsonville, IL 62890	X		100 %	Warranty Deed Dated:12/15/1988	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 372, Page 312.
04-09-300-028	Williamson Energy, LLC P.O. Box 99 Johnston City, IL 62951	X		0%	Easement Dated: 12/11/2012	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 340, Page 922 & 923.
04-09-300-031	Deborah Robinson 16432 Thompsonville Rd Thompsonville, IL 62890	X		100%	Warranty Deed Dated: 5/20/1999	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 448, Page 872.
04-09-300-031	Williamson Energy, LLC P.O. Box 99 Johnston City, IL 62951	X		0%	Easement Dated: 9/24/2012	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 340, Page 912
04-16-100-016	Christy Chrostoski 16346 Thompsonville Rd Thompsonville, IL 62890	X		100%	Warranty Deed Dated: 7/14/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 340, Page 912
04-16-100-016	Williamson Energy, LLC P.O. Box 99 Johnston City, IL 62951	X		0%	Easement Dated: 9/24/2012	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 485, Page 819.
04-16-100-008	Robin Williams & John Kee 156888 Thompsonville Road Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 1/15/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 340, Page 912
04-09-400-009	Charles Edwards 16749 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 12/15/1988	Recorded within the Office of the Williamson County Clerk and Recorder in Deed 484, Page 434.
04-09-300-027	Kandra Gourley 16421 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 1/1/2007	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 372, Page 312.
04-09-300-025	Jolene Gourley 16475 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 6/15/2004	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 475, Page 779.
04-09-300-016	New River Royalty 208 Public Square 4th Floor Benton, IL 62812		X	100%	Merger Dated: 8/12/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 466, Page 315.
04-09-300-017	Charles & Kimberly West 16563 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 5/11/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 330, Page 922.
04-09-300-019	New River Royalty 208 Public Square 4th Floor Benton, IL 62812		X	100%	Merger Dated: 8/12/2010	
04-09-300-018	New River Royalty 208 Public Square 4th Floor Benton, IL 62812		X	100%	Merger Dated: 8/12/2010	

Permit ID	B11296 375 IBR
Rev Date	6/27/13

PROPERTY INDEX NO.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	PROPERTY LOCATION Adjacent	APPLICANT CONTROL Ownership Percentage	APPLICANT CONTROL ROE Type	APPLICANT CONTROL Comments
04-09-300-026	Stanley & Patsy Gourley 16443 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 9/10/1996	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 439, Page 301.
04-09-300-030	Jerry Eberhardt 20957 Thorn Road Thompsonville, IL 62890		X	100%	Warranty Deed Dated 7/9/2008	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 480, Page 407.
04-16-100-019	Stanley Gourley 16443 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 1/1/2007	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 479, Page 865.
04-09-300-032	Christy Chrostoski 16346 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 9/16/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 485, Page 819.
04-16-200-001	David & Sheila Hurley 16308 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 10/1/1997	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 446, Page 837.
04-09-400-010	Danny L. Edwards 800 W 19th Street Johnston City, IL 62951		X	100%	Warranty Deed Dated: 9/30/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 483, Page 689.
04-09-300-029	Steven Edwards 1304 Durham Street Johnston City, IL 62951		X	100%	Warranty Deed Dated: 4/14/2008	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 489, Page 688.
4-09-300-022	Larry Edwards 20809 Thorn Road Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 11/1/2007	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 478, Page 553.
04-16-100-014	Stanley Gourley 16443 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 4/24/2008	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 479, Page 865.
04-16-100-018	Kandra Gourley 16421 Thompsonville Rd Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 4/24/2008	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 487, Page 419.
04-09-100-007	Charles Edwards 800 W 10th Street Johnston City, IL 62951		X	100%	Warranty Deed Dated: 7/26/2011	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 488, Page 410.

Permit ID 375 IBR

Rev Date 6/27/13

PARCEL NOS.	PROPERTY OWNERSHIP **Owner of Record**	PROPERTY LOCATION Within	Adjacent	APPLICANT CONTROL Ownership Percentage	ROE Type	Comments
04-09-700-003	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801	X		100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-16-700-001	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801	X		100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-08-700-003	WPP, LLC Suite 300, 1035 Third Ave. Huntington, WV 25727		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-08-700-007	WPP, LLC Suite 300, 1035 Third Ave. Huntington, WV 25727		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-09-700-001	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-09-700-002	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-09-700-004	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-16-700-002	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-16-700-003	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-16-700-004	Independence Land Co., LLC 430 Harper Park Drive Beckley, WV 25801		X	100%	Special Warranty Deed Dated: 3/10/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 940.
04-17-700-003	WPP, LLC Suite 300, 1035 Third Ave. Huntington, WV 25727		X	100%	Special Warranty Deed Dated 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 470, Page 688.
04-17-700-006	WPP, LLC Suite 300, 1035 Third Ave. Huntington, WV 25727		X	100%	Special Warranty Deed Dated 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 470, Page 688.

Permit ID	375 IBR
Rev Date	6/27/13

REAL ESTATE AFFIDAVIT
LEGAL RIGHT TO ENTER & CONDUCT MINING SUPPORT OPERATIONS

I, Anthony Webb
(Individual or Individuals)
under penalty of perjury declare on behalf of the applicant, Williamson Energy, LLC, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area, and that such legal right is not in any way the subject of pending court litigation.

Dated this 27th day of June 2013.

Signed: Anthony Webb Authorized Agent
Signature/Title

State of Illinois

County of Williamson

Signed and subscribed to before me on 6/27/13 (date) by Anthony Webb (name of person)

OFFICIAL SEAL
CATHY L. SKELTON
Notary Public - State of Illinois
My Commission Expires Feb 15, 2016

Cathy L Skelton
(Signature of Notary Public)

Permit ID	375 IBR
Rev Date	6/27/13

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" in the box below if that item is relevant.

	Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mine use of the site.
	Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.
X	Certification of Illinois Environmental Protection Agency - 35 Ill. Adm. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

James M. Miller, Chief Engineer
Name

062-059719
Illinois Registration Number (seal)

Mach Mining, LLC
Firm

(618) 983-3020
Phone Number

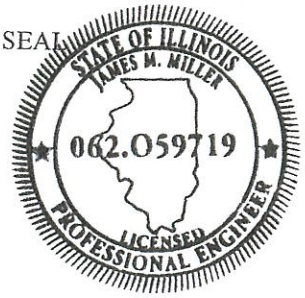
P. O. Box 99
Address

Johnston City, Illinois 62951

James Miller
Signature

6/27/13
Date

SEAL



Permit ID	375 IBR
Rev Date	6/27/13

Consent Waiver for Surface Coal Mining Operations Near Occupied Dwelling

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004432970004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 911
File 2013-00001213

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 24th day of SEPTEMBER, 2012, from Robert Chrostoski and Christy Chrostoski, h/w, with and address of 16346 Thompsonville Road, Thompsonville, Illinois 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

All that part of the NE ¼ of the NW ¼ of Section 16, Township 8 South, Range 4 East of the 3rd P.M., Williamson County, Illinois, lying East of the center line of the public road commonly known as the Corinth/Thompsonville Road, and lying North of the south line of an easement being described in that certain Deed Granting Easement dated July 21, 1994, as recorded in the office of the Recorder for Williamson County, Illinois on July 22, 1994, in Miscellaneous Record 221 at page 957.

WHEREAS, Grantee owner or leases the coal rights as to the real property

corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as

the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

ROBERT CHROSTOSKI

CHRISTY CHROSTOSKI

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Robert Chrostoski and Christy Chrostoski, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 24th day of September, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004432990004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 913
File 2013-00001215

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 24TH day of SEPTEMBER, 2012, from David Smith and Deborah Robinson-Smith, h/w, with and address of 16432 Thompsonville Road, Thompsonville, Illinois 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The East Five (5) acres more or less being that part of the description listed below that lies East and adjacent to the County Road running in a Northeasterly and Southwesterly direction along the East side of the following described tract:
The Southeast Quarter (SE1/4) of the Southwest Quarter (SW1/4), and the East one-half (E1/2) of the Southwest Quarter (SW1/4) of the Southwest Quarter (SW1/4), all in Section Nine (9), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, Excepting the North Forty-Five (45) acres thereof.

Also, part of the Northeast Quarter (NE 1/4) of the Northwest Quarter (NW 1/4) of Section 16 in Township 8 South, Range 4 East of the Third Principal Meridian, Williamson County, Illinois, being more particularly described as follows:
Commencing at a #5 rebar found at the northeast corner of the said Northwest Quarter (NW

1/4) of Section 16; thence on the north line of the said Northwest Quarter, North 88 degrees 57 minutes 32 seconds West, 519.19 feet to the point of beginning. From the said point of beginning; thence South 1 degree 02 minutes 28 seconds West, 19.53 feet; thence North 88 degrees 57 minutes 32 seconds West, 104.31 feet to the existing easterly right of way line of Thompsonville Road; thence on the said existing easterly right of way line, North 13 degrees 29 minutes 04 seconds West, 20.00 feet to the north line of the said Northwest Quarter of Section 16; thence on the said north line, South 88 degrees 57 minutes 32 seconds East, 100.00 feet to the point of beginning. The above described parcel contains 0.046 acres, more or less.

Excepting the following: Part of the Southeast Quarter of the Southwest Quarter of Section 9 in Township 8 South, Range 4 East of the Third Principal Meridian, Williamson County, Illinois, being more particularly described as follows:
Beginning at a #5 rebar found at the southeast corner of the said Southwest Quarter of Section 9; thence on the north line of the said Southwest Quarter, North 88 degrees 57 minutes 32 seconds West, 100.00 feet; thence North 1 degree 02 minutes 28 seconds East, 20.00 feet; thence South 88 degrees 57 minutes 32 seconds East, 99.72 feet to the east line of the said Southwest Quarter of Section 9; thence on the said east line, South 0 degrees 14 minutes 47 seconds West, 20.00 feet to the point of beginning. The above described parcel contains 0.046 acres, more or less.

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

David Smith

Deborah Robinson-Smith

STATE OF ILLINOIS)
) SS
COUNTY OF WILLIAMSON)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that David Smith and Deborah Robinson-Smith, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 24 day of SEPTEMBER, 2012.

Notary Public

My Commission Expires:
JULY 27, 2014

WELLC_SurfWaiverConsent.v01

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004433010004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 915
File 2013-00001217

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 10th day of OCTOBER, 2012, from James Isaacs and Rebecca Isaacs, h/w, with and address of 16494 Thompsonville Road, Thompsonville, Illinois 62980, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

Part of the Southeast Quarter of the Southwest Quarter of Section 9, Township Eight South, Range Four East of the Third P.M., Williamson County, Illinois. Further described as follows:

Commencing at a found roof bolt marking the Northeast corner, of the Southeast Quarter of the Southwest Quarter of Section 9, thence South 0° 14'32" West, along the East line of the Southwest Quarter of Section 9, 665.66 feet to a found roof bolt, to the point of beginning, thence North 88° 58' 19" West, 461.49 feet to a set 5/8 inch iron pin, thence South 13° 53' 1" west, along the east right of way line of the Thompsonville Blacktop, 341.349 feet to a set 5/8 inch iron pin, thence South 88° 58' 16" East, 542.01 feet to a set 5/8 inch iron pin, thence North 1° 14' 32" East, 332.83 feet to said point of beginning. Situated in the County of Williamson, in the State of Illinois.

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

JAMES ISAACS

REBECCA ISAACS

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that James Isaacs and Rebecca Isaacs, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 10TH day of OCTOBER, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004433020005 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 5
Fees: $46.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 916
File 2013-00001218

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 16TH day of OCTOBER, 2012, from Stanley L. and Patsy M. Gourley, with and address of 16443 Thompsonville Road, Thompsonville, Illinois 62980, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

TRACT 1

Part of the Northeast Quarter of the Northwest Quarter of Section 16, Township 8 South, Range 4 East of the Third P.M., Williamson County, Illinois. Further described as follows:

Commencing at a #5 rebar marking the Northeast corner of the Northwest Quarter of said Section 16; thence North 88 degrees 58 minutes 12 seconds West along the North line of Section 16, 663.55 feet to a #4 rebar on the West Right of Way line of Thompsonville Blacktop; thence North 88 degrees 58 minutes 12 seconds West, along said line, 655.23 feet to a #4 rebar on the West line of the Northeast Quarter of the

Northwest Quarter of said Section 16; thence South 0 degrees 01 minutes 39 seconds East, along said line, 357.00 feet to a #4 rebar, thence South 88 degrees, 58 minutes 12 seconds East, 567.38 feet to a #4 rebar on the West Right of Way line of Thompsonville Road; thence North 13 degrees 53 minutes 01 seconds East, along said line 366.14 feet to the said Point of Beginning.

TRACT 2

A part of the Northeast Quarter of the Northwest Quarter of Section 16, Township 8 South, Range 4 East of the Third Principal Meridian all located in Williamson County, Illinois, further described as follows:

Commencing at a #4 rebar at the Northwest corner of the Northeast Quarter of the Northwest Quarter of said Section 16; thence South 0 degrees 10 minutes 42 seconds East, along the West line of the Northeast Quarter of the Northwest Quarter of said Section 16, 357.00 feet to a #4 rebar, at the Point of Beginning; thence South 0 degrees 10 minutes 42 seconds East along said West line, 243.00 feet to a #4 rebar; thence South 88 degrees 57 minutes 48 seconds East, 512.66 feet to a #4 rebar on the West Right of Way line of the Thompsonville Road; thence North 11 degrees 43 minutes 41 seconds East, along said line 247.24 feet to a #4 rebar; thence North 88 degrees 57 minutes 46 seconds West, 563.77 feet to the said Point of Beginning. Containing 3.00 acres more or less.

TRACT 3

The West Ten (10) acres more or less being that part of the description listed below that lies West and adjacent to the County Road running in a Northeasterly and Southwesterly direction along the East side of the following described tract:

The Surface only of the Southeast Quarter (SE ¼) of the Southwest Quarter (SW ¼), and the East One-Half (E ½) of the Southwest Quarter (SW ¼) of the Southwest Quarter (SW ¼), all in Section Nine (9), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, Excepting the North Forty-Five (45) acres thereof. Situated in Williamson County, Illinois.

Except from Tract 3 above:

Part of the Southeast quarter (SE ¼) of the Southwest Quarter (SW ¼) of Section Nine (9), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian in Williamson County, Illinois, further described as follows: Commencing at a found roof bolt marking the Northeast corner of the Southeast Quarter of the Southwest Quarter of said Section 9; thence South 0 degrees 14 minutes 32 seconds West, along the East line of the Southwest Quarter of said Section 9, 998.49 feet to a found 1 inch iron pin; thence North 88 degrees 58 minutes 16 seconds West, 583.04 feet to a found 1 inch iron

pin at the Point of Beginning; thence South 13 degrees 53 minutes 01 seconds West, along the West Right of Way of the Thompsonville Blacktop, 170.67 feet to a set 5/8 inch iron pin; thence North 88 degrees 58 minutes 16 seconds West, 503.41 feet to a set 5/8 inch iron pin; thence North 0 degrees 13 minutes 36 seconds East, 166.41 feet to a set 5/8 inch iron pin; thence South 88 degrees 58 minutes 16 seconds East 543.71 feet to the said point of beginning.

Also, Except from Tract 3 above:

Part of the Southeast Quarter of the Southwest Quarter of Section 9, Township 8 South, Range 4 East, of the Third Principal Meridian in Williamson County, Illinois, Further Described as follows:

Commencing at a found roof bolt marking the Northeast corner of the Southeast Quarter of the Southwest Quarter of said Section 9; thence South 0 degrees 14 minutes 32 seconds West, along the East line of the Southwest Quarter of said Section 9, 998.49 feet to a found 1 inch iron pin; thence North 88 degrees 58 minutes 16 seconds West, 583.04 feet to a found 1 inch iron pin; thence South 13 degrees 53 minutes 01 seconds West, along the West Right of Way of the Thompsonville Blacktop, 291.34 feet to a set ½ inch iron pin at the Point of Beginning; thence South 13 degrees 53 minutes 01 seconds West, along said Right of Way line, 50.00 feet to a ½ inch rebar; thence North 88 degrees 58 minutes 12 seconds West, 705.89 feet to a ½ inch rebar; thence North 0 degrees 52 minutes 12 seconds West, 166.47 feet to a ½ inch rebar; thence South 88 degrees 58 minutes 16 seconds East, 545.38 feet to a ½ inch rebar; thence South 13 degrees 53 minutes 37 seconds West, 120.67 feet to a ½ inch rebar; thence South 88 degrees 58 minutes 07 seconds East, 204.02 feet to the said Point of Beginning.

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the

benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

Stanley L. Gourley
STANLEY L. GOURLEY

Patsy M. Gourley
PATSY M. GOURLEY

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Stanley L. and Patsy M. Gourley, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 16th day of October, 2012.

Notary Public

My Commission Expires:
July 27, 2014

WELLC_SurfWaiverConsent.v01

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004433030004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 917
File 2013-00001219

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 16TH day of OCTOBER, 2012, from Jolene Sioux Gourley and Michael R. Norris, with and address of 16475 Thompsonville Road, Thompsonville, Illinois 62980, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

Part of the Southeast Quarter of the Southwest Quarter of Section 9, Township Eight South, Range Four East of the Third Principal Meridian in Williamson County, Illinois. Further described as follows:

Commencing at a found roof bolt marking the Northeast corner, of the Southeast Quarter of the Southwest Quarter of Section 9; thence South 0° 14'32" West, along the East line of the Southwest Quarter of Section 9, 998.49 feet to a found inch iron pin; thence North 88° 58' 16" West, 583.04 feet to found one inch iron pin at the Point of Beginning; thence South 13° 53' 1" west, along the west right of way line of the Thompsonville Blacktop, 170.67 feet to a set 5/8 inch iron pin; thence North 88° 58' 16" west, 503.41 feet to a set 5/8 inch iron pin; thence North 0° 13' 36" East, 166.41feet to a set 5/8 inch iron pin; thence South 88 degrees 58 minutes 16 seconds East 543.71 feet to the said point of beginning.

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as

the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

JOLENE SIOUX GOURLEY

MICHAEL R. NORRIS

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Jolene Sioux Gourley and Michael R. Norris, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 16TH day of OCTOBER, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004433060004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 920
File 2013-00001222

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 11TH day of December, 2012, Charles L. Edwards and Dorris D. Edwards, husband and wife, with an address of 800 W. 10th Street, Johnston City, IL 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The surface corresponding to part of the NW ¼ SE ¼ and part of the NE ¼ SW ¼ all in Section 9, Township 8 South, Range 4 East of the Third Principal Meridian, in Williamson County, Illinois, (for a complete description see Quit-Deed dated December 15, 1988, recorded in the Clerk and Recorder's Office for Williamson County, Illinois in Deed Record 415 at page 796 and Deed Record 372 at page 312) hereafter referred to as the "Property",

WHEREAS, Grantee owner or leases the coal rights as to the real property

corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as

the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

Charles L Edwards
CHARLES L. EDWARDS

DORRIS D. EDWARDS

STATE OF Illinois)
) SS
COUNTY OF WILLIAMSON)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that **Charles L. Edwards and Dorris D. Edwards,** personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that THEY signed and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 11TH day of DECEMBER, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

Image# 004433070004 Type: WAIV
Recorded: 02/07/2013 at 09:52:49 AM
Page 1 of 4
Fees: $45.00
IL Rental Housing Fund: $10.00
Williamson County, IL
Amanda Barnes Clerk & Recorder
Book 340 Page 921
File 2013-00001223

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 11TH day of December, 2012, Charles L. Edwards and Dorris D. Edwards, husband and wife, with an address of 800 W. 10th Street, Johnston City, IL 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The surface corresponding to part of the NW ¼ SE ¼ and part of the NE ¼ SW ¼ all in Section 9, Township 8 South, Range 4 East of the Third Principal Meridian, in Williamson County, Illinois, (for a complete description see Quit-Deed dated December 15, 1988, recorded in the Clerk and Recorder's Office for Williamson County, Illinois in Deed Record 415 at page 796 and Deed Record 372 at page 312) hereafter referred to as the "Property",

WHEREAS, Grantee owner or leases the coal rights as to the real property

corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as

the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

CHARLES L. EDWARDS

Dorris D. Edwards

DORRIS D. EDWARDS

STATE OF ILLINOIS)
) SS
COUNTY OF WILLIAMSON)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that **Charles L. Edwards and Dorris D. Edwards**, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that THEY signed and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 11TH day of DECEMBER, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public State of Illinois
My Commission Expires
July 27, 2014

Permit ID 375 IBR
Rev Date 6/27/13

Public Notice

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy, LLC, P. O. Box 99, Johnston City, IL 62951 hereby gives notice that on June 27, 2013, an incidental boundary revision has been submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division, One Natural Resources Way, Springfield, IL 62707-1271. The IBR application is for 2.31 acres located primarily East of and adjacent to Thompsonville Road in the N½ of the NE¼ of the NW¼ of Section 16, T8S, R4E and the E½ of the SW¼ of Section 9, T8S, R4E, Williamson County. The proposed IBR will also include multiple direct bores under Thompsonville Road and a nominal area West of and adjacent to Thompsonville Road in the NE¼ of the SW¼ of Section 9, T8S, R4E, Williamson County.

The IBR proposes only underground installation of a buried pump discharge pipeline and probable electrical power line.

Copies of the application are on file for public viewing at Illinois Department of Natural Resources, Office of Mines and Minerals, 503 East Main Street, Benton, Illinois 62812, and at the Springfield office. Written comments concerning the operations should be submitted to the Illinois Department of Natural Resources Springfield office no later than seven [7] days from the publication date of this notice. Comments or request for public hearing regarding activities within one hundred feet of the right-of-way of Thompsonville Road must be received no later than fourteen [14] days from the publication date of this notice.

Permit ID	375 IBR
Rev Date	6/27/13

Soil Identification				Mining Area							Support Area						
				Prime Soils		NonPrime Soils					Prime Soils		NonPrime Soils				
Soil Map Symbol	Soil Name	Slope Class [%]	Capability Class	Prime Farmland [acres]	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]	Prime Farmland [acres]	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]
301B	Grantsburg silt loam	2-5	2e									2.12					2.12
14B	Ava silt loam	2-5	2e									0.19					0.19
			Total									2.31					2.31

Note : Soil information was determined from the Soil Survey of Williamson County, Illinois, 1978, prepared by the United States Department of Agriculture, Soil Conservation Service in cooperation with the Illinois Agricultural Experiment Station.

R11331

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Marion Illinois Sub-Office (ES)
8588 Route 148
Marion, Illinois 62959
(618) 997-3344

January 30, 2013

Braden A. Hoffman
Senior Project Manager
Alliance Consulting, Inc.
124 Philpott Lane
Beaver, West Virginia 25813-9502

Dear Mr. Hoffman:

Thank you for the transmittal letter dated December 13, 2012, requesting review of the Indiana Bat (*Myotis Sodalis*) Protection and Enhancement Plan (PEP) prepared for Williamson Energy, LLC, Pond Creek Mine No.1 Expansion Area located in Williamson County, Illinois. The PEP was developed in accordance with the 2009 Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (PEP Guidelines). These comments are provided under the authority of and in accordance with the provisions of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

The proposed project consists of a 5,364.5 acre expansion to the existing Pond Creek Mine (Permit No.375) and includes a deep mine subsidence area that may need to have drainage correction activities completed in order to correct the ponding effect caused by subsidence as well as future incidental boundary revisions (IBRs) for surface installations required in support of ongoing underground mining operations. According to the PEP, tree clearing will be necessary in order to complete the proposed drainage corrections activities, but only a small portion of the forest habitat within the shadow area will need to be cleared.

From May 15 through July 31, 2012, Alliance Consulting, Inc. conducted mist-net surveys and telemetry in the project area in order to determine: 1) if Indiana bats occur in the project area; 2) document the location of Indiana bat roost trees; and, 3) estimate the size of the colony. A total of 2 male Indiana bats were captured and fitted with radio transmitters for tracking purposes and 3 roost trees (1 presumed main roost tree and 2 satellite roost trees) were located. Based on exit count surveys, the main colony was estimated at 34 adult Indiana bats.

Since females or juveniles were not captured and/or tracked to any of the roost trees, Alliance Consulting, Inc. is currently addressing the roost trees as a bachelor colony of males. Thus, the PEP is based upon a 2.5 mile buffer from the primary roost tree. The number of Indiana bats observed exiting the main colony (34) is more indicative of a maternity colony than a bachelor colony. However, the buffer distance is the same for a male capture record or maternity tree so the Service concurs with the use of a 2.5 mile buffer from the primary roost tree. Information

provided in the PEP indicates that there is approximately 5,709 acres of forested habitat within the 2.5 mile buffer and that the remaining 6,978 acres are primarily agricultural land. In addition, 36% of the area within the 2.5 mile buffer zone will be undermined and the remaining 64% of the area is not currently proposed to be impacted in anyway.

The PEP includes a number of protection and enhancement measures. The Service offers the following comments regarding the proposed measures.

Avoidance Measures:

Minimization Actions

- The PEP area shall be surveyed in 2013 in order to monitor the status of the bachelor colony.

  The Service supports this measure, as it should provide insight to confirm whether the known colony is in fact a bachelor colony vs. a maternity colony. It will also provide valuable information regarding the Indiana bat population response to the proposed disturbance and the protection and enhancement measures. A plan should be developed that fully describes the proposed methods for surveying and monitoring the Indiana bat population and their habitat and the plan should be coordinated with this office.

Tree Clearing Restrictions

- Seasonal tree clearing will require the applicant only conduct project related tree removal from October 15 to March 31st within the PEP boundary. This restriction will apply to any mining related activities (including IBR's Revisions, etc).

  This measure is acceptable as proposed, as it will minimize any chance of direct take of the species.

- All areas outside of this 2.5 mile radius, and within the previously surveyed mining limits, will not be subject to tree clearing restrictions based upon the results of the 2010 and 2012 survey, and tree clearing can occur at any time.

  The Service agrees that the survey results from 2010 indicate probable absence within the previously surveyed mining limits and that the 2012 survey results indicate probable absence outside the 2.5 mile radius around the primary roost. The negative results allow the applicant to initiate timber removal at any time within the limits of the study area but outside the 2.5 mile radius around the primary roost tree. The survey results shall be valid for a period of 5 years based on the permit renewal cycle for state SMCRA permits (Range-wide Indiana Bat Protection and Enhancement Plan Guidelines). The permit area will need to be re-surveyed if the permit area still contains suitable/potential Indiana bat habitat beyond the 5 year time period. Survey requirements will be based on the amount of suitable/potential Indiana bat habitat remaining on the site at that time. In the event

new information becomes available that would affect the area covered by this survey, further consultation may be necessary.

Buffering Caves and Abandoned Underground Mines

- Caves and abandoned mines may provide winter habitat for the Indiana bat and therefore should be protected within the project area. At this time, there are no known caves or abandoned underground mine openings within the project area.

  In the event that new information becomes available, indicating the presence of caves and/or abandoned underground mine openings within the project area, further consultation with this office should be initiated.

Riparian Buffer Zone Protection

- To minimize direct impacts to Indiana bat foraging and roosting habitat riparian buffer zone protection will be utilized by the applicant within the 2.5 mile buffer area. At this time it is only anticipated that stream flow restoration activities will be necessary within the 2.5 mile buffer. The applicant will develop restoration plans that minimize tree clearing and riparian buffer zones will be maintained, to the greatest extent practicable. Additionally, the applicant will not complete stream restorations if not essential to the project in order to minimize disturbances to Indiana bat foraging habitat. Riparian areas that are not essential to the project will not be disturbed.

  This measure is acceptable as proposed. When developing restoration plans, project plans that avoid impacting streams and wetlands, and leave a minimum 50-foot buffer along the stream edge (total of 100ft from both stream banks) or wetland, can reduce impacts to foraging bats and are encouraged (PEP Guidelines).

Minimization of Disturbed Area

- The applicant will limit the disturbance footprint to the minimum width necessary to conduct stream flow restoration. Additionally, as previously stated, the applicant will not complete stream restoration if not essential to the project in order to minimize disturbances to Indiana bat foraging habitat.

  The Service supports this proposed measure. In addition, per the PEP Guidelines, if forested habitat is avoided, the acreage of habitat avoided should be quantified. On-site avoidance can reduce the number and/or amount of other minimization and short and long-term replacement measures required for the proposed project.

Minimization Measures: Short-term Habitat Measures

Provide Roosting Habitat

- Information included in the PEP indicates that potential summer roosting habitat within the 2.5 mile buffer area is plentiful due to large amounts of dead snags within canopy gaps and blow downs, created by the Southern Illinois derecho that occurred in May of 2009. Because plentiful roosting habitat exists within the PEP area; tree girdling, bat box placement, and the creation of flooded timber, is not proposed in association with this PEP.

  For the reason described above, the measure is acceptable as proposed.

Staged Tree Removal

- Staged tree removal will be conducted in order to minimize the temporal loss of summer habitat associated with this project. Any projects to be disturbed by the project for drainage correction or other purposes will be completed, at most, on a panel by panel basis. Tree removal areas will be limited to the area necessary to correct drainage from past years mining efforts.

  The Service supports this proposed measure, as this will ensure that forest clearing will occur only as needed, to allow for drainage corrections from past years mining efforts.

Flooded Timber

- Due to the large amounts of dead snags within canapy gaps, blow downs, and standing trees created by the Southern Illinois derecho that occurred in May of 2009, the creation of flooded timber is not proposed in association with this PEP.

  For the reason described above, the measure is acceptable as proposed.

Minimization Measures: Long-term Habitat Measures

Watering Areas

- Since the project will be working on existing watering areas for bats, the creation of additional watering areas is not proposed in association with this PEP.

  For the reason described above, this measure is acceptable as proposed.

Reforestation

- The intent of the applicant's reforestation plan is to provide for the long-term habitat needs of the Indiana bats that may be adversely affected by the project. Areas of deforestation due to equipment access for flow restoration activities will be reclaimed and re-vegetated. Reclamation for this project area will be designed using strategies to provide future habitat for the Indiana bat. Since not all Indiana bat habitat is being removed within the proposed project area, trees will be replaced within the disturbed areas only, and where allowable by the land owner.

The PEP Guidelines require reclamation activities must result in the reforestation of at least 70 percent of the total Indiana bat forested habitat that was or will be lost unless off-site mitigation measures are used. This acreage should be based on the pre-mining forested acreage known and/or potential summer habitat. It is unclear how many forested acres will be impacted and likewise how many acres will be reforested. Information in the PEP indicates that the impacted forested area will be reclaimed at a ratio of 1:1 where allowable by the land owner. A 1:1 ratio is insufficient to replace the habitat value of the forested habitat that will be lost given the amount of time required for forest habitat to become established. The Service recommends that the impacted forested area be reclaimed at a minimum ratio of 2:1. Total forest impacts and acreage to be reforested should be addressed in the final revision of the PEP if possible.

Herbaceous Ground Cover

- Any surface permitted areas disturbed as part of this project will be seeded with an herbaceous mixture as required by the current mining permit, consisting of the following; spring oats, ryegrass, sunflower, German millet, sorghum/sudan/sudex, Korean lespedeza, and wheat. Any subsidence mitigation areas disturbed as part of the project may be seeded with the herbaceous mixture indicated above or with a comparable mix of native species.

  Per PEP Guidelines; the use of native species is required when establishing the herbaceous ground cover in area with forest and/or wildlife post mine land uses. The planting of non-native, exotic, and invasive species (such as Korean lespedeza) should be avoided, therefore, the Service recommends the seed mixture above be modified to include a mixture of native warm season grass that will provide greater benefits to grassland birds and small mammals.

Tree Species Selection

- Where reforestation will occur, it will include the planting of a minimum of six different tree species from the list provided in Appendix E of the PEP. Trees will be planted to obtain 250 live woody stems per acre upon completion of reclamation. The reclamation will be carried out in the project area, using a modified list of plant species from the approved tree species list for Indiana bat protection and enhancement plans, as well as the use of native species when possible.

  The Service supports the use of native species and while any of the tree species in the Appendix E list are appropriate for providing future Indiana bat roosting trees, we recommend the tree species planted include primarily hard mast or fruit bearing species so that overall wildlife benefits may be maximized. Additionally, the PEP does not provide details regarding the overall reclamation plan for deforested areas. The information should be expanded to include discussion of the size of trees proposed for planting (e.g., 1 year or 2 year saplings, root-pruned method trees, etc.) and the proposed spacing for plantings. For 1 year saplings, we recommend a minimum of 435 trees per

acre (10' X 10') spacing. Larger size tree plantings would require a larger spacing and fewer trees for planting.

Travel Corridors

- In areas of drainage restoration the applicant will be restoring forested travel corridors in and around local streams. Therefore, the restoration of travel corridors is proposed by this PEP.

  The PEP does not provide details regarding the overall reclamation plan for travel corridors. The Service recommends, per PEP Guidelines, that a minimum travel corridor of four rows of trees should be planted to establish a suitable travel corridor at least 50 feet in width. When restoring forested travel corridors along stream edge, the Service recommends a minimum of 50 feet riparian corridor on each side of the stream bank to reduce impacts to foraging bats.

Restoring Stream Buffer Zones

- The restoration of stream buffer zones is proposed by this PEP. Where drainage restoration will occur the applicant will be restoring a forested riparian buffer zone. It will include the planting of a minimum of six different tree species from the list provided in Appendix E of the PEP. The reclamation will be carried out in the project area, using a modified list of plant species from the approved tree species list for Indiana bat protection and enhancement plans, as well as the use of native species when possible.

  In addition to the above protection and enhancement measures, the Service recommends per PEP Guidelines, that when restoring stream buffer zones during reclamation, areas impacted should be reforested with a minimum 50-foot riparian corridor on each side of the stream to reduce impacts to foraging bats.

Minimization Measures: Off-Site Habitat Mitigation Measures

- Off-site habitat mitigation measures are not proposed in association with this PEP. At this time the applicant does not anticipate that the proposed project would pose any significant threat to the Indiana bat population in and around the area. Based upon the applicant's seasonal tree clearing restrictions, no direct impacts to Indiana bats is likely. Indirect impacts to Indiana bats will be avoided and minimized by the applicant's protection of riparian buffer zones, limiting overall disturbance and removing trees in a staged process. Additionally, the applicant proposes to restore any Indiana bat habitat that is disturbed during project operations with the outlined reforestation plan.

  The PEP Guidelines require reclamation activities must result in the reforestation of at least 70 percent of the total Indiana bat forested habitat that was or will be lost unless off-site mitigation measures are used. This acreage should be based on the pre-mining forested acreage known and/or potential summer habitat. As stated in the Long-term Habitat Measures section above, information in the PEP regarding amount of forested

acres to be impacted is unclear. A 1:1 ratio is insufficient to replace the habitat value of the forested habitat that will be lost, given the amount of time required for forest habitat to become established. The Service recommends that the impacted forested area be reclaimed at a minimum ratio of 2:1. The Service also recommends that all mitigation occur within the PEP project area when possible. If the minimum restoration obligation is unable to be completed, for whatever reason (i.e. unwillingness of landowner), than off-site mitigation would be necessary as described in the PEP Guidelines. Total forest impacts and acreage to be reforested should be addressed in the final revision of the PEP if possible.

Additional Comments

In addition to the above comments, the Service requests per PEP Guidelines, that the PEP Development Checklist included in Appendix B of the PEP Guidelines be completed and included as part of the PEP document.

Thank you for the opportunity to review the PEP. We look forward to working with Alliance Consulting and Williamson Energy as the PEP is implemented to ensure the protection of endangered Indiana bats in the area. Please contact me at (618) 997-3344, ext. 345, should you have any questions.

Sincerely,

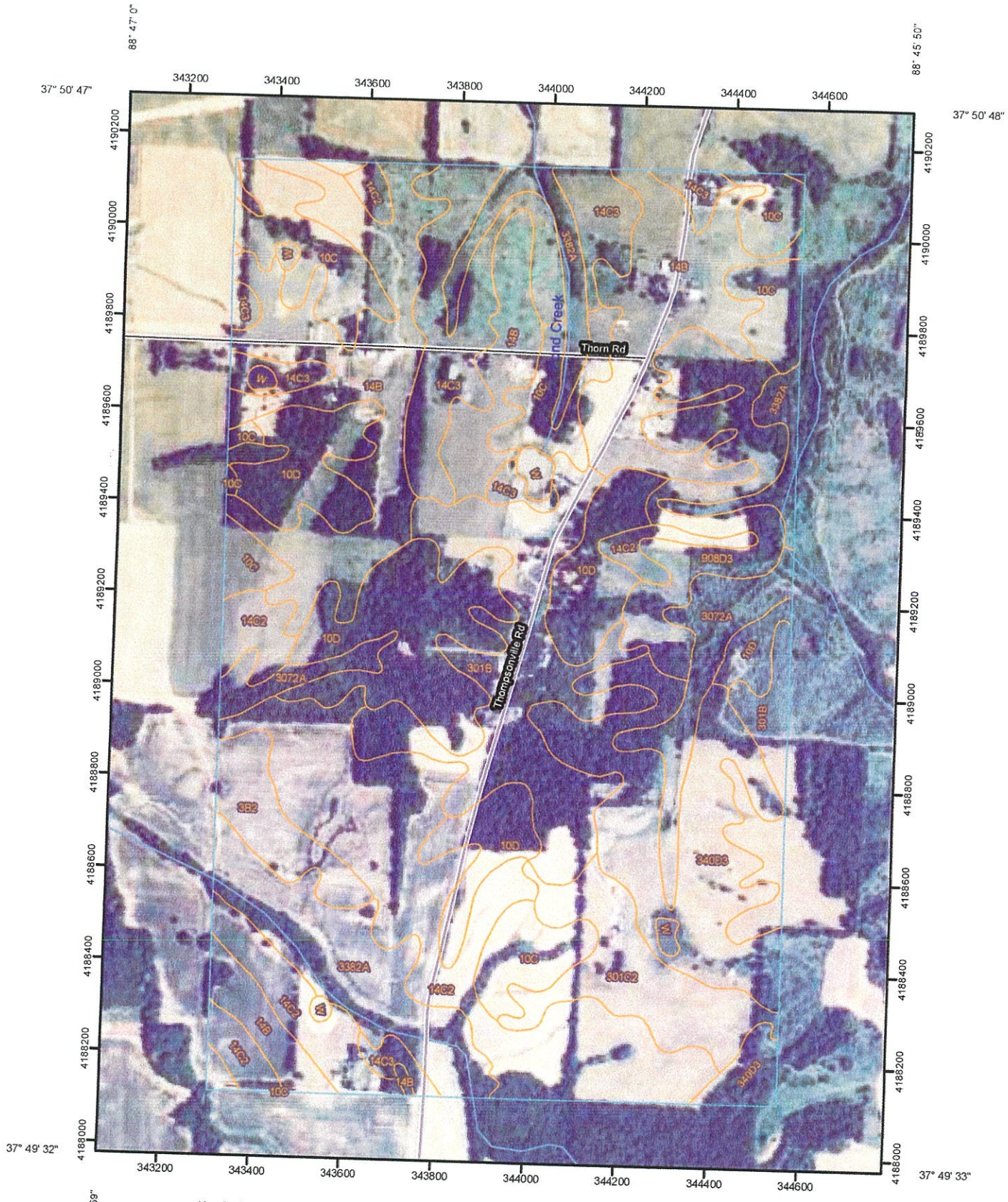
/s/ Matthew T. Mangan

Matthew T. Mangan
Biologist in Charge

cc: IDNR (Malone, Kolar)

APPENDIX

Soil Map—Williamson County, Illinois



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:11,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Date(s) aerial images were photographed: 6/13/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R11341

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3B2	Hoyleton silt loam, 2 to 5 percent slopes, eroded	12.4	2.0%
10C	Plumfield silty clay loam, 5 to 10 percent slopes	53.0	8.5%
10D	Plumfield silty clay loam, 10 to 18 percent slopes	72.8	11.6%
14B	Ava silt loam, 2 to 5 percent slopes	108.6	17.4%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	91.2	14.6%
14C3	Ava silty clay loam, 5 to 10 percent slopes, severely eroded	46.2	7.4%
301B	Grantsburg silt loam, 2 to 5 percent slopes	61.5	9.8%
301C2	Grantsburg silt loam, 5 to 10 percent slopes, eroded	23.7	3.8%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	51.2	8.2%
908D3	Hickory-Kell clay loams, 10 to 18 percent slopes, severely eroded	31.4	5.0%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	20.7	3.3%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	48.1	7.7%
W	Water	4.4	0.7%
Totals for Area of Interest		625.1	100.0%

Williamson County, Illinois (IL199)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
301B	Grantsburg silt loam, 2 to 5 percent slopes	2.12	91.9%
14B	Ava silt loam, 2 to 5 percent slopes	0.19	8.1%
Totals for Area of Interest		2.31	100.0%

Detailed Soil Map Units

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Land capability classification

Determinations of land capability involve consideration of the risks of land damage from erosion and other causes and the difficulties in land use resulting from physical land characteristics and from climate. Land capability, as used in the USA, is an expression of the effect of physical land characteristics and climate on the suitability of soils for crops that require regular tillage, for grazing, for woodland, and for wildlife habitat.

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, forestland, or engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. Capability classes are determined for both irrigated and nonirrigated land. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion. These soils have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation. The significance of each subclass letter is described as follows:

Subclass letter e shows that the main problem is the hazard of erosion unless close-growing plant cover is maintained. The susceptibility to erosion and past erosion damage are the major soil-related factors affecting the soils that are assigned this subclass letter.

Subclass letter w shows that water in or on the soil interferes with plant growth or cultivation. In some soils the wetness can be partly corrected by artificial drainage. Ponding, a high water table, and/or flooding affect the soils that are assigned this subclass letter.

Subclass letter s shows that the soil has limitations within the root zone, such as shallowness of the root zone, a high content of stones, a low available water capacity, low fertility, and excessive salinity or sodicity. Overcoming these limitations is difficult.

Subclass letter c shows that the chief hazard or limitation is climate that is very cold or very dry. This subclass letter is used only in some parts of the United States.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. The use of this category of the land capability classification is a state option. This category of the system is not stored in the soil survey database. For information about capability units, please contact the local NRCS State Soil Scientist. For locations of the offices of the State Soil Scientists, click on the State Contacts link in the upper portion of this window.

Reference:
"National Soil Survey Handbook," Part 622 (00-Exhibit 1), USDA, NRCS

Williamson County, Illinois

301B—Grantsburg silt loam, 2 to 5 percent slopes

Map Unit Setting

Landscape: Uplands
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Grantsburg and similar soils: 90 percent

Description of Grantsburg

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over residuum

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 11 inches: Silt loam
11 to 24 inches: Silt loam
24 to 38 inches: Silty clay loam
38 to 61 inches: Silt loam
61 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

14B—Ava silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava and similar soils: 90 percent

Description of Ava

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 6.3 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Silt loam
8 to 18 inches: Silt loam
18 to 36 inches: Silty clay loam
36 to 53 inches: Silt loam
53 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

COUNTY HIGHWAY PERMIT
INSTALL WATER/POWER/FIBER OPTIC CABLE

WHEREAS, **Williamson Energy**, has requested permission to construct/install and operate a new 12" water line, power line, & fiber optic cable along **Thompsonville Road (FAS 1887)** in Williamson County which is subject to the jurisdiction and authority of said County and its officers.

WHEREAS, the proposed construction consists of installation of a new 12" waterline, power line, & fiber optic conduit to be placed along and/or under the following roadway under jurisdiction of the Williamson County Highway Department: **Thompsonville Road** in Williamson County in Sections 9 & 16, of T8S, R4E of the 3rd Prime Meridian and as depicted on the attached aerial photography. It is anticipated that these utilities will be operated for a period of up to 10 years from the date of this permit. Once these utilizes are no longer being used, it is anticipated that they will be removed from the roadway right of ways within the following year.

THEREFORE, be it permitted and granted by the County Engineer of Williamson County, Illinois, that permission be granted to proceed with said construction and operations, subject to the following conditions:

1. That the petitioner shall furnish all materials, do all work and pay all costs of such work.

2. That one-way traffic be maintained during the period of construction and adequate protection for the safety of the public be provided. This includes all necessary signing, flagmen or other traffic control.

3. That the petitioner or his assigns shall assume all risks and liability for accidents and damages that may occur to persons or property on account of said work and utilities.

4. That this permit is effective insofar only as the County has jurisdiction and does not presume to release the petitioner from compliance with the provisions of any existing statute relative to the work involved.

5. That the said work shall be constructed to the satisfaction of the County Engineer.

6. That the work shall be performed so as not to permanently impair the existing road, and that any damage to the said road that might be done during the time of construction shall be repaired to the satisfaction of the County Engineer.

7. That the water line & power/fiber optic cables shall be a minimum of four (4) feet below the present grade of the road where the fiber optic cable crosses the roadway and four (4) feet

below the existing ground line if located outside of the roadbed but within the R.O.W. The said water/power/fiber optic cables shall be placed near the back of the right of way to the greatest extent possible, in the back slope of the ditch.

8. That the water line & power/fiber optic cables shall be relocated at no expense to the County if such a move is needed for future maintenance or construction work on the subject road.

9. Open cutting of the road surface will not be allowed as part of this permit. Any crossings under Thompsonville Road must be made utilizing directional bore and the utilities must be encased in steel conduit.

10. That this permit shall be subject to and covered under that certain Performance Bond provide to the County in the amount of **$150,000** under that certain agreement by and between the County and **Williamson Energy** dated the 22nd day of January 2008.

11. All trenching or open cuts made within county right of way must be repaired/restored to its prior condition or better. This includes but is not limited to restoring damage to any drainage ways, entrances, roads, signs, shoulders, slopes, culverts, silting, as well as seeding and mulching these disturbed areas to restore proper ground cover.

12. Care must be taken to prevent damage to drainage structures/pipes resulting from trenching or direct boring operations. Open cuts must be a narrow as possible (no greater than 2') to limit damages to surrounding features.

13. Any future damages to Thompsonville Road within that 10 year window resulting from the operation of these utilities on the right of ways will be the responsibility of Williamson Energy to repair to restore the roadway to its previous condition.

PERMIT REQUESTED BY: Anthony Will

Authorized Person for
Williamson Energy, LLC

IN WITNESS WHEREOF, I have hereunto set my hand and seal by the authority given to me as the County Engineer of Williamson County, Illinois, this 27th day of June, 2013.

Gregory S. Smothers
County Engineer
Williamson County Highway Dept.

U.S. Fish and Wildlife Service

National Wetlands Inventory



Jun 24, 2013

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Permit 375 Incidental Boundary Revision

R11350

EcoCAT
Ecological Compliance Assessment Tool

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Applicant: James Miller
Contact: James Miller
Address: 16824 Liberty School Road
Marion, IL 62959

IDNR Project Number: 1315405
Date: 06/24/2013

Project: Underground Pipeline and Power Line Installation
Address: Thompsonville Road, Thompsonville

Description: The site is the proposed location for an underground pump discharge pipeline and electrical powerline.

Natural Resource Review Results

This project was submitted for information only. It is not a consultation under Part 1075.

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

Rice Rat *(Oryzomys palustris)*

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Williamson

Township, Range, Section:
8S, 4E, 9
8S, 4E, 16



IL Department of Natural Resources Contact
Impact Assessment Section
217-785-5500
Division of Ecosystems & Environment

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

DOCUMENT

63

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

Subject: Williamson Energy, LLC – Pond Creek Mine

Data: Log No. 5168-13

Reviewed by: D. Maschhoff **Date:** 2/18/15

Log No. 5168-13 ⇒ IBR No. 52 to OMM Permit No. 375

Log No. 5168-13

- IBR consisting of 4.18 acres located in Section 15, Township 8 South, Range 4 East, Williamson County.
- The IBR proposes construction of an underground mine support facility including a borehole and installation of an electric vertical turbine pump. It also includes the installation of a buried pipeline and electric powerline and construction of a concrete pad.
- The turbine pump will be used for mine dewatering.
- A sediment pond exemption is requested for this permit area. Silt fence and/or straw bales will be placed for drainage control.
- Topsoil piles will be seeded and mulched to reduce runoff and promote growth.

* Action: Reference IEPA Log No. 5168-13 in renewed and modified NPDES permit for additional 4.18 acres for the installation of a borehole for a vertical pump and buried waterline.

5168 · / 13
Due date: 5/3/13
R11855

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

May 9, 2013

James Miller
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

RECEIVED
MAY 15 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Re: Permit No. 375
Incidental Boundary Revision No. 52

Dear Mr. Miller:

The appropriate Department technical staff has reviewed the proposed incidental boundary revision dated March 22, 2013, and the supplemental information dated April 8, 2013, and April 24, 2013, submitted by Williamson Energy for Pond Creek Mine. The request would add 4.18 acres to conduct underground mining operations. The additional acres would be used for a borehole and installation of an electric vertical turbine pump facility.

The Department finds the permittee has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

1761.11(e) The proposed permit area is within three hundred (300) feet of an occupied dwelling. The owner of the dwelling has provided a written waiver pursuant to 62 Ill. Adm. Code 1761.15 consenting to surface coal mining operations closer than 300 feet.

1773.15(c)(12) The effect of the proposed permitting action on properties listed on or eligible for listing on the National Register of Historic Places has been taken into account by the Department.

The fee for the area will be $104.50. The fee is comprised of Non-surface Fee Amount for non-surface mining area ($5/acres x 4.18-acres x 5 years the bond is in force).

The bond for the area will be $28,264.00. Copies of bond form SCML-2 have been enclosed for your use. For additional bonding and other forms, please contact this office or download a copy from the web at: www.dnr.state.il.us/mines/lrd/forms.htm. Please note many forms have been modified. **Only** the most current versions will be accepted.

Upon receipt by the Department of the fee and bond, mining activities on these 4.18 acres may commence, following Department approval.

5168-/13
Due date: 5-31-13
R11356



Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

4.18 ACRES
INCIDENTAL BOUNDARY REVISION
FOR PERMIT NO. 375

WILLIAMSON COUNTY, IL
POND CREEK MINE NO. 1

MARCH 22, 2013

R11357

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

March 22, 2013

Mr. Larry Crislip
Illinois Environmental Protection Agency
Mine Pollution Control Program
2309 West Main
Marion, IL 62959

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Vertical Turbine Pump Site

Mr. Crislip:

Please find enclosed (2) copies of a 4.18 acre IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed location for a borehole and installation of an electric dewatering vertical turbine pump facility. Please refer to the enclosed material for details of the IBR.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 154 or (618) 889-8905.

Respectfully submitted,

James Miller

James Miller, PE
Authorized Representative
Williamson Energy, LLC

RECEIVED
APR 26 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

March 22, 2013

Mr. Scott Fowler, Supervisor
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Vertical Turbine Pump Site

Dear Mr. Fowler:

This letter authorizes Mr. James Miller permission to perform work on, receive comments and submit corrections on the above referenced application. Please send copies of any comments to Williamson Energy, LLC at the above address.

Thank you for your cooperation.

Sincerely,

Anthony Webb
Authorized Representative

RECEIVED
APR 26 2013
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

March 22, 2013

Mr. Scott Fowler, Supervisor
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Pond Creek No. 1 Mine, Permit #375
Incidental Boundary Revision
Vertical Turbine Pump Site

Dear Mr. Fowler:

Please find enclosed an original and one copy of a 4.18 acre IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed location for a borehole and installation of an electric dewatering vertical turbine pump facility.

Please be advised that one copy of this IBR application has also been sent to Mr. Brad Murphy in the Benton office.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 154 or (618) 889-8905.

Sincerely,

James Miller

James Miller, P.E.
Authorized Representative
Williamson Energy, LLC

Cc: ILDNR/OMM Benton attn. B. Murphy (1) +.pdf
ILEPA Marion, attn. L. Crislip (2) +.pdf

Permit ID 375 IBR
Rev Date 3/22/13

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
One Natural Resources Way
Springfield, Illinois 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS PERMIT INCIDENTAL BOUNDARY REVISION IBR-1

PART I

(Application to be submitted 120 days (180 day for NPDES) prior to the desired effective date of the permit)

DATE: March 22, 2013

NOTICE

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill Rev Stat 1989, Ch. 961/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(I) (We) (The) Williamson Energy, LLC
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 99 Johnston City, IL 62951 (Address) [618] 983-3020 (Telephone Number)

hereby submits application for an Incidental Boundary Revision to Permit No. #375

Name of Mine: Pond Creek No. 1 Mine

MSHA ID No. 11-03141

I, Anthony Webb
(vice president or his duly authorized representative)

under penalty of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Signature Anthony Webb
Title: Authorized Agent

EXISTING PERMIT ACREAGE 645.39 ADDITIONAL ACRES REQUESTED 4.18

Permit ID 375 IBR
Rev Date 3/22/13

B) **Indicate the type of disturbance and associated acreage.**

Type of Disturbance	Acreage		
	Existing Permit	IBR	Total
Area Stripping	20.13		20.13
Mine Waste Areas	277.39		277.39
Processing Areas & Support Facilities	148.10	4.18	152.28
Access, Haul Roads & Transport Facilities	23.57		23.57
Soil Storage Areas	75.70		75.70
Diversions	32.85		32.85
Coal Recovery (Gob & Slurry)	0.00		0.00
Other	30.46		30.46
Not to be Disturbed	37.19		37.19
Total	645.39	4.18	649.57

2) A) **Provide the name and address of every legal or equitable owner of record of the proposed IBR area.**

RESPONSE: See Attachment I.2.A

B) **Provide the name and address of the owner of record of all surface and subsurface areas contiguous to any part of the proposed IBR area.**

RESPONSE: See Attachment I.2.A.

C) **Show the location of owners of record of those lands, both surface and subsurface, included in or contiguous to the proposed IBR area on the pre-mining land use map or another map, if necessary.**

RESPONSE: See Map 1, Identification of Interests

3) **Provide name and address of any holder of record of leasehold interest for the proposed IBR area.**

RESPONSE: Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

4) **Affidavits, Certifications**

A) **Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.**

RESPONSE: See Attachment I.2.A and I.4.A.

B) **Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit**

Permit ID 375 IBR
Rev Date 3/22/13

requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: See Attachment I.4.B.

5) Areas Designated Unsuitable for Mining

A) Does proposed IBR area include:

1) Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?

Yes [ ] No [X]

2) National forest land?

Yes [ ] No [X]

3) Any land which will adversely affect any publicly owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per 62 Ill. Adm. Code 1761.11(a)(3) or Section 10, (B)(c) of the SCM-1?

Yes [ ] No [X]

If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1 Application.

4) Any public roads, which are to be removed, relocated or temporarily closed?

Yes [ ] No [X]

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

RESPONSE: Not Applicable.

B) Will the proposed IBR area be located:

1) Within 100 feet of the right-of-way line of any public road?

Yes [ ] No [X]

If yes, explain proposed procedure for complying with regulation Section 1761.12 (c), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

Permit ID 375 IBR
Rev Date 3/22/13

RESPONSE: Not Applicable.

2) **Within 300 feet measured horizontally from any occupied dwelling?**

Yes [X] No [ ]

If yes, is waiver provided meeting requirements of Section 1761.15(b)?

RESPONSE: In accordance with the exception allowed in Section 1761.11(e)(1) and the procedure described in 1761.15(b), written waivers consenting to surface coal mining operations within 300 feet of an occupied dwelling are included. See Attachment I.5.B.

3) **Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?**

Yes [ ] No [X]

4) **Within 100 feet measured horizontally of a cemetery?**

Yes [ ] No [X]

C) **Are valid existing rights (per 1761.11) claimed for any part of the IBR area?**

Yes [ ] No [X]

If yes, provide documentation to substantiate claim.

RESPONSE: Not Applicable.

D) **Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.**

RESPONSE: Please refer to Attachment I.5.D for the draft copy of the newspaper notice. The notice will be published in The Daily American newspaper.

Permit ID 375 IBR
Rev Date 3/22/13

PART II

PREMINING INFORMATION

Pre-mining information is to be displayed on pre-mining land use map unless otherwise indicated.

1) **Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different than the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.**

RESPONSE: The IBR boundary will be delineated by using PVC and/or metal posts and will be located within eye sight of one another. All corners will be installed using Global Positioning System (GPS) referenced to the North American Datum of 1927 (NAD27) and Illinois State Plane Coordinate System (ISPCS) East Zone. A reference point to the IBR will be a National Geodetic Survey (NGS) monument located on Map 2, Pre-Mining Land Use Map, and west of the IBR area near Shooting Club Lane.

NGS Horizontal Control Mark (HB1630)
Northing: 422,464.60
Easting: 376,078.24
Elevation: 600.32

NGS Reference Mark (HB1630 No. 4)
Northing: 422,462.34
Easting: 376,034.89
Elevation: 599.89

2) **Explain and locate areas where the IBR is contiguous to an existing permit.**

RESPONSE: The proposed IBR is contiguous to the current permitted boundary and to the pending 13.2 acre IBR submitted February 1, 2013 and it overlies the Shadow Area of UG Mining Permit #375. See Map 1, Identification of Interests for a delineation of the IBR boundary and the relationship of IBR boundary to the existing permit boundary.

3) **Give the acreage of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on pre-mining land use map existing land uses in the proposed permit area and adjacent to it. Include on the pre-mining land use map the location of all buildings and identify the current use of these buildings.**

Pre-Mine Land Use	Acreage		
	Existing Permit	IBR	Total
Cropland	521.41	0.00	521.41
Pasture Land	0.00	2.61	2.61
Grazing land	0.00	0.00	0.00
Forestry	101.86	0.00	101.86
Residential	4.32	0.00	4.32
Industrial/Commercial	0.00	0.00	0.00
Recreation	0.00	0.00	0.00
Fish & Wildlife Habitat	16.36	1.57	17.93
Developed Water Resources	1.44	0.00	1.44
Undeveloped Land	0.00	0.00	0.00
Total	645.39	4.18	649.57

RESPONSE: See Pre-Mining Land Use Map.

Permit ID 375 IBR
Rev Date 3/22/13

4) **Soils Information**

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes [X] No [ ]

If no, explain:

B) Delineate on the soils map(s) the area, which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

RESPONSE: No removal of overburden or deposition of overburden for the extraction of coal will occur on the IBR area. Proposed site disturbance is minimal and will include only topsoil removal and a temporary drill hole cuttings pit. Topsoil material will be stored on site.

C) Are any of the identified map units correlated as prime farmland by NRCS criteria?

Yes [ ] No [X]

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: Not Applicable.

D) Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.

RESPONSE: See Attachment II.4.

E) Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.

RESPONSE: See Attachment II.4.

F) Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?

Yes [ ] No [X]

If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 3/22/13

PART III

OPERATIONS PLAN

1) Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.

RESPONSE: The proposed IBR is intended for construction of an underground mine support facility including an 18" diameter, 460' deep steel-lined drill hole and installation of an electric vertical turbine pump. The 250-hp, 480V turbine pump will be used for mine dewatering and will include surface installation of a transformer, motor, and pump starter along with underground installation of a pump discharge pipeline and probable buried power line. The pump, pump starter, and transformer will all be installed on concrete pads, each approximately 8' x 8' x 6" thick.

A temporary pit will be excavated in close proximity to the turbine pump borehole location. The pit will have approximate dimensions of 12' x 12' x 10' (depth) to provide sufficient storage volume for drill hole cuttings. When drilling is completed, the pit will be backfilled with excavated material and covered with rock.

Areas being rocked, including the access lane and material "lay down" areas will mainly consist of removing the existing topsoil (minimum six inches) and having fabric laid down followed by six inches of 3-6" rock capped with CA6 gravel. The area to be rocked, as shown on the attached Mining Operations Map, is approximately 0.6 acres. The remaining permitted area will contain soil stockpiles. Soil stockpiles will be seeded with a cover crop to minimize exposure to excessive water and wind erosion. Mulch, chemical binders or other stabilization techniques may be used, as required for stockpile protection. Signs will be posted to identify topsoil piles. Please see the attached Mining Operations Map for site layout.

2) Surface Drainage Control

A) 1) Locate on the mining operations map or on a separate drainage map all proposed drainage control systems and show drainage patterns of all affected mining areas.

RESPONSE: Disturbed area drainage will be controlled with proven alternate methods of drainage control which may include installation of silt fencing, straw bale containment check dams, earthen berms and/or mulched filter strips. Following completion of the access driveway and borehole installation, long term surface drainage will be controlled by well-established vegetative cover.

2) Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?

Yes [ ] No [X]

If yes, delineate how and where surface drainage will be collected and treated, and list the permit numbers and type of permit that the drainage control systems are operated under. If the above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: See Part III.2.A.1.

B) Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?

Yes [ ] No [X]

If no, please discuss.

Permit ID 375 IBR
Rev Date 3/22/13

RESPONSE: See Part III.2.A.1.

C) **Overland Flow Diversions and Sediment Ponds. Are either overland flow diversions or sediment ponds to be constructed?**

Yes [ ] No [X]

If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (Surface Drainage Control).

D) **Does a perennial or intermittent stream occur within the proposed IBR area?**

Yes [ ] No [X]

If yes, is an exception to the 100' buffer zone being requested or is a stream diversion being proposed. For an exception to the 100' buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

RESPONSE: Not Applicable.

3) **Roads and other activities**

A) **Are roads to be constructed in the IBR area?**

Yes [X] No [ ]

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: A one hundred twenty foot long gravel lane will be constructed to provide site access from existing permitted area and will be incorporated into the site as the beginning of the gravel pad. A centerline profile and a typical cross-section of the access lane is shown on the Pre-Mining Land Use Map.

B) **If the operations involve other activities not specifically addressed above, complete applicable parts of the SCM-1 or UCM-1.**

RESPONSE: No other activities are proposed.

4) **Are any existing structures proposed for utilization in the IBR?**

Yes [ ] No [X]

If yes, complete Part IV.4 of the SCM-1.

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 3/22/13

PART IV

RECLAMATION PLAN

1) **Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.**

RESPONSE: When drilling is completed, the temporary drill hole cuttings pit will be permanently backfilled with excavated material and covered with rock. The area overlying the pit will be maintained for industrial use until the time of reclamation. When the mine dewatering turbine pump and ancillary facilities are no longer required at the site, they will be relocated. The steel drill hole lining will be removed a minimum distance of four feet below the ground and the drill hole will be filled with incombustible material and capped with concrete. All gravel will also be removed and topsoil will be replaced. Buried pump discharge pipelines and power lines may be removed or abandoned depending on replacement value and/or landowner request. The original #375 permit provides more detail regarding soil conservation and reclamation practices. The original permit will be followed with regard to soil handling and replacement. Pre-mine topography and land use will remain as is currently present at the site.

2) **Post Mining Land Use**

A) **Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the post-mining land uses on the Post Mining Land Use Map. Acreage figures for post-mining land use must differentiate between mined and surface disturbance areas based on the mining line used in the pre-mining section of the application.**

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCrop	Prime	HCap	NonCrop	Prime	HCap	NonCrop
Cropland	4.18	1.52	2.46				4.18	1.52	2.46
Pasture Land					0.77	1.84		0.77	1.84
Grazing Land									
Forestry			13.36						13.36
Residential			0.11						0.11
Industrial/Commercial									
Recreation									
Fish & Wildlife Habitat (Herbacious)		0.45	36.22		0.69	0.88		1.14	37.10
Fish & Wildlife Habitat (Woody)		0.84	566.99					0.84	566.99
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.26						19.26
Undeveloped Land									
Total	4.18	2.81	638.40		1.46	2.72	4.18	4.27	641.12

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

Permit ID 375 IBR
Rev Date 3/22/13

3) **Pursuant to Section 1784.21 the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.**

RESPONSE: Effectively, all of the proposed IBR area is located within a 2.5-mile buffer radius of the primary roost trees of at least two male Indiana bats as observed during mist net surveys conducted by Alliance Consulting, Inc. during the period from May 15 - July 31, 2012. A Protection and Enhancement Plan (PEP) was developed for Williamson Energy, LLC dated December 2012 detailing specific avoidance and minimization measures specific to the species. Based on the latest U.S. Fish and Wildlife (FWS) Correspondence dated January 30, 2013 (copy included as Attachment IV.3), project-related seasonal tree removal has been accepted yearly between October 15th–March 31st within the PEP buffer boundary. The proposed turbine pump location and construction corridor for the buried powerline and pump discharge line is selectively projected within areas previously cleared privately by the Lessor. Any new tree removal will be subject to PEP seasonal restrictions and reforestation guidelines. Refer to the Pre Mining Land Use Map 3 for an orthophotographic map of the site with the IBR boundary delineated.

Permit ID	375 IBR
Rev Date	3/22/13

Attachment List

Attachment I.2.A	Property Ownership Information
Attachment I.4.A	Real Estate Affidavit
Attachment I.4.B	Engineering Certification
Attachment I.5.B	Consent Waivers for Surface Coal Mining Operations
Attachment I.5.D	Newspaper Public Notice
Attachment II.4	Soils Information Chart
Attachment IV.3	Protection and Enhancement Plan/U.S. Fish and Wildlife Service Correspondance

Permit ID 375 IBR

Rev Date 3/22/13

PROPERTY INDEX NO.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	PROPERTY LOCATION Adjacent	APPLICANT CONTROL Ownership Percentage	APPLICANT CONTROL ROE Type	APPLICANT CONTROL Comments
04-15-100-001	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774	X		100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-15-100-005	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774	X		100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-15-300-001	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774	X		100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-10-300-004	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774		X	100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-10-300-006	Billy & Anita Malone 16169 Malone Rd. Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 4/20/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 486, Page 412.
04-15-100-008	New River Royalty, LLC 208 Public Square 4th Floor Benton, IL 62812		X	100%	Warranty Deed Dated: 11/10/2005 Merger Dated: 6/6/2011	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 471, Page 879.
04-15-100-009	New River Royalty, LLC 208 Public Square 4th Floor Benton, IL 62812		X	100%	Warranty Deed Dated: 6/21/2012	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 490, Page 788.
04-15-100-011	Billy & Anita Malone 16169 Malone Rd. Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 4/20/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 486, Page 412.
04-15-100-013	Billy & Anita Malone 16169 Malone Rd. Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 03/1991	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 421, Page 907.
04-15-300-003	William Grant 1305 N. Jefferson Johnston City, IL 62951		X	100%	Warranty Deed Dated: 10/8/1969	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 360, Page 392.
04-15-300-017	New River Royalty, LLC 208 Public Square 4th Floor Benton, IL 62812		X	100%	Warranty Deed Dated: 11/10/2005 Merger Dated: 6/6/2011	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 330, Page 922.
04-16-200-002	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774		X	100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-16-200-003	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774		X	100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.
04-16-400-002	Randy & Rebecca Wright 917 13th Street St. Cloud, Florida 34774		X	100%	Warranty Deed Dated: 2/13/2009	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 481, Page 950.

Permit ID 375 IBR

Rev Date 3/22/13

PARCEL NOS.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	Adjacent	APPLICANT CONTROL Ownership Percentage	ROE Type	Comments
04-15-700-001	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410	X		100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-15-700-006	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410	X		100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-09-700-007	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-10-700-004	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-10-700-005	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-15-700-003	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorded in Deed Record 470, Page 688.
04-15-700-007	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated: 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 470, Page 688.
04-16-700-005	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 470, Page 688.
04-16-700-007	Colt, LLC 3801 PGA Blvd., Suite 903 Palm Beach Gardens, FL 33410		X	100%	Special Warranty Deed Dated 7/22/2005	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 470, Page 688.

Permit ID	375 IBR
Rev Date	3/22/13

REAL ESTATE AFFIDAVIT
LEGAL RIGHT TO ENTER & CONDUCT MINING SUPPORT OPERATIONS

I, Anthony Webb
(Individual or Individuals)
under penalty of perjury declare on behalf of the applicant, Williamson Energy, LLC, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area, and that such legal right is not in any way the subject of pending court litigation.

Dated this 22nd day of March 2013.

Signed: Authay Webb President Authorized Agent
Signature/Title

State of Illinois

County of Williamson

Signed and subscribed to before me on 3/22/13 by Anthony Webb
(date) (name of person)

Gwen Finnegan
(Signature of Notary Public)

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

Permit ID 375 IBR
Rev Date 3/22/13

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" in the box below if that item is relevant.

	Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mine use of the site.
	Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.
X	Certification of Illinois Environmental Protection Agency - 35 Ill. Adm. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

James M. Miller, Chief Engineer
Name

062-059719
Illinois Registration Number (seal)

Mach Mining, LLC
Firm

(618) 983-3020
Phone Number

P. O. Box 99
Address

Johnston City, Illinois 62951

James Miller
Signature

3/22/13
Date

SEAL



Permit ID	375 IBR
Rev Date	3/22/13

Consent Waiver for Surface Coal Mining Operations Near Occupied Dwelling

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 28th day of November, 2012, from Billy G. Malone and Michelle Malone, h/w, with an address of 16277 Malone Road, Thompsonville, Illinois 62890, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The East One-half (E ½) of the Northeast One-Fourth (NE ¼) of the Northwest Quarter (NW ¼) of Section Fifteen (15), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, EXCEPT THE FOLLOWING DESCRIBED TRACT, TO-WIT: A part of the Northeast Fourth of the Northwest Quarter of Section 15, Township 8 South, Range 4 East of the Third Principal Meridian, described as beginning at the southeast corner of the above described 40 acre tract and run thence West 40 rods; thence run North 20 rods; thence run East to the West Right-of-Way line of the public Road; thence run Southwest along and with the West Right-of-Way line of said Public Road to the point of beginning, in said exception, all of said land being situated in Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, situated in Williamson County, Illinois.

Tax Parcel Number: 04-15-100-003

Also;

The Northwest Six acres of the Northwest One Fourth (1/4) of the Northeast Quarter (¼) excepting one acre in the Northwest corner of the above description, in Section Fifteen (15), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, Williamson County, Illinois.

Tax Parcel Number: 04-15-200-002

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable

consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

Billy G. Malone

Michelle Malone

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Billy G. Malone and Michelle Malone, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 28th day of November, 2012.

Gwen Finnegan
Notary Public

My Commission Expires:

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 21th day of NOVEMBER, 2012, from Bill Malone and Anita Malone, h/w, with an address of 16169 Malone Road, Thompsonville, Illinois 62890, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The West One-half (W ½) of the Northeast Fourth (NE ¼) of the Northwest Quarter (NW 1/4) of Section Fifteen (15), Township eight (8) South, Range Four (4) East of the Third Principal Meridian, EXCEPT Five (5) acres off and across the south side of the West One-half (W ½) of Northeast One-fourth (NE ¼) of the Northwest Quarter (NW ¼) of Section Fifteen (15), Township Eight (8) South, Range Four (4) East of the Third Principle Meridian, EXCEPT all the coal, oil, gas, and other minerals underlying said land with the right to mine and remove the same and subject to all other right and easements in favor of the owner of the mineral estate or of any party claiming by, through or under said estate situated in the County of Williamson and State of Illinois.

Tax Parcel Number: 04-15-100-001

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

Bill Malone
Bill Malone

Anita Malone
Anita Malone

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Bill Malone and Anita Malone, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 27th day of November, 2012.

Gwen Finnegan
Notary Public

My Commission Expires:
9-6-15

GWEN FINNEGAN
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
September 06, 2015

Permit ID 375 IBR
Rev Date 3/22/13

Public Notice

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy, LLC, P. O. Box 99, Johnston City, IL 62951 hereby gives notice that on March 22, 2013, an incidental boundary revision has been submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division, One Natural Resources Way, Springfield, IL 62707-1271. The IBR application is for 4.18 acres located in the E½ of the NW¼ of the NW¼ and the E½ of the SW¼ of the NW¼ and the NE¼ of the NW¼ of the SW¼ of Section 15, T8S, R4E, Williamson County.

The IBR proposes construction of an underground mine support facility including a steel-lined drill hole and installation of an electric vertical turbine pump. Mining operations associated with the turbine pump include installation of a buried pipeline and electric powerline and construction of a concrete pad.

Copies of the application are on file for public viewing at Illinois Department of Natural Resources, Office of Mines and Minerals, 503 East Main Street, Benton, Illinois 62812, and at the Springfield office. Written comments concerning the operations should be submitted to the Illinois Department of Natural Resources Springfield office no later than seven [7] days from the publication date of this notice.

Permit ID	375 IBR
Rev Date	3/22/13

Soil Identification				Mining Area							Support Area						
				Prime Soils		NonPrime Soils					Prime Soils		NonPrime Soils				
Soil Map Symbol	Soil Name	Slope Class [%]	Capability Class	Prime Farmland [acres]	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]	Prime Farmland [acres]	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]
301B	Grantsburg silt loam	2-5	2e									0.77					0.77
301C2	Grantsburg silt loam	5-10	3e										0.45				0.45
340D3	Zanesville silty clay loam	10-18	6e											2.72			2.72
3072A	Sharon silt loam	0-2	2w									0.24					0.24
			Total									1.01	0.45	2.72			4.18

Note : Soil information was determined from the Soil Survey of Williamson County, Illinois, 1978, prepared by the United States Department of Agriculture, Soil Conservation Service in cooperation with the Illinois Agricultural Experiment Station.

R11385

Williamson County, Illinois (IL199)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
301B	Grantsburg silt loam, 2 to 5 percent slopes	0.77	18.3%
301C2	Grantsburg silt loam, 5 to 10 percent slopes, eroded	0.45	10.7%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	2.72	65.1%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	0.24	5.9%
Totals for Area of Interest		4.18	100.0%

Detailed Soil Map Units

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided

into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Land capability classification

Determinations of land capability involve consideration of the risks of land damage from erosion and other causes and the difficulties in land use resulting from physical land characteristics and from climate. Land capability, as used in the USA, is an expression of the effect of physical land characteristics and climate on the suitability of soils for crops that require regular tillage, for grazing, for woodland, and for wildlife habitat.

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, forestland, or engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. Capability classes are determined for both irrigated and nonirrigated land. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion. These soils have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation. The significance of each subclass letter is described as follows:

Subclass letter e shows that the main problem is the hazard of erosion unless close-growing plant cover is maintained. The susceptibility to erosion and past erosion damage are the major soil-related factors affecting the soils that are assigned this subclass letter.

Subclass letter w shows that water in or on the soil interferes with plant growth or cultivation. In some soils the wetness can be partly corrected by artificial drainage. Ponding, a high water table, and/or flooding affect the soils that are assigned this subclass letter.

Subclass letter s shows that the soil has limitations within the root zone, such as shallowness of the root zone, a high content of stones, a low available water capacity, low fertility, and excessive salinity or sodicity. Overcoming these limitations is difficult.

Subclass letter c shows that the chief hazard or limitation is climate that is very cold or very dry. This subclass letter is used only in some parts of the United States.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. The use of this category of the land capability classification is a state option. This category of the system is not stored in the soil survey database. For information about capability units, please contact the local NRCS State Soil Scientist. For locations of the offices of the State Soil Scientists, click on the State Contacts link in the upper portion of this window.

Reference:
"National Soil Survey Handbook," Part 622 (00-Exhibit 1), USDA, NRCS

Williamson County, Illinois

301B—Grantsburg silt loam, 2 to 5 percent slopes

Map Unit Setting

Landscape: Uplands
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Grantsburg and similar soils: 90 percent

Description of Grantsburg

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over residuum

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 11 inches: Silt loam
11 to 24 inches: Silt loam
24 to 38 inches: Silty clay loam
38 to 61 inches: Silt loam
61 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

301C2—Grantsburg silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

Landscape: Uplands
Elevation: 340 to 1,020 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Grantsburg, eroded, and similar soils: 90 percent

Description of Grantsburg, Eroded

Setting

Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over residuum

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Silt loam
7 to 21 inches: Silt loam
21 to 35 inches: Silty clay loam
35 to 58 inches: Silt loam

58 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

340D3—Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded

Map Unit Setting

Landscape: Uplands
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Zanesville, severely eroded, and similar soils: 90 percent

Description of Zanesville, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over residuum

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 19 to 32 inches to fragipan; 40 to 80 inches to paralithic bedrock; 40 to 80 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: D

Typical profile

0 to 2 inches: Silty clay loam
2 to 19 inches: Silty clay loam
19 to 37 inches: Silt loam
37 to 55 inches: Channery silt loam

55 to 65 inches: Bedrock

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

3072A—Sharon silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Landscape: Alluvial plains
Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Sharon, frequently flooded, and similar soils: 90 percent

Description of Sharon, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Very high (about 12.4 inches)

Interpretive groups

Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season
Land capability (nonirrigated): 2w
Hydrologic Soil Group: B

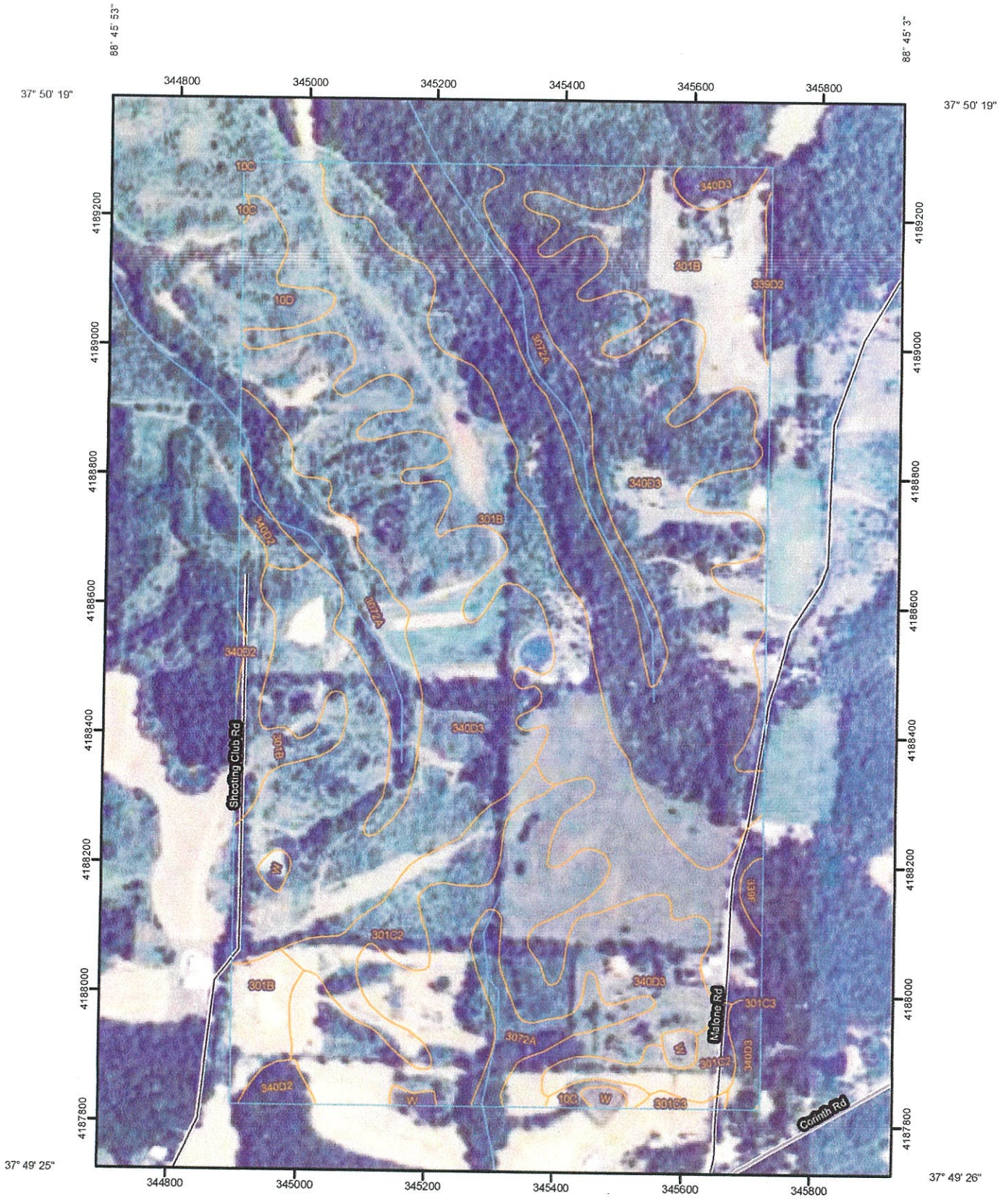
Typical profile

0 to 13 inches: Silt loam
13 to 40 inches: Silt loam
40 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Soil Map—Williamson County, Illinois



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1 7,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Date(s) aerial images were photographed: 6/13/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R11396

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
10C	Plumfield silty clay loam, 5 to 10 percent slopes	1.0	0.3%
10D	Plumfield silty clay loam, 10 to 18 percent slopes	4.0	1.3%
301B	Grantsburg silt loam, 2 to 5 percent slopes	78.4	26.4%
301C2	Grantsburg silt loam, 5 to 10 percent slopes, eroded	13.6	4.6%
301C3	Grantsburg silt loam, 5 to 10 percent slopes, severely eroded	0.6	0.2%
339D2	Wellston silt loam, 10 to 18 percent slopes, eroded	0.6	0.2%
339F	Wellston silt loam, 18 to 35 percent slopes	0.7	0.3%
340D2	Zanesville silt loam, 10 to 18 percent slopes, eroded	3.3	1.1%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	164.7	55.5%
3072A	Sharon silt loam, 0 to 2 percent slopes, frequently flooded	28.0	9.4%
W	Water	2.1	0.7%
Totals for Area of Interest		**297.0**	**100.0%**

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Marion Illinois Sub-Office (ES)
8588 Route 148
Marion, Illinois 62959
(618) 997-3344

January 30, 2013

Braden A. Hoffman
Senior Project Manager
Alliance Consulting, Inc.
124 Philpott Lane
Beaver, West Virginia 25813-9502

Dear Mr. Hoffman:

Thank you for the transmittal letter dated December 13, 2012, requesting review of the Indiana Bat (*Myotis Sodalis*) Protection and Enhancement Plan (PEP) prepared for Williamson Energy, LLC, Pond Creek Mine No.1 Expansion Area located in Williamson County, Illinois. The PEP was developed in accordance with the 2009 Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (PEP Guidelines). These comments are provided under the authority of and in accordance with the provisions of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

The proposed project consists of a 5,364.5 acre expansion to the existing Pond Creek Mine (Permit No.375) and includes a deep mine subsidence area that may need to have drainage correction activities completed in order to correct the ponding effect caused by subsidence as well as future incidental boundary revisions (IBRs) for surface installations required in support of ongoing underground mining operations. According to the PEP, tree clearing will be necessary in order to complete the proposed drainage corrections activities, but only a small portion of the forest habitat within the shadow area will need to be cleared.

From May 15 through July 31, 2012, Alliance Consulting, Inc. conducted mist-net surveys and telemetry in the project area in order to determine: 1) if Indiana bats occur in the project area; 2) document the location of Indiana bat roost trees; and, 3) estimate the size of the colony. A total of 2 male Indiana bats were captured and fitted with radio transmitters for tracking purposes and 3 roost trees (1 presumed main roost tree and 2 satellite roost trees) were located. Based on exit count surveys, the main colony was estimated at 34 adult Indiana bats.

Since females or juveniles were not captured and/or tracked to any of the roost trees, Alliance Consulting, Inc. is currently addressing the roost trees as a bachelor colony of males. Thus, the PEP is based upon a 2.5 mile buffer from the primary roost tree. The number of Indiana bats observed exiting the main colony (34) is more indicative of a maternity colony than a bachelor colony. However, the buffer distance is the same for a male capture record or maternity tree so the Service concurs with the use of a 2.5 mile buffer from the primary roost tree. Information

provided in the PEP indicates that there is approximately 5,709 acres of forested habitat within the 2.5 mile buffer and that the remaining 6,978 acres are primarily agricultural land. In addition, 36% of the area within the 2.5 mile buffer zone will be undermined and the remaining 64% of the area is not currently proposed to be impacted in anyway.

The PEP includes a number of protection and enhancement measures. The Service offers the following comments regarding the proposed measures.

Avoidance Measures:

Minimization Actions

- The PEP area shall be surveyed in 2013 in order to monitor the status of the bachelor colony.

  The Service supports this measure, as it should provide insight to confirm whether the known colony is in fact a bachelor colony vs. a maternity colony. It will also provide valuable information regarding the Indiana bat population response to the proposed disturbance and the protection and enhancement measures. A plan should be developed that fully describes the proposed methods for surveying and monitoring the Indiana bat population and their habitat and the plan should be coordinated with this office.

Tree Clearing Restrictions

- Seasonal tree clearing will require the applicant only conduct project related tree removal from October 15 to March 31st within the PEP boundary. This restriction will apply to any mining related activities (including IBR's Revisions, etc).

  This measure is acceptable as proposed, as it will minimize any chance of direct take of the species.

- All areas outside of this 2.5 mile radius, and within the previously surveyed mining limits, will not be subject to tree clearing restrictions based upon the results of the 2010 and 2012 survey, and tree clearing can occur at any time.

  The Service agrees that the survey results from 2010 indicate probable absence within the previously surveyed mining limits and that the 2012 survey results indicate probable absence outside the 2.5 mile radius around the primary roost. The negative results allow the applicant to initiate timber removal at any time within the limits of the study area but outside the 2.5 mile radius around the primary roost tree. The survey results shall be valid for a period of 5 years based on the permit renewal cycle for state SMCRA permits (Range-wide Indiana Bat Protection and Enhancement Plan Guidelines). The permit area will need to be re-surveyed if the permit area still contains suitable/potential Indiana bat habitat beyond the 5 year time period. Survey requirements will be based on the amount of suitable/potential Indiana bat habitat remaining on the site at that time. In the event

new information becomes available that would affect the area covered by this survey, further consultation may be necessary.

Buffering Caves and Abandoned Underground Mines

- Caves and abandoned mines may provide winter habitat for the Indiana bat and therefore should be protected within the project area. At this time, there are no known caves or abandoned underground mine openings within the project area.

  In the event that new information becomes available, indicating the presence of caves and/or abandoned underground mine openings within the project area, further consultation with this office should be initiated.

Riparian Buffer Zone Protection

- To minimize direct impacts to Indiana bat foraging and roosting habitat riparian buffer zone protection will be utilized by the applicant within the 2.5 mile buffer area. At this time it is only anticipated that stream flow restoration activities will be necessary within the 2.5 mile buffer. The applicant will develop restoration plans that minimize tree clearing and riparian buffer zones will be maintained, to the greatest extent practicable. Additionally, the applicant will not complete stream restorations if not essential to the project in order to minimize disturbances to Indiana bat foraging habitat. Riparian areas that are not essential to the project will not be disturbed.

  This measure is acceptable as proposed. When developing restoration plans, project plans that avoid impacting streams and wetlands, and leave a minimum 50-foot buffer along the stream edge (total of 100ft from both stream banks) or wetland, can reduce impacts to foraging bats and are encouraged (PEP Guidelines).

Minimization of Disturbed Area

- The applicant will limit the disturbance footprint to the minimum width necessary to conduct stream flow restoration. Additionally, as previously stated, the applicant will not complete stream restoration if not essential to the project in order to minimize disturbances to Indiana bat foraging habitat.

  The Service supports this proposed measure. In addition, per the PEP Guidelines, if forested habitat is avoided, the acreage of habitat avoided should be quantified. On-site avoidance can reduce the number and/or amount of other minimization and short and long-term replacement measures required for the proposed project.

Minimization Measures: Short-term Habitat Measures

Provide Roosting Habitat

- Information included in the PEP indicates that potential summer roosting habitat within the 2.5 mile buffer area is plentiful due to large amounts of dead snags within canopy gaps and blow downs, created by the Southern Illinois derecho that occurred in May of 2009. Because plentiful roosting habitat exists within the PEP area; tree girdling, bat box placement, and the creation of flooded timber, is not proposed in association with this PEP.

  For the reason described above, the measure is acceptable as proposed.

Staged Tree Removal

- Staged tree removal will be conducted in order to minimize the temporal loss of summer habitat associated with this project. Any projects to be disturbed by the project for drainage correction or other purposes will be completed, at most, on a panel by panel basis. Tree removal areas will be limited to the area necessary to correct drainage from past years mining efforts.

  The Service supports this proposed measure, as this will ensure that forest clearing will occur only as needed, to allow for drainage corrections from past years mining efforts.

Flooded Timber

- Due to the large amounts of dead snags within canapy gaps, blow downs, and standing trees created by the Southern Illinois derecho that occurred in May of 2009, the creation of flooded timber is not proposed in association with this PEP.

  For the reason described above, the measure is acceptable as proposed.

Minimization Measures: Long-term Habitat Measures

Watering Areas

- Since the project will be working on existing watering areas for bats, the creation of additional watering areas is not proposed in association with this PEP.

  For the reason described above, this measure is acceptable as proposed.

Reforestation

- The intent of the applicant's reforestation plan is to provide for the long-term habitat needs of the Indiana bats that may be adversely affected by the project. Areas of deforestation due to equipment access for flow restoration activities will be reclaimed and re-vegetated. Reclamation for this project area will be designed using strategies to provide future habitat for the Indiana bat. Since not all Indiana bat habitat is being removed within the proposed project area, trees will be replaced within the disturbed areas only, and where allowable by the land owner.

The PEP Guidelines require reclamation activities must result in the reforestation of at least 70 percent of the total Indiana bat forested habitat that was or will be lost unless off-site mitigation measures are used. This acreage should be based on the pre-mining forested acreage known and/or potential summer habitat. It is unclear how many forested acres will be impacted and likewise how many acres will be reforested. Information in the PEP indicates that the impacted forested area will be reclaimed at a ratio of 1:1 where allowable by the land owner. A 1:1 ratio is insufficient to replace the habitat value of the forested habitat that will be lost given the amount of time required for forest habitat to become established. The Service recommends that the impacted forested area be reclaimed at a minimum ratio of 2:1. Total forest impacts and acreage to be reforested should be addressed in the final revision of the PEP if possible.

Herbaceous Ground Cover

- Any surface permitted areas disturbed as part of this project will be seeded with an herbaceous mixture as required by the current mining permit, consisting of the following; spring oats, ryegrass, sunflower, German millet, sorghum/sudan/sudex, Korean lespedeza, and wheat. Any subsidence mitigation areas disturbed as part of the project may be seeded with the herbaceous mixture indicated above or with a comparable mix of native species.

  Per PEP Guidelines; the use of native species is required when establishing the herbaceous ground cover in area with forest and/or wildlife post mine land uses. The planting of non-native, exotic, and invasive species (such as Korean lespedeza) should be avoided, therefore, the Service recommends the seed mixture above be modified to include a mixture of native warm season grass that will provide greater benefits to grassland birds and small mammals.

Tree Species Selection

- Where reforestation will occur, it will include the planting of a minimum of six different tree species from the list provided in Appendix E of the PEP. Trees will be planted to obtain 250 live woody stems per acre upon completion of reclamation. The reclamation will be carried out in the project area, using a modified list of plant species from the approved tree species list for Indiana bat protection and enhancement plans, as well as the use of native species when possible.

  The Service supports the use of native species and while any of the tree species in the Appendix E list are appropriate for providing future Indiana bat roosting trees, we recommend the tree species planted include primarily hard mast or fruit bearing species so that overall wildlife benefits may be maximized. Additionally, the PEP does not provide details regarding the overall reclamation plan for deforested areas. The information should be expanded to include discussion of the size of trees proposed for planting (e.g., 1 year or 2 year saplings, root-pruned method trees, etc.) and the proposed spacing for plantings. For 1 year saplings, we recommend a minimum of 435 trees per

acre (10' X 10') spacing. Larger size tree plantings would require a larger spacing and fewer trees for planting.

Travel Corridors

- In areas of drainage restoration the applicant will be restoring forested travel corridors in and around local streams. Therefore, the restoration of travel corridors is proposed by this PEP.

  The PEP does not provide details regarding the overall reclamation plan for travel corridors. The Service recommends, per PEP Guidelines, that a minimum travel corridor of four rows of trees should be planted to establish a suitable travel corridor at least 50 feet in width. When restoring forested travel corridors along stream edge, the Service recommends a minimum of 50 feet riparian corridor on each side of the stream bank to reduce impacts to foraging bats.

Restoring Stream Buffer Zones

- The restoration of stream buffer zones is proposed by this PEP. Where drainage restoration will occur the applicant will be restoring a forested riparian buffer zone. It will include the planting of a minimum of six different tree species from the list provided in Appendix E of the PEP. The reclamation will be carried out in the project area, using a modified list of plant species from the approved tree species list for Indiana bat protection and enhancement plans, as well as the use of native species when possible.

  In addition to the above protection and enhancement measures, the Service recommends per PEP Guidelines, that when restoring stream buffer zones during reclamation, areas impacted should be reforested with a minimum 50-foot riparian corridor on each side of the stream to reduce impacts to foraging bats.

Minimization Measures: Off-Site Habitat Mitigation Measures

- Off-site habitat mitigation measures are not proposed in association with this PEP. At this time the applicant does not anticipate that the proposed project would pose any significant threat to the Indiana bat population in and around the area. Based upon the applicant's seasonal tree clearing restrictions, no direct impacts to Indiana bats is likely. Indirect impacts to Indiana bats will be avoided and minimized by the applicant's protection of riparian buffer zones, limiting overall disturbance and removing trees in a staged process. Additionally, the applicant proposes to restore any Indiana bat habitat that is disturbed during project operations with the outlined reforestation plan.

  The PEP Guidelines require reclamation activities must result in the reforestation of at least 70 percent of the total Indiana bat forested habitat that was or will be lost unless off-site mitigation measures are used. This acreage should be based on the pre-mining forested acreage known and/or potential summer habitat. As stated in the Long-term Habitat Measures section above, information in the PEP regarding amount of forested

acres to be impacted is unclear. A 1:1 ratio is insufficient to replace the habitat value of the forested habitat that will be lost, given the amount of time required for forest habitat to become established. The Service recommends that the impacted forested area be reclaimed at a minimum ratio of 2:1. The Service also recommends that all mitigation occur within the PEP project area when possible. If the minimum restoration obligation is unable to be completed, for whatever reason (i.e. unwillingness of landowner), than off-site mitigation would be necessary as described in the PEP Guidelines. Total forest impacts and acreage to be reforested should be addressed in the final revision of the PEP if possible.

Additional Comments

In addition to the above comments, the Service requests per PEP Guidelines, that the PEP Development Checklist included in Appendix B of the PEP Guidelines be completed and included as part of the PEP document.

Thank you for the opportunity to review the PEP. We look forward to working with Alliance Consulting and Williamson Energy as the PEP is implemented to ensure the protection of endangered Indiana bats in the area. Please contact me at (618) 997-3344, ext. 345, should you have any questions.

Sincerely,

/s/ Matthew T. Mangan

Matthew T. Mangan
Biologist in Charge

cc: IDNR (Malone, Kolar)

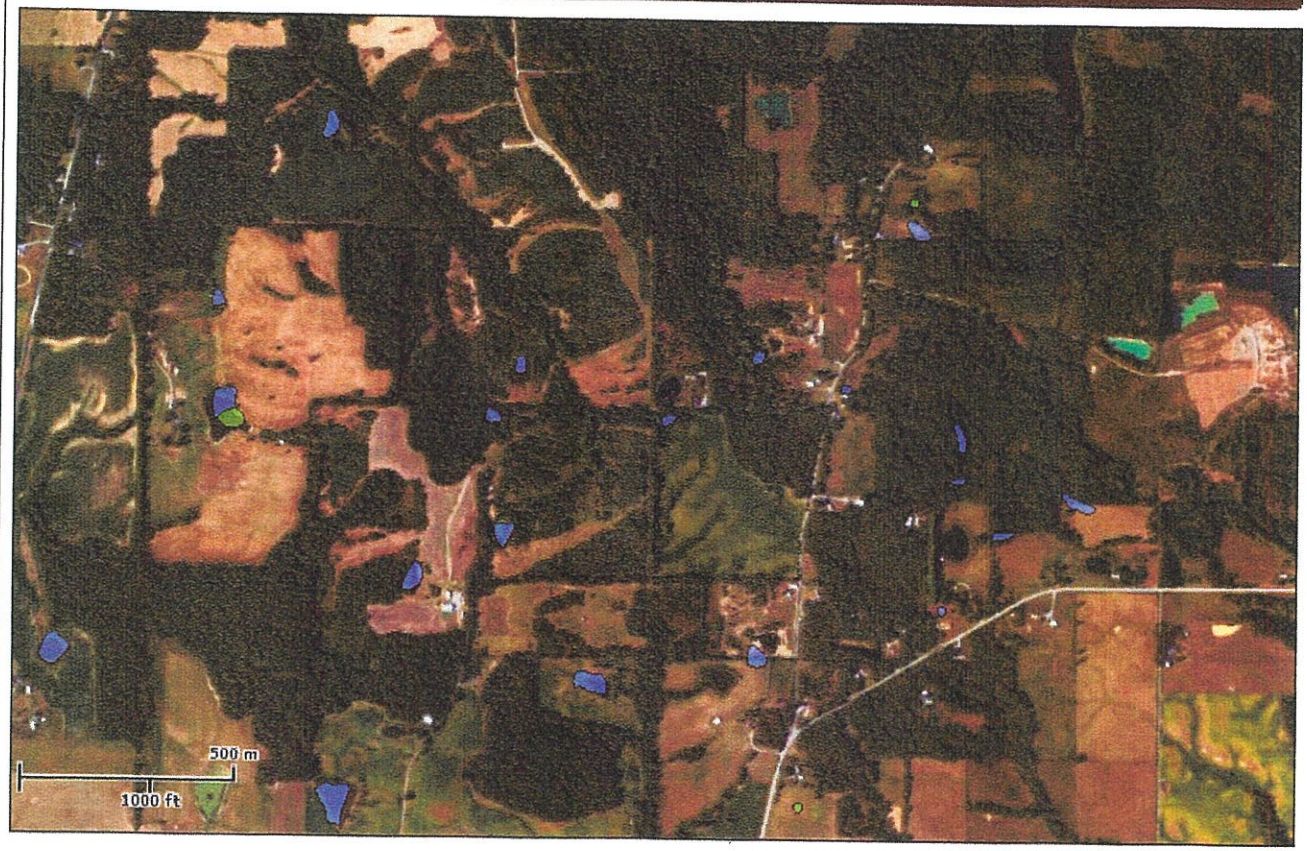
Permit ID 375 IBR
Rev Date 3/22/13

APPENDIX

U.S. Fish and Wildlife Service

National Wetlands Inventory

Mar 19, 2013



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Permit 375 Incidental Boundary Revision

R11406

EcoCAT
Ecological Compliance Assessment Tool

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Applicant: James Miller
Contact: James Miller
Address: 16824 Liberty School Road
Marion, IL 62959

Project: Mine Dewatering Vertical Turbine Pump Site
Address: Malone Road, Thompsonville

IDNR Project Number: 1311407
Date: 03/22/2013

Description: The site is the proposed location for a borehole for installation of a mine dewatering electric vertical turbine pump facility.

Natural Resource Review Results

This project was submitted for information only. It is not a consultation under Part 1075.

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Williamson

Township, Range, Section:
8S, 4E, 15



IL Department of Natural Resources Contact
Impact Assessment Section
217-785-5500
Division of Ecosystems & Environment

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

DOCUMENT

64

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
MINE RELATED WATER POLLUTION CONTROL PERMIT

R1141

PERMIT NO.: 2013-MA-6562

DATE ISSUED: January 2, 2013

FINAL PLANS, SPECIFICATIONS, APPLICATION AND SUPPORTING DOCUMENTS

EXPIRATION DATE: December 31, 2017

PREPARED BY: James M. Miller
Alliance Consulting, Inc.

LOG NUMBERS: 6562-12

SUBJECT: Williamson Energy, LLC – Pond Creek Mine

Williamson Energy, LLC – Pond Creek Mine
P.O. Box 99
Johnston City, Illinois 62951

Permit is hereby granted to the above designated permittee to construct and operate the surface facilities to support the underground mine facility described as follows:

A permit area consisting of 3.81 acres, also identified as an Incidental Boundary Revision (IBR) to OMM Permit No. 375, located in Section 16, T8S, R4E, Williamson County, Illinois, as described and depicted in IEPA Log No. 6562-12. This area is to be utilized for the construction of a steel-liner drill hole and temporary installation of a pumpable cement product mixing plant used for underground mine ground control which will be replaced by an electric turbine pump. A pump discharge pipeline and buried electric powerline will also be located within this area.

Runoff from the area approved herein will be controlled by silt fence, mulching, seeding, vegetation, rock check dams, erosion control blankets, etc.

The abandonment plan shall be executed and completed in accordance with 35 Ill. Adm. Code 405.109.

(Continued on Page 2)

This permit is issued in accordance with the Illinois Environmental Protection Act of 1970, the Title 35, Subtitle C: Water Pollution and Subtitle D: Mine Related Pollution Regulations adopted pursuant thereto by the Illinois Environmental Protection Act. THE STANDARD CONDITIONS OF ISSUANCE INDICATED ON THE ATTACHMENT TO THIS PERMIT (PAGE 1a) MUST BE COMPLIED WITH IN FULL. READ ALL CONDITIONS CAREFULLY.

Larry D. Crislip, P.E.
Manager, Permit Section
Mine Pollution Control Program
Bureau of Water

cc: IDNR, Office of Mines and Minerals
IDNR, Division of Water Resources
BOW/MPCP/FOS/Marion

LDC:cs/6259c/1-7-13

This Permit is issued subject to the following Special Condition. If such Special Condition requires additional or revised facilities, satisfactory engineering plan documents must be submitted to this Agency for review and approval for issuance of a Supplemental Permit.

Special Condition No. 1: This permit is issued with the expressed understanding that there shall be no surface discharge from these facilities. If such discharge occurs, additional or alternate facilities shall be provided. The construction of such additional or alternate facilities may not be started until a Permit for the construction is issued by the Agency.

6562-/12
R11412
Due date: 12-21-12

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

December 4, 2012

James Miller
Williamson Energy, LLC
P.O. Box 99
Johnston City, IL 62951

RECEIVED
DEC 06 2012
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Re: Permit No. 375
Incidental Boundary Revision No. 49

Dear Mr. Miller:

The appropriate Department technical staff has reviewed the proposed incidental boundary revision dated September 21, 2012, and supplemental information dated November 9, 2012, and supplemental information dated November 9, 2012, November 27, 2012, and November 29, 2012, submitted by Williamson Energy for Pond Creek Mine, Permit No. 375. The request would add 3.81 acres to conduct surface coal mining activities. The additional acres would be used for a borehole and temporary pumpable cement product mixing plant for underground mine ground control. The site is further proposed for installation of an electric dewatering turbine pump facility.

The Department finds Williamson Energy has demonstrated in its request, and field inspections by the Department's field representative have confirmed that these areas (3.81 acres) meet the requirements for an incidental boundary change as outlined in 62 Ill. Adm. Code 1774.13(d). Section 1774.13(d)(6) publication requirements have been met.

SEDIMENT POND EXEMPTION - Sections 1817.46(e)

1817.46(e) A sediment pond exemption is requested for an area delineated in the application. The regulations at 62 Ill. Adm. Code 1817.46(e) allow the Department to grant exemptions from the requirement to pass all disturbed drainage through a siltation structure when:

a. The disturbed drainage area within the total disturbed area is small; and

b. Alternate sediment control measures as described in Section 1817.45(b) are used in lieu of a siltation structure, and the permittee demonstrates that siltation structures are not necessary for drainage from the disturbed area to meet the effluent limitations and water quality standards for the receiving waters set forth in Section 1816/1817.42

The Department has determined that the area for which a sediment pond exemption is requested meets the criteria established in Section 1817.46(e) and hereby grants an exemption from the use of a sedimentation pond for this area.

Mining activities within 100 feet of a public road – Section 1761.11(d)

1761.11(d) The proposed permit area is within one hundred (100) feet of the outside right-of-way line of a public road in Williamson County.

As provided by 62 Ill. Adm. Code 1761.14(b), No approvals from the authority with jurisdiction over the road were required. The applicant provided proper public notice and opportunity for a public hearing. No hearing was requested and no written comments were submitted to the Department concerning these roads. The proposed permit area is adjacent to the right-of-way of Thompsonville Road. The proposed activities within 100 feet of the road right-of-way area include buried pump discharge pipeline and power line, and an access road and service pad.

The Department finds the interests of the public and affected landowners will be protected from the proposed mining operations as a result of the measures to be taken by the applicant, described in the mining operations plan concerning these roads.

1761.11(e) The proposed permit area is within three hundred (300) feet of occupied dwellings.

The owners of the dwellings have provided a written waiver pursuant to 62 Ill. Adm. Code 1761.15 consenting to underground coal mining surface operations closer than 300 feet.

The fee for the area will be $95.25. The fee is comprised of $95.25 for non-surface mining area ($5/acres x 3.81 acres x 5 years the bond is in force).

The bond for the area will be $32,760.00. Copies of bond form SCML-2 have been enclosed for your use. For additional bonding and other forms, please contact this office or download a copy from the web at: www.dnr.state.il.us/mines/lrd/forms.htm. Please note many forms have been modified. **Only** the most current versions will be accepted.

Upon receipt by the Department of the fee and bond and, at the same time, forwarding two copies to Ronald Morse, Illinois Environmental Protection Agency, 2309 West Main Street, Marion, Illinois 62959, mining activities on these 3.81 acres may commence, following Department approval.

All conditions and provisions contained in the approved permit also apply to this revision. Approval from this agency does not relieve Williamson Energy from obtaining approval from other agencies requiring such.

Should you have any questions, please contact Brad Murphy at our Benton office.

Sincerely,

Scott K. Fowler, Supervisor
Land Reclamation Division

SKF:CBM:gr

Enclosure
cc: B. Murphy
R. Morse
M. Parrish
C. Skelton

0562-12
Due Date 12-21-12
R11415

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

3.81 ACRES NON-CONTIGUOUS INCIDENTAL BOUNDARY REVISION FOR PERMIT NO. 375

WILLIAMSON COUNTY, IL
POND CREEK MINE NO. 1

SEPTEMBER 21, 2012
November 9, 2012 (updated)

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

September 21, 2012

Mr. Larry Crislip
Illinois Environmental Protection Agency
Mine Pollution Control Program
2309 West Main
Marion, IL 62959

Re: Incident Boundary Revision
Cement Product Mixing Plant/Turbine Pump Site
Pond Creek No. 1 Mine, Permit #375

Mr. Crislip:

Please find enclosed (2) copies of a 3.81 acre non-contiguous IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed location for a borehole and a temporary pumpable cement product mixing plant for underground mine ground control. The site is further proposed for installation of an electric dewatering turbine pump facility. Please refer to the enclosed material for details of the IBR.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 154 or (618) 889-8905.

Respectfully submitted,

James Miller

James Miller, PE
Authorized Representative
Williamson Energy, LLC

RECEIVED
NOV 13 2012
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Williamson Energy, LLC
PO Box 99
Johnston City, IL 62951
Office: 618-983-3020 Fax: 618-983-3017

September 21, 2012

Mr. Scott Fowler, Supervisor
Office of Mines and Minerals
Land Reclamation Division
Illinois Dept. of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Re: Incidental Boundary Revision
Cement Product Mixing Plant/Turbine Pump Site
Pond Creek No. 1 Mine, Permit #375

Dear Mr. Fowler:

Please find enclosed an original and one copy of a 3.81 acre non-contiguous IBR application to the Pond Creek No. 1 Mine, Permit #375. The IBR is for the proposed location for a borehole and a temporary pumpable cement product mixing plant for underground mine ground control. The site is further proposed for installation of an electric dewatering turbine pump facility.

Please be advised that one copy of this IBR application has also been sent to Mr. Brad Murphy in the Benton office.

Should additional information or questions exist with regard to this proposed IBR, please contact me directly at (618) 983-3020 Ext 154 or (618) 889-8905.

Sincerely,

James Miller

James Miller, P.E.
Authorized Representative
Williamson Energy, LLC

Cc: ILDNR/OMM Benton attn. B. Murphy (1) +.pdf
ILEPA Marion, attn. L. Crislip (2) +.pdf

Permit ID 375 IBR
Rev Date 9/21/12

State of Illinois
Department of Natural Resources
Office of Mines and Minerals
One Natural Resources Way
Springfield, Illinois 62702-1271

APPLICATION FOR SURFACE COAL MINING AND RECLAMATION OPERATIONS PERMIT INCIDENTAL BOUNDARY REVISION IBR-1

PART I

(Application to be submitted 120 days (180 day for NPDES) prior to the desired effective date of the permit)

DATE: September 21, 2012

NOTICE

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Ill Rev Stat 1989, Ch. 961/2, par. 7901.01 et seq. Disclosure of this information is voluntary, however failure to comply may result in this form not being processed. This form has been approved by the Forms Management Center.

1) A) General Information

(I) (We) (The) Williamson Energy, LLC
(Name of Company, Corporation, Partnership or Individual)

P. O. Box 99 Johnston City, IL 62951 [618] 983-3020
(Address) (Telephone Number)

hereby submits application for an Incidental Boundary Revision to Permit No. #375

Name of Mine: Pond Creek No. 1 Mine

MSHA ID No. 11-03141

I, Anthony Webb
(vice president or his duly authorized representative)

under penalty of perjury declare that all information provided in this application is true and correct to the best of my knowledge.

Signature Anthony Webb
Title: Authorized Agent

EXISTING PERMIT ACREAGE 641.58 ADDITIONAL ACRES REQUESTED 3.81

Permit ID 375 IBR
Rev Date 9/21/12

B) Indicate the type of disturbance and associated acreage.

Type of Disturbance	Acreage		
	Existing Permit	IBR	Total
Area Stripping	20.13		20.13
Mine Waste Areas	277.39		277.39
Processing Areas & Support Facilities	144.29	3.81	148.10
Access, Haul Roads & Transport Facilities	23.57		23.57
Soil Storage Areas	75.70		75.70
Diversions	32.85		32.85
Coal Recovery (Gob & Slurry)	0.00		0.00
Other	30.46		30.46
Not to be Disturbed	37.19		37.19
Total	641.58	3.81	645.39

2) A) **Provide the name and address of every legal or equitable owner of record of the proposed IBR area.**

RESPONSE: See Attachment I.2.A

B) **Provide the name and address of the owner of record of all surface and subsurface areas contiguous to any part of the proposed IBR area.**

RESPONSE: See Attachment I.2.A.

C) **Show the location of owners of record of those lands, both surface and subsurface, included in or contiguous to the proposed IBR area on the pre-mining land use map or another map, if necessary.**

RESPONSE: See Map 1, Identification of Interests

3) **Provide name and address of any holder of record of leasehold interest for the proposed IBR area.**

RESPONSE: Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

4) **Affidavits, Certifications**

A) **Complete affidavit regarding applicant's legal right to enter and begin surface coal mining and reclamation operations in the IBR area and whether that right is the subject of pending litigation. Identify the documents upon which affidavit is based by type and date of execution and identify specific lands to which each document pertains and explain the legal rights claimed by the applicant (1778.15(a)). If the private mineral estate to be mined has been severed from the private surface estate, provide copies of the documents required under Section 1778.15(B)(1)-(3). On the permit map or other designated map show the boundaries of land within the permit area upon which the applicant has the legal right to enter and begin surface mining activities.**

RESPONSE: See Attachment I.2.A and I.4.A.

B) **Complete certification for engineering aspects of the application. In addition to the general certification, three specific certifications are included which are applicable only if the box in front of each is marked. The first two cover special permit requirements and should be marked only when they occur for the proposed permit. The third certification covers the Illinois Environmental Protection Agency permit**

Permit ID 375 IBR
Rev Date 9/21/12

requirements. In most cases, an Illinois registered engineer will be required to certify I.E.P.A. permit requirements. Except as otherwise provided all maps, plans and cross-sections included in the permit application shall be prepared by, or under the direction of, and sealed by a qualified registered professional engineer licensed under the Illinois Professional Engineering Act, a qualified registered structural engineer licensed under the Illinois Structural Engineering Act or if authorized by state law, a qualified registered professional land surveyor licensed under the Illinois Land Surveyors Act with assistance from experts in related fields.

RESPONSE: See Attachment I.4.B.

5) **Areas Designated Unsuitable for Mining**

A) **Does proposed IBR area include:**

1) **Lands within boundaries of the National Park System, National Wildlife Refuge System, National Recreation Areas, etc. [Section 1761.11(a)]?**

Yes [ ] No [X]

2) **National forest land?**

Yes [ ] No [X]

3) **Any land which will adversely affect any publicly owned park or places included in or eligible for listing in the National Register of Historic places, etc. [per 62 Ill. Adm. Code 1761.11(a)(3) or Section 10, (B)(c) of the SCM-1?**

Yes [ ] No [X]

If yes, complete Part II, Section 10, (B) & (C) of the SCM-1 or the UCM-1 Application.

4) **Any public roads, which are to be removed, relocated or temporarily closed?**

Yes [ ] No [X]

Indicate on the pre-mining land use map or other designated map the location of the public roads and attach a copy of the written agreement from the appropriate authority authorizing the relocation, removal or temporary closure. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

RESPONSE: Not Applicable.

B) **Will the proposed IBR area be located:**

1) **Within 100 feet of the right-of-way line of any public road?**

Yes [X] No [ ]

If yes, explain proposed procedure for complying with regulation Section 1761.12 (c), including request for variance, if relevant. Provide location of public roads on pre-mining land use map or other designated map. Describe the measures to be used to insure that the interest of the public and landowners affected will be protected.

Permit ID 375 IBR
Rev Date 9/21/12

RESPONSE: A total of 2.35 acres of the proposed IBR area is located within 100 feet of the right-of-way line of Thompsonville Road. However, of the total, 1.97 acres includes only the underground installation of a pump discharge pipeline and probable electrical power line. After installation, these appurtenances are not expected to require maintenance or access, similarly to the public utilities that also parallel the public road. The remaining nominal acreage will include a newly constructed limited use access road and a gravel service pad. The Williamson County Highway Department has been provided with advanced notification of the intent to construct within 100 feet of the right-of-way without objection. The area within 100 feet of the Thompsonville Road right-of-way is requested for Department exception according to the process identified in Title 62 ILCS Section 1761.11(d)(2).

2) **Within 300 feet measured horizontally from any occupied dwelling?**

Yes [X] **No** [ ]

If yes, is waiver provided meeting requirements of Section 1761.15(b)?

RESPONSE: In accordance with the exception allowed in Section 1761.11(e)(1) and the procedure described in 1761.15(b), written waivers consenting to surface coal mining operations within 300 feet of an occupied dwelling are included. See Attachment I.5.B.

3) **Within 300 feet measured horizontally of any public building, school, church, community or institutional building or public park?**

Yes [ ] **No** [X]

4) **Within 100 feet measured horizontally of a cemetery?**

Yes [ ] **No** [X]

C) **Are valid existing rights (per 1761.11) claimed for any part of the IBR area?**

Yes [ ] **No** [X]

If yes, provide documentation to substantiate claim.

RESPONSE: Not Applicable.

D) **Provide a draft copy of the proposed newspaper notice and name of local newspaper of general circulation in which advertisement of the application will be published, per 62 Ill. Adm. Code 1774.13(d)(6). Certification of publication is to be furnished to the Department and must be received prior to Department approval of the IBR.**

RESPONSE: Please refer to Attachment I.5.D for the draft copy of the newspaper notice. The notice will be published in The Daily American newspaper.

Permit ID 375 IBR
Rev Date 9/21/12

PART II

PREMINING INFORMATION

Pre-mining information is to be displayed on pre-mining land use map unless otherwise indicated.

1) **Describe how the IBR area perimeter will be marked and discuss the method or system employed to locate permit area perimeter and set markers along it. Designate a reference point outside the IBR area if different than the original permit. Provide a description of the reference point and a sketch relating the reference point to the IBR area perimeter.**

   RESPONSE: The IBR boundary will be delineated by using PVC and/or metal posts and will be located within eye sight of one another.

2) **Explain and locate areas where the IBR is contiguous to an existing permit.**

   RESPONSE: The proposed IBR is not contiguous to the current permitted boundary, but does overly the Shadow Area of UG Mining Permit #375. See Map 1, Identification of Interests for a delineation of the IBR boundary and the relationship of IBR boundary to the existing permit boundary.

3) **Give the acreage of each land use within the proposed IBR and existing permit area, employing land use categories of Section 1701.5 listed below, and delineate on pre-mining land use map existing land uses in the proposed permit area and adjacent to it. Include on the pre-mining land use map the location of all buildings and identify the current use of these buildings.**

Pre-Mine Land Use	Acreage		
	Existing Permit	IBR	Total
Cropland	518.43	2.98	521.41
Pasture Land	0.00	0.00	0.00
Grazing land	0.00	0.00	0.00
Forestry	101.86	0.00	101.86
Residential	4.32	0.00	4.32
Industrial/Commercial	0.00	0.00	0.00
Recreation	0.00	0.00	0.00
Fish & Wildlife Habitat	15.53	0.83	16.36
Developed Water Resources	1.44	0.00	1.44
Undeveloped Land	0.00	0.00	0.00
Total	641.58	3.81	645.39

RESPONSE: See Pre-Mining Land Use Map.

4) **Soils Information**

A) Does the submitted soils map represent a map developed by the National Resources Conservation Service (NRCS)?

Yes [X] No [ ]

If no, explain:

B) Delineate on the soils map(s) the area, which will incur actual mining (removal of overburden and/or deposition of overburden for the extraction of coal).

Permit ID 375 IBR
Rev Date 9/21/12

RESPONSE: No removal of overburden or deposition of overburden for the extraction of coal will occur on the IBR area. Proposed site disturbance is minimal and will include only topsoil removal and a temporary drill hole cuttings pit. Topsoil material will be stored on site.

C) **Are any of the identified map units correlated as prime farmland by NRCS criteria?**

Yes [ ] No [X]

If yes, explain and provide documentation to meet the requirements of Section 1785.17, if a determination for grandfathering and/or negative determination is sought. If prime farmlands exist which will not meet the exemption criteria described above, the approved prime farmlands restoration plan must be followed.

RESPONSE: Not Applicable.

D) **Submit, by completing soils information chart, acreage totals of each map unit (soil type and slope classification) and land use capability classes in the IBR area and the percent slope range of each lettered slope classification used on the soil map.**

RESPONSE: See Attachment II.4.

E) **Provide, by completing soil information chart, acreage for each of the map units of high capability land (including grandfathered and negatively determined prime farmland) and non-cropland capability land with respect to areas which will be mined and areas which will incur other forms of disturbance (i.e., roads, ditches, etc.). Identify and provide map unit acreage values, if any, for areas which will not be disturbed.**

RESPONSE: See Attachment II.4.

F) **Are selected overburden materials proposed to be used in lieu of or as a supplement to the A-horizon?**

Yes [ ] No [X]

If yes, provide the appropriate information required under 1780.18(b)(4)/1784.13(b)(4).

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 9/21/12

PART III

OPERATIONS PLAN

1) **Explain the proposed operation and why the IBR is needed. Locate on a mining operations map.**

RESPONSE: The proposed IBR is intended for construction of an underground mine support facility including an 18" diameter, 450' deep steel-lined drill hole and temporary installation of a pumpable cement product mixing plant used for underground mine ground control, which will subsequently be replaced by an electric turbine pump. The 250-hp, 480V turbine pump will be used for mine dewatering and will include surface installation of a transformer, motor, and pump starter along with underground installation of a pump discharge pipeline and probable buried power line. The pump, pump starter, and transformer will all be installed on concrete pads, each approximately 8' x 8' x 6" thick.
Areas being rocked, including the access lane and material "lay down" areas will mainly consist of removing the existing topsoil (minimum six inches) and having fabric laid down followed by six inches of 3-6" rock capped with CA6 gravel. The area to be rocked, as shown on the attached Mining Operations Map, is approximately 0.7 acres. The remaining permitted area will contain soil stockpiles. Soil stockpiles will be seeded with a cover crop to minimize exposure to excessive water and wind erosion. Mulch, chemical binders or other stabilization techniques may be used, as required for stockpile protection. Signs will be posted to identify topsoil piles. Please see the attached Mining Operations Map for site layout.

2) **Surface Drainage Control**

A) 1) **Locate on the mining operations map or on a separate drainage map all proposed drainage control systems and show drainage patterns of all affected mining areas.**

RESPONSE: Disturbed area drainage will be controlled with proven alternate methods of drainage control which may include installation of silt fencing, straw bale containment check dams, earthen berms and/or mulched filter strips. Following completion of the access driveway and borehole installation, long term surface drainage will be controlled by well-established vegetative cover.

2) **Will all surface drainage from the affected mining area be collected and treated prior to leaving the IBR area?**

Yes [ ] No [X]

If yes, delineate how and where surface drainage will be collected and treated, and list the permit numbers and type of permit that the drainage control systems are operated under. If the above answer is no, explain how regulatory compliance will be achieved without treatment, i.e., address the requirements of 1816.46(e)/1817.46(e).

RESPONSE: See Part III.2.A.1.

B) **Will all surface drainage from unaffected areas be intercepted and diverted around the affected mining area?**

Yes [ ] No [X]

If no, please discuss.

RESPONSE: See Part III.2.A.1.

Permit ID 375 IBR
Rev Date 9/21/12

C) **Overland Flow Diversions and Sediment Ponds. Are either overland flow diversions or sediment ponds to be constructed?**

Yes [ ] No [X]

If yes, complete applicable parts of the SCM-1 or UCM-1 Part IV (Surface Drainage Control).

D) **Does a perennial or intermittent stream occur within the proposed IBR area?**

Yes [ ] No [X]

If yes, is an exception to the 100' buffer zone being requested or is a stream diversion being proposed. For an exception to the 100' buffer zone, indicate how compliance with 1816.57/1817.57 will be assured. For a stream diversion, complete applicable parts of the SCM-1 or UCM-1.

RESPONSE: Not Applicable.

3) **Roads and other activities**

A) **Are roads to be constructed in the IBR area?**

Yes [X] No [ ]

If yes, complete the applicable part of the SCM-1or UCM-1 (transportation facilities).

RESPONSE: A one hundred fifty foot long gravel lane will be constructed to provide site access from Thompsonville Road and will be incorporated into the site as part of the gravel pad. A profile of the access lane is shown on the Pre-Mining Land Use Map.

B) **If the operations involve other activities not specifically addressed above, complete applicable parts of the SCM-1 or UCM-1.**

RESPONSE: No other activities are proposed.

4) **Are any existing structures proposed for utilization in the IBR?**

Yes [ ] No [X]

If yes, complete Part IV.4 of the SCM-1.

RESPONSE: Not Applicable.

Permit ID 375 IBR
Rev Date 9/21/12

PART IV

RECLAMATION PLAN

1) Provide a reclamation plan map outlining proposed reclamation of the lands within the proposed IBR area and state how the IBR area will be reclaimed in conformity with the original plan.

RESPONSE: When the mine dewatering turbine pump and ancillary facilities are no longer required at the site, they will be relocated. The steel drill hole lining will be removed a minimum distance of four feet below the ground and the drill hole will be filled with incombustible material and capped with concrete. All gravel will also be removed and topsoil will be replaced. Buried pump discharge pipelines and power lines may be removed or abandoned depending on replacement value and/or landowner request. The original #375 permit provides more detail regarding soil conservation and reclamation practices. The original permit will be followed with regard to soil handling and replacement. Pre-mine topography and land use will remain as is currently present at the site.

2) **Post Mining Land Use**

A) **Provide a detailed description of proposed post-mining land uses and capabilities employing land use and capability categories listed below. Provide acreage figures for each post-mining land use proposed for the existing permit, the IBR area and total permit after inclusion of the IBR acreage and designate the post-mining land uses on the Post Mining Land Use Map. Acreage figures for post-mining land use must differentiate between mined and surface disturbance areas based on the mining line used in the pre-mining section of the application.**

Land Use	Capability								
	Existing Permit (ac)			IBR (ac)			Total (ac)		
	Prime	HCap	NonCrop	Prime	HCap	NonCrop	Prime	HCap	NonCrop
Cropland	3.28		1.97	0.90	1.52	0.49	4.18	1.52	2.46
Pasture Land									
Grazing Land									
Forestry			13.36						13.36
Residential			0.11						0.11
Industrial/Commercial									
Recreation									
Fish & Wildlife Habitat (Herbacious)		0.45	36.22					0.45	36.22
Fish & Wildlife Habitat (Woody)		0.42	566.51		0.42	0.48		0.84	566.99
Fish & Wildlife Habitat (Wetland)									
Developed Water Resources			19.26						19.26
Undeveloped Land									
Total	3.28	0.87	637.43	0.90	1.94	0.97	4.18	2.81	640.92

Prime: Prime farmland
HCap: High Capability - meeting productivity requirements of 62 Ill. Adm. Code 1825.
NonCrop: Non-Cropland - All soils which do not qualify as prime farmland or high capability.

Permit ID 375 IBR
Rev Date 9/21/12

3) **Pursuant to Section 1784.21 the applicant shall provide a protection and enhancement plan for the Indiana bat meeting the specifications of the July 2009 Range-wide Indiana bat protection and enhancement plan guidelines developed by the U.S. Fish and Wildlife Service and the Office of Surface Mining, or justify why no protection and enhancement plan is required under those guidelines.**

RESPONSE: Approximately 0.7 acres of the IBR area contains some combination of herbaceous and immature woody wildlife habitat. A survey of the Approved Shadow Area previously resulted in negative findings for the Indiana bat or its habitat, leading the U.S. Fish and Wildlife Service to grant clearance on 3/14/12 for a period of up to five years. A more recent comprehensive mist net survey resulted in the capture of two adult male specimens and the location of multiple roost sites. However, of the aforementioned wildlife habitat area, less than 0.1 acre or approximately 100 linear feet are located within the 2.5-mile roost tree buffer radius. The nominal affected area is planned for limited disturbance which generally excludes tree removal. However, any tree removal that is required will be performed only during the dormant period of the Indiana bat specifically identified as October 15 – March 31. As a result, the FWS concurred on 11/05/12 that a Protection and Enhancement Plan specific to this proposed IBR would not be warranted. Refer to the Pre-Mining Land Use Map 3 for an orthophotographic map of the site with the IBR boundary delineated.

Permit ID	375 IBR
Rev Date	9/21/12

Attachment List

Attachment I.2.A	Property Ownership Information
Attachment I.4.A	Real Estate Affidavit
Attachment I.4.B	Engineering Certification
Attachment I.5.B	Consent Waivers for Surface Coal Mining Operations
Attachment I.5.D	Newspaper Public Notice
Attachment II.4	Soils Information Chart

Permit ID	375 IBR
Rev Date	9/21/12

PROPERTY INDEX NO.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	Adjacent	APPLICANT CONTROL Ownership Percentage	ROE Type	Comments
04-16-300-009	Robin Williams & John Milo Kee 156888 Thompsonville Road Thompsonville, IL 62890	X		100%	Warranty Deed Dated: 1/15/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed 484, Page 434.
04-16-100-015	Robin Williams & John Milo Kee 156888 Thompsonville Road Thompsonville, IL 62890	X		100%	Warranty Deed Dated: 1/15/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed 484, Page 434.
04-16-100-016	Christy Chrostoski 16346 Thompsonville Road Thompsonville, IL 62890		X	100%	Warranty Deed Dated: 7/14/2010	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 485, Page 819.

PARCEL NOS.	PROPERTY OWNERSHIP Owner of Record	PROPERTY LOCATION Within	Adjacent	APPLICANT CONTROL Ownership Percentage	ROE Type	Comments
04-16-700-001	Independence Land Company, LLC 430 Harper Park Drive Beckley, WV 25801	X		100%	Special Warranty Deed Dated: 1/20/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 571.
04-16-700-001	Williamson Energy, LLC P. O. Box 99 Johnston City, IL 62951	X		Lease Hold Estate 100%	Coal Lease Dated: 3/13/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 301, Page 479.
04-16-700-003	Independence Land Company, LLC 430 Harper Park Drive Beckley, WV 25801	X		100%	Special Warranty Deed Dated: 1/20/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 472, Page 571.
04-16-700-003	Williamson Energy, LLC P. O. Box 99 Johnston City, IL 62951	X		Lease Hold Estate 100%	Coal Lease Dated: 3/13/2006	Recorded within the Office of the Williamson County Clerk and Recorder in Deed Record 301, Page 479.

R11429

Permit ID	375 IBR
Rev Date	9/21/12

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements were done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations. I have placed an "X" in the box below if that item is relevant.

	Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans to conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mine use of the site.
	Whereas the operation proposes disposal of spoil or waste materials in areas other than mining workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.
X	Certification of Illinois Environmental Protection Agency - 35 Ill. Adm. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

James M. Miller, Chief Engineer
Name

062-059719
Illinois Registration Number (seal)

Mach Mining, LLC
Firm

(618) 983-3020
Phone Number

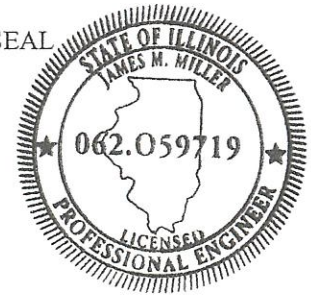
P. O. Box 99
Address

Johnston City, Illinois 62951

James Mille
Signature

9/21/12
Date

SEAL



Permit ID 375 IBR
Rev Date 9/21/12

REAL ESTATE AFFIDAVIT
LEGAL RIGHT TO ENTER & CONDUCT MINING SUPPORT OPERATIONS

I, Anthony Webb
(Individual or Individuals)
under penalty of perjury declare on behalf of the applicant, Williamson Energy, LLC, that said applicant has valid documents which bestow upon the applicant a legal right to enter and commence surface coal mining and reclamation operations upon lands contained in the proposed IBR area, and that such legal right is not in any way the subject of pending court litigation.

Dated this 21st day of September 2012.

Signed: Anthony Webb Authorized Agent
Signature/Title

State of Illinois

County of Williamson

Signed and subscribed to before me on 9/21/12 by Anthony Webb
(date) (name of person)

Cathy L Skelton
(Signature of Notary Public)

OFFICIAL SEAL
CATHY L. SKELTON
Notary Public - State of Illinois
My Commission Expires Feb 15, 2016

Permit ID 375 IBR
Rev Date 9/21/12

Public Notice

Pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (PA-81-1015, as amended) and the Rules and Regulations of the Act, Williamson Energy, LLC, P. O. Box 99, Johnston City, IL 62951 hereby gives notice that on September 21, 2012, an incidental boundary revision has been submitted to the Illinois Department of Natural Resources, Office of Mines and Minerals, Land Reclamation Division, One Natural Resources Way, Springfield, IL 62707-1271. The IBR application is for 3.81 acres located East of and adjacent to Thompsonville Road in the NW¼ of the NE¼ of the SW¼ and in the E½ of the NW¼ of Section 16, T8S, R4E, Williamson County.

The IBR proposes construction of an underground mine support facility including a steel-lined drill hole and temporary installation of a pumpable cement product mixing plant used for underground mine ground control, which will subsequently be replaced by an electric turbine pump. The IBR includes mining operations including installation of a buried pipeline and electric powerline within one hundred feet of the right-of-way of the above-referenced public road.

Copies of the application are on file for public viewing at Illinois Department of Natural Resources, Office of Mines and Minerals, 503 East Main Street, Benton, Illinois 62812, and at the Springfield office. Written comments concerning the operations should be submitted to the Illinois Department of Natural Resources Springfield office no later than seven [7] days from the publication date of this notice. Comments or request for public hearing regarding activities within one hundred feet of the right-of-way must be received no later than fourteen [14] days from the publication date of this notice.

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 24TH day of SEPTEMBER, 2012, from David Smith and Deborah Robinson-Smith, h/w, with and address of 16432 Thompsonville Road, Thompsonville, Illinois 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

The East Five (5) acres more or less being that part of the description listed below that lies East and adjacent to the County Road running in a Northeasterly and Southwesterly direction along the East side of the following described tract:
The Southeast Quarter (SE1/4) of the Southwest Quarter (SW1/4), and the East one-half (E1/2) of the Southwest Quarter (SW1/4) of the Southwest Quarter (SW1/4), all in Section Nine (9), Township Eight (8) South, Range Four (4) East of the Third Principal Meridian, Excepting the North Forty-Five (45) acres thereof.

Also, part of the Northeast Quarter (NE 1/4) of the Northwest Quarter (NW 1/4) of Section 16 in Township 8 South, Range 4 East of the Third Principal Meridian, Williamson County, Illinois, being more particularly described as follows:
Commencing at a #5 rebar found at the northeast corner of the said Northwest Quarter (NW

1/4) of Section 16; thence on the north line of the said Northwest Quarter, North 88 degrees 57 minutes 32 seconds West, 519.19 feet to the point of beginning. From the said point of beginning; thence South 1 degree 02 minutes 28 seconds West, 19.53 feet; thence North 88 degrees 57 minutes 32 seconds West, 104.31 feet to the existing easterly right of way line of Thompsonville Road; thence on the said existing easterly right of way line, North 13 degrees 29 minutes 04 seconds West, 20.00 feet to the north line of the said Northwest Quarter of Section 16; thence on the said north line, South 88 degrees 57 minutes 32 seconds East, 100.00 feet to the point of beginning. The above described parcel contains 0.046 acres, more or less.

Excepting the following: Part of the Southeast Quarter of the Southwest Quarter of Section 9 in Township 8 South, Range 4 East of the Third Principal Meridian, Williamson County, Illinois, being more particularly described as follows:
Beginning at a #5 rebar found at the southeast corner of the said Southwest Quarter of Section 9; thence on the north line of the said Southwest Quarter, North 88 degrees 57 minutes 32 seconds West, 100.00 feet; thence North 1 degree 02 minutes 28 seconds East, 20.00 feet; thence South 88 degrees 57 minutes 32 seconds East, 99.72 feet to the east line of the said Southwest Quarter of Section 9; thence on the said east line, South 0 degrees 14 minutes 47 seconds West, 20.00 feet to the point of beginning. The above described parcel contains 0.046 acres, more or less.

WHEREAS, Grantee owner or leases the coal rights as to the real property corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

David Smith

Deborah Robinson-Smith

STATE OF ILLINOIS)
) SS
COUNTY OF WILLIAMSON)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that David Smith and Deborah Robinson-Smith, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 24 day of SEPTEMBER, 2012.

Notary Public

My Commission Expires:
JULY 27, 2014

WELLC_SurfWaiverConsent.v01

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

SURFACE WAIVER AND CONSENT

Prepared by:
Williamson Energy, LLC
P. O. Box 99
Johnston City, IL 62951

SURFACE WAIVER AND CONSENT

This surface waiver and consent (herein this "Waiver and Consent") is made this 24th day of SEPTEMBER, 2012, from Robert Chrostoski and Christy Chrostoski, h/w, with and address of 16346 Thompsonville Road, Thompsonville, Illinois 62951, (herein the "Grantor"), in favor of Williamson Energy, LLC with and address at P.O. Box 99, Johnston City, Illinois 62951, (herein the "Grantee").

WHEREAS, the Grantor is the owner of an occupied dwelling located upon the following described real property (herein the "Dwelling"):

All that part of the NE ¼ of the NW ¼ of Section 16, Township 8 South, Range 4 East of the 3rd P.M., Williamson County, Illinois, lying East of the center line of the public road commonly known as the Corinth/Thompsonville Road, and lying North of the south line of an easement being described in that certain Deed Granting Easement dated July 21, 1994, as recorded in the office of the Recorder for Williamson County, Illinois on July 22, 1994, in Miscellaneous Record 221 at page 957.

WHEREAS, Grantee owner or leases the coal rights as to the real property

corresponding to the Dwelling and will be conducting surface coal mining operations with respect to the coal rights; and,

WHEREAS, the surface coal mining operations of Grantee will be conducted within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor and Grantee acknowledge that Grantor, as owner of the Dwelling, has the legal right to deny surface coal mining operations within said 300 feet; and,

WHEREAS, notwithstanding Grantor's legal right to deny mining, Grantor desires to waive this right and consent to surface coal mining operations within 300 feet, measured horizontally, of the Dwelling; and,

WHEREAS, Grantor desires to execute this Waiver and Consent waiving said right and consenting to said operations.

NOW, THEREFORE, for and in consideration of the foregoing recitals, the mutual benefits to be derived herefrom and Ten Dollars and other valuable consideration, Grantor agrees, waives, and consents as follows:

1. Waives the right to deny Grantee the right to conduct surface coal mining operations within 300 feet, measured horizontally, of the Dwelling.

2. Consents to the conducting of surface coal mining operations by Grantee closer than 300 feet, measured horizontally, of the Dwelling.

3. Waives and consents as set forth in paragraphs 1 and 2 above knowing that as

the owner of the Dwelling, Grantor has the right to deny such surface coal mining operations.

4. Consents to the recording of this Waiver and Consent in the County Clerk and Recorder's Office in the county where the Dwelling is located.

5. Waives all rights under and by virtue of the homestead exemption laws of the State of Illinois.

6. Agrees that this Waiver and Consent shall be binding upon and inure to the benefit of the Grantor and Grantee together with their successors and assigns.

7. Agrees that this Waiver and Consent is executed pursuant to 62 Ill.Adm.Code 1761.15(b).

DATED the day and year above written.

GRANTOR

ROBERT CHROSTOSKI

CHRISTY CHROSTOSKI

STATE OF Illinois)
) SS
COUNTY OF Williamson)

I, the undersigned, a Notary Public, in and for said County, in the State aforesaid, do hereby certify that Robert Chrostoski and Christy Chrostoski, h/w, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that they signed, sealed, and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth, including the release and waiver of the right of homestead.

Given under my hand and seal this 24th day of September, 2012.

Notary Public

My Commission Expires:
July 27, 2014

ERIC WAYNE SCHMITZ
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
July 27, 2014

Permit ID 375 IBR

Rev Date 9/21/12

Soil Identification				Mining Area							Support Area						
				Prime Soils		NonPrime Soils					Prime Soils		NonPrime Soils				
Soil Map Symbol	Soil Name	Slope Class [%]	Capability Class	Prime Farmland [acres]	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]	Prime Farmland [acres	Neg Det PFL [acres]	High Capable [acres]	Low Capable [acres]	Alternate Topsoil [acres]	Previous Mined [acres]	Totals [acres]
10D	Plumfield silty clay loam	10-18	6e											0.97			0.97
14B	Ava silt loam	2-5	2e								0.10						0.10
14C2	Ava silt loam	5-10	3e										0.44				0.44
14C3	Ava silty clay loam	5-10	3e										1.08				1.08
301B	Grantsburg silt loam	2-5	2e									0.22					0.22
3382A	Belknap silt loam	0-2	3w								0 80	0.20					1.00
			Total								0 90	0.42	1.52	0.97			3.81

Note : Soil information was determined from the Soil Survey of Williamson County, Illinois, 1978, prepared by the United States Department of Agriculture, Soil Conservation Service in cooperation with the Illinois Agricultural Experiment Station.

R11441

Soil Map—Williamson County, Illinois



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:6,650 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Date(s) aerial images were photographed: 6/13/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

R11443

Map Unit Legend

Williamson County, Illinois (IL199)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10C	Plumfield silty clay loam, 5 to 10 percent slopes	10.8	7.9%
10D	Plumfield silty clay loam, 10 to 18 percent slopes	11.6	8.5%
13B2	Bluford silt loam, 2 to 5 percent slopes, eroded	4.8	3.5%
14B	Ava silt loam, 2 to 5 percent slopes	11.3	8.2%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	38.1	27.7%
14C3	Ava silty clay loam, 5 to 10 percent slopes, severely eroded	15.6	11.3%
301B	Grantsburg silt loam, 2 to 5 percent slopes	16.2	11.8%
301C2	Grantsburg silt loam, 5 to 10 percent slopes, eroded	6.3	4.6%
340D3	Zanesville silty clay loam, 10 to 18 percent slopes, severely eroded	2.5	1.8%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	19.3	14.0%
W	Water	0.8	0.6%
Totals for Area of Interest		**137.4**	**100.0%**

Williamson County, Illinois (IL199)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10D	Plumfield silty clay loam, 10 to 18 percent slopes	0.97	25.5%
14B	Ava silt loam, 2 to 5 percent slopes	0.10	2.5%
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	0.44	11.6%
14C3	Ava silty clay loam, 5 to 10 percent slopes, severely eroded	1.08	28.3%
301B	Grantsburg silt loam, 2 to 5 percent slopes	0.22	5.8%
3382A	Belknap silt loam, 0 to 2 percent slopes, frequently flooded	1.00	26.3%
Totals for Area of Interest		3.81	100.0%

Detailed Soil Map Units

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Land capability classification

Determinations of land capability involve consideration of the risks of land damage from erosion and other causes and the difficulties in land use resulting from physical land characteristics and from climate. Land capability, as used in the USA, is an expression of the effect of physical land characteristics and climate on the suitability of soils for crops that require regular tillage, for grazing, for woodland, and for wildlife habitat.

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation

projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, forestland, or engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. Capability classes are determined for both irrigated and nonirrigated land. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion. These soils have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation. The significance of each subclass letter is described as follows:

Subclass letter e shows that the main problem is the hazard of erosion unless close-growing plant cover is maintained. The susceptibility to erosion and past erosion damage are the major soil-related factors affecting the soils that are assigned this subclass letter.

Subclass letter w shows that water in or on the soil interferes with plant growth or cultivation. In some soils the wetness can be partly corrected by artificial drainage. Ponding, a high water table, and/or flooding affect the soils that are assigned this subclass letter.

Subclass letter s shows that the soil has limitations within the root zone, such as shallowness of the root zone, a high content of stones, a low available water capacity, low fertility, and excessive salinity or sodicity. Overcoming these limitations is difficult.

Subclass letter c shows that the chief hazard or limitation is climate that is very cold or very dry. This subclass letter is used only in some parts of the United States.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic

numeral to the subclass symbol, for example, 2e-4 and 3e-6. The use of this category of the land capability classification is a state option. This category of the system is not stored in the soil survey database. For information about capability units, please contact the local NRCS State Soil Scientist. For locations of the offices of the State Soil Scientists, click on the State Contacts link in the upper portion of this window.

Reference:
"National Soil Survey Handbook," Part 622 (00-Exhibit 1), USDA, NRCS

Williamson County, Illinois

10D—Plumfield silty clay loam, 10 to 18 percent slopes

Map Unit Setting

Elevation: 360 to 840 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Plumfield and similar soils: 90 percent

Description of Plumfield

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over glacial drift

Properties and qualities

Slope: 10 to 18 percent
Depth to restrictive feature: 5 to 20 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 1.0 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 5 inches: Silty clay loam
5 to 12 inches: Silt loam
12 to 36 inches: Silt loam
36 to 60 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

14B—Ava silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava and similar soils: 90 percent

Description of Ava

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 6.3 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Silt loam
8 to 18 inches: Silt loam
18 to 36 inches: Silty clay loam
36 to 53 inches: Silt loam
53 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

14C2—Ava silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, eroded, and similar soils: 90 percent

Description of Ava, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 9 inches: Silt loam
9 to 28 inches: Silty clay loam
28 to 64 inches: Silt loam
64 to 78 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

14C3—Ava silty clay loam, 5 to 10 percent slopes, severely eroded

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Ava, severely eroded, and similar soils: 90 percent

Description of Ava, Severely Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Peoria and roxana loess over glacial drift

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 25 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 4.9 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 9 inches: Silty clay loam
9 to 28 inches: Silty clay loam
28 to 64 inches: Silt loam
64 to 78 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

301B—Grantsburg silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 360 to 660 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Grantsburg and similar soils: 90 percent

Description of Grantsburg

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Peoria and roxana loess over residuum

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 4.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 11 inches: Silt loam
11 to 24 inches: Silt loam
24 to 38 inches: Silty clay loam
38 to 61 inches: Silt loam
61 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

Williamson County, Illinois

3382A—Belknap silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Elevation: 340 to 490 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 175 to 195 days

Map Unit Composition

Belknap, frequently flooded, and similar soils: 90 percent

Description of Belknap, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Very high (about 12.7 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 7 inches: Silt loam
7 to 59 inches: Silt loam
59 to 80 inches: Silt loam

Data Source Information

Soil Survey Area: Williamson County, Illinois
Survey Area Data: Version 7, Jan 20, 2012

U.S. Fish and Wildlife Service

National Wetlands Inventory

Sep 10, 2012



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Permit 375 Incidental Boundary Revision

R11455

DOCUMENT

65

6431-/12-A
Due date: 10-2-12
R11457

Alliance Consulting, Inc.
Engineers • Constructors • Scientists

INSIGNIFICANT PERMIT REVISION
PERMIT NO. 375
RESPONSE TO COMMENTS DATED MAY 17, 2012

POND CREEK NO. 1 MINE
COAL REFUSE DISPOSAL FACILITY NO. 2
PHASES 5A, 7 AND 8

Prepared for

WILLIAMSON ENERGY, LLC
JOHNSTON CITY, ILLINOIS

ALLIANCE PROJECT NO. B11-530-1413
SEPTEMBER 2012

Summersville, WV
848 Northside Drive
Summersville, WV 26651
Telephone: (304) 883-2360
Fax: (304) 883-2361

Beckley, WV
Raleigh County Airport Industrial Park
124 Philpott Lane
Beaver, WV 25813-9502
Telephone: (304) 255-0491
Fax: (304) 255-4232

Canonsburg, PA
3 Four Coins Drive, Ste. 100
Canonsburg, PA 15317
Telephone: (724) 745-3630
Fax: (724) 745-3631

Alliance Consulting, Inc.
Engineers · Constructors · Scientists

September 14, 2012

Project No. B11-530-1413

Ms. Victoria M. Broomhead
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
One Natural Resources Way
Springfield, IL 62712

Response to Comments
IPR Permit No. 375
Pond Creek No. 1 Mine
Coal Refuse Disposal Facility No. 2
Phases 5A, 7 and 8
Williamson Energy, LLC

RECEIVED
SEP 2 5 2012
IL Environmental Protection Agency
MARION REGIONAL OFFICE

Dear Ms. Broomhead:

On behalf of our client, Williamson Energy LLC, this letter and attachments have been prepared in response to your email dated May 17, 2012 (copy attached).

Response to Comment No. 1 – Please provide information regarding the proposed liner for this IPR area; at a minimum, this area must be lined in a similar fashion to the existing RDA's.

The proposed liner for this IPR area will be the same at the approved liner.

Response to Comment No. 2 – Please provide further information on the pipeline located beneath this proposed IPR area. Will the pipeline remain in place or will it be removed? If the pipeline is to remain, what precautions will be taken to prevent the pipeline from becoming a conduit for mine-related contamination beyond the permit boundaries?

The pipeline will remain in place. Filter diaphragms will be used. A report containing calculations, design & specifications for the filter diaphragms are enclosed.

Response to Comment No. 3 – It appears groundwater monitoring well GW-8 is located within the area to receive refuse. What precautions will be taken to ensure the intregity of this well will remain? Are there plans to plug/abandon this well and replace it with a new one?

Groundwater monitoring well GW-8 will be relocated. The new well location is shown on the "Existing Conditions Map" Drawing No. B11-530-E2.

We trust the information contained herein is sufficient for your review. If there are any questions, please contact us.

Respectfully submitted,

ALLIANCE CONSULTING, INC.

Harold L. Owens
Senior Project Manager

Claudio E. Yon, P. E.
Senior Project Manager

CEY:jrs
Enclosures

FILE: 1153-03

CALCULATION BRIEF
METHANE PIPELINE FILTER DIAPHRAGM DESIGN
RESPONSE TO ILDNR MAY 17, 2012 COMMENTS
PHASE 2-3 CONNECTOR
COAL REFUSE DISPOSAL FACILITY NO. 2
POND CREEK NO. MINE
WILLIAMSON ENERGY, LLC
PROJECT NO. B11-530-1413
TABLE OF CONTENTS

TOPIC	PAGE
Gas Line Antiseep Diaphragm Design	1
Geotextile Design	4
Filter Diaphragm Layout Sketch	5
Drain Material Gradation	6
Drain Material Permeability	7
Foundation Soil Grain Size Analysis	8
Permeability Tests Results	10
Refuse Disposal Area Cross Section along DTE Pipeline	11

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

1

BY: HLO DATE: 05/30/12 CHKD BY: DATE:

PROJECT NAME: Williamson Energy, LLC; Phase 2-3 Connector

PROJECT NO. B11-530-1413 SHEET 1 OF 11

DESCRIPTION DTE Gas Line Antiseep Design

File: Mach DTE_1.xls, hlo, rev. 09/21/2012

The gas line will be left in place where it will be eventually be under the two Phase 2-3 Connector Embankments. Design a measure to prevent the possibility of the development of soil erosion along the pipe and to collect for treatment any contaminated seepage that might travel along the pipe.

Reference: National Engineering Handbook, Part 628, Dams, Chapter 45, "Filter Diaphragms", NRCS, USDA, January 2007.

The DTE pipe line will exit nearly perpendicular to the slopes of the east and west Phase 2-3 Connector Embankments (see Drawing No. B11-146-E6). Design a filter diaphragm for the east and west 2-3 Connector Embankments based on the maximum possible embankment height and slurry level that it is feasible to built in the future.

It should be noted that seepage along the gas pipeline is not anticipated to be a problem anywhere on this site because: 1) The pipe is trenched into a clay soil. Permeability tests on uncompacted samples of the soil indicate that it's vertical permeability ranges from 2×10^{-7} to 3×10^{-8} cm/sec, and 2) As soon as slurry is pumped into the impoundments the pool will become additionally sealed with a material which has in excess of 95% minus the #200 sieve.

Nevertheless, filter diaphragms will be designed for the locations the gas pipeline exits the embankments into the open to guard against the initial condition of the pools before slurry is deposited. The general guidelines in Ch. 45, referenced above, will be used for the design.

Due to the relative stiffness of the pipe, treat it as a rigid conduit as applies to diaphragm required size.

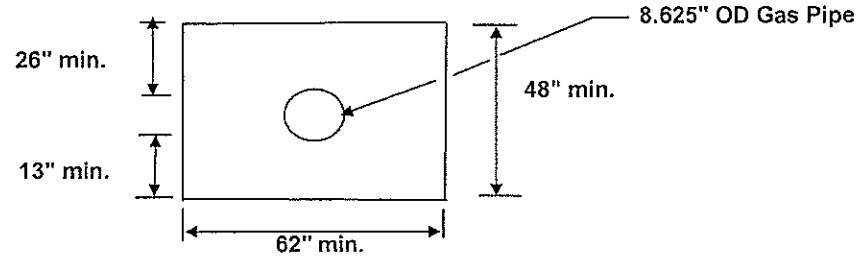
Assume $\delta < 0.7$, approximately 15 feet of CL soil is between the bottom of the pipe and bedrock.

Upward Vertical Collar Projection = 3 x Do = 3 x 8.625 = 25.9" (Fig. 45-A4)

Horizontal Collar Projection = 3 x Do = 25.9" (Fig. 45-A1)

Downward Vertical Collar Projection = 1.5 x Do = 1.5 x 8.625" = 12.9' (Pg. 4-A6)

Use collar size as follows:



Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:
PROJECT NAME: Williamson Energy, LLC; Phase 2-3 Connector
PROJECT NO. B11-530-1413 SHEET 3 OF 11
DESCRIPTION DTE Gas Line Antiseep Design
File: Mach DTE_3.xls, hlo, rev. 09/21/2012

Filter Diaphragm Design (continued)

West End Phase 2-3 Connector at the end of Potential Phase 8 (continued)

For a minimum outlet drain size of 4 sf: $Q = 0.8(10)^3$ fpd x 4 sf = 3,200 cu-ft/day
>> 975.3 cu-ft/day , OK for 1% grade

Try 0.5 % grade
$q/A \times 10^3 = 0.5$ fpd for minimum relative density
$Q = 0.5(10)^3 \times 4$ sf = 2,000 cu-ft/day, still >> 975.3 cu-ft/day, OK

Select a 2' x 2' outlet drain on a minimum slope of 0.5%

East End Phase 2-3 Connector at the end of Potential Phase 8

This situtation is the mirrow image of the above West End, use the same design and put the outflow from the filter diaphragm outlet channel into the sediment ditch.

Construction Notes:

The filter diaphragm and it's outlet drain dimensions shown on Sheet 5 are the minimum required, they may be increased to meet construction equipment requirements if needed.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 06/11/12 CHKD BY: DATE:

PROJECT NAME: Williamson Energy, LLC; Phase 2-3 Connector

PROJECT NO. B11-530-1413 SHEET 2 OF 11

DESCRIPTION DTE Gas Line Antiseep Design

File: Mach DTE_2.xls, hlo, rev. 09/21/2012

Filter Diaphragm Locations

Criteria: 1. Downstream of the center line of the dam when no cutoff trench is used, and
2. Upstream of a point where the embankment cover is at least half of the difference between the top of the diaphragm and the maximum potential reservoir water level.

Reservoir Water Levels:

Phase/Stage	Max. Slurry Elev.	Max. Storm Water Elev.
Phase 2-3 Connectors	491.3	499.0 (conservatively assumed 3' below dam crest elev. 502.0)

Design of the Filter Diaphragm for Maximum Water Level in Potential Phase 8:

(See Cross Section on Sheet 11)

Diaphragm Location:

Top of diaphragm elevation = 464.0 at methane pipeline station 3+56
Head on top of diaphragm = 499 - 464 = 35'
One-half head = 17.5', embankment cover at 3+56 = 502.0 - 464.0 = 38.0' OK
Place diaphragm at pipeline station 3+56
Discharge any seepage along the pipeline collected by the diaphragm into the treatment ponds via a gravel drain along the pipeline from stations 3+56 to 2+40 and then in a ditch or pipe beyond the toe of the dam (station 2+40).

Seepage Quantity:

$k'_{(embankment)} = 6 \times 10^{-4}$ cm/sec (use 6×10^{-2} cm/sec = 170.1 fpd)
Diaphragm Area = A = (62" x 48")/144 = 20.7 sf (minimum)
$i = \Delta h/\Delta l$, $\Delta l = 126'$, $\Delta h = 35'$, $i = 0.278$
Q = k' x I x A = 170.1 fpd(0.277)20.7 sf = 975.3 cu-ft/day = 0.01113 cfs = 5.07 gpm

Assume the outlet drain is on a 1% slope, length - 190' to toe of dam
The drainfill aggregate available at the site has the following gradation:
100% is 1.5" to 3/8', 2/3's is 3/8" to 1', 1/3 is 1" to 1.5".
This is somewhat coarser than Gradation No. 15 (see Sheet 6)
$q/A \times 10^3 = 0.8$ fpd for minimum relative density
(See Sheet 7 - Figure C-15, SM Note No. 9. SCS, USDA, March 1984)

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:
PROJECT NAME: Williamson EnergyLLC; Phase 2-3 Connector
PROJECT NO. B11-530-1413 SHEET 4 OF 11
DESCRIPTION DTE Gas Line Antiseep Design
File: Mach DTE_4.xls, hlo, rev. 09/21/2012

Filter Diaphragm Design (continued)

Select a Geotextile to Wrap the Gravel Diaphragm and Outlet Drain

Reference: "Geosynthetic Design and Construction Guidelines", Publication No. HI-95-038, Section 2, Geosynthetics in Subsurface Drainage Systems, Revised April 1998, National Highway Institure, Federal Highway Adminstration.

Assume steady state flow conditions

Retention Criteria:

AOS or $O_{95(geotextile)} \leq B\ D_{85(soil)}$ (EQ. 2-1)

$B = 1.8$; $O_{95} \leq 1.8\ D_{85}$ (for nonwoven geotextile and silts and clays (EQ. 2-4)

AOS or $O_{95} \leq 0.3$ mm (EQ. 2-5)

$D_{85} = 0.15$ mm (see attached Grain Size Analysis for Sample B-8874), PI = 24.1

1.8(0.15mm) = 0.27mm

Maximum AOS size = 0.30 mm for more than 50% passing #200 sieve & PI > 7.

Permeability/Permittivity Criteria:

$K_{geotextile} \geq k_{soil}$ (permeability requirements) (EQ. 2-7a)

$\Psi \geq 0.1\ sec^{-1}$ for > 50% passing #200 (EQ. 2-8c)

Clogging Resistance Criteria:

$O_{95(geotextile)} \geq 3\ D_{15(soil)}$ (EQ. 2-10)

Select Geotextile:

Try Propex's Geotex 601, nonwoven

AOS = 0.212mm < 0.27mm, OK

$\Psi = 1.4\ sec^{-1} > 0.1\ sec^{-1}$, OK (this is also equal to 110 gpm/ft^2)

The AOS (O_{95}) of the geotextile is obviously > 3 times the D_{15} of the soil, OK

Design inflow along gas pipeline = 5.07 gpm, therefore Geotex 601 will admit the anticipated inflow with a safety factor of over 20 per sq-ft of surface area (110/5.07 = 21.7).

Select Geotex 601 (or equilvalent) to provide a filter between the clayey foundation soil and the filter diaphragm and it's outlet drain.

Alliance Consulting, Inc.
Engineers · Constructors · Scientists
Beckley, WV

BY: HLO DATE: 09/13/12 CHKD BY: DATE:

PROJECT NAME: Williamson Energy LLC, Phase 2-3 Connector

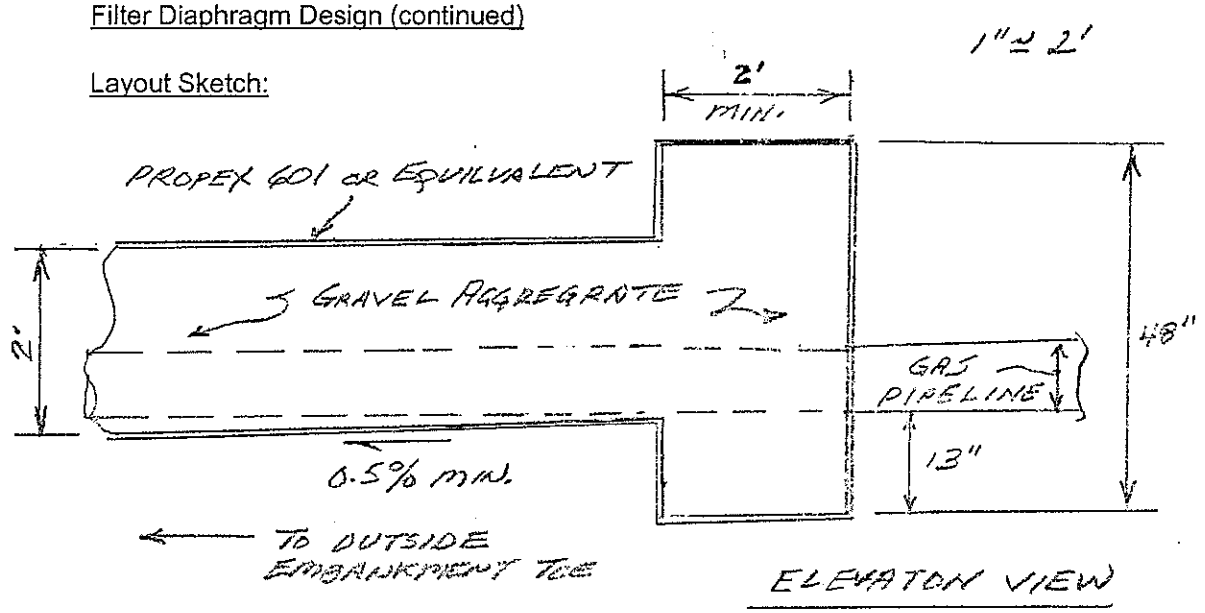
PROJECT NO. B11-530-1413 SHEET 5 OF 11

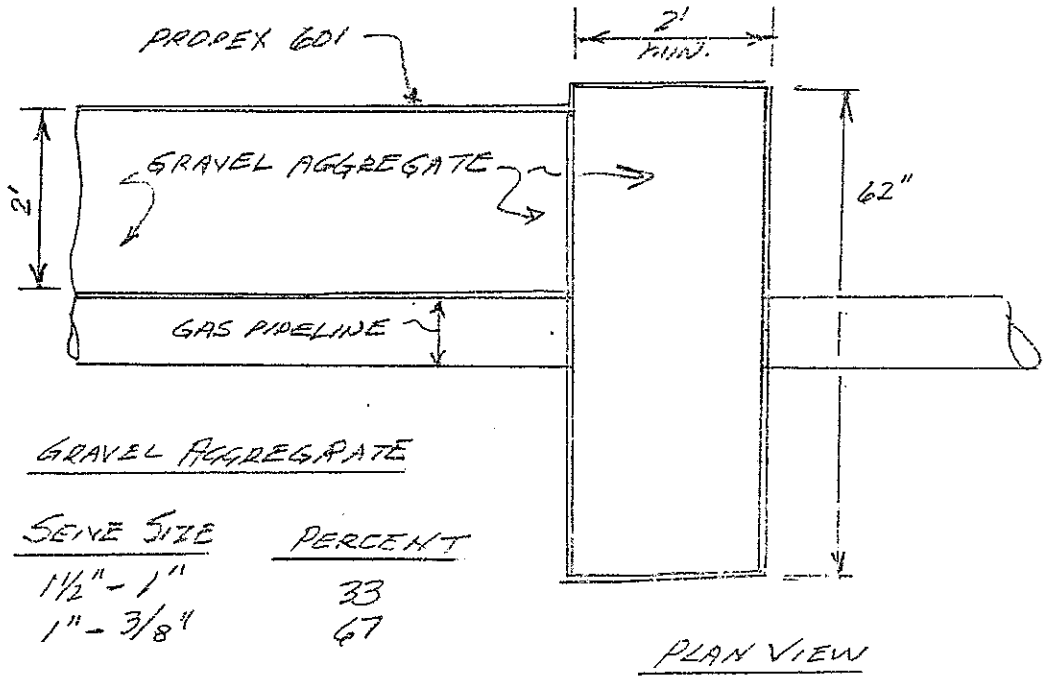
DESCRIPTION DTE Gas Line Antiseep Design

File: Mach DTE_5.xls, hlo, rev. 09/21/2012

Filter Diaphragm Design (continued)

Layout Sketch:





GRAVEL AGGREGATE

SEIVE SIZE	PERCENT
1½" - 1"	33
1" - 3/8"	67

(6/11)

Form SCS 130
5-65

4

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

PROJECT and STATE: WILLIAMSON ENERGY, LLC; PHASE 2-3 CONNECTOR, ILLINOIS

DESIGNED AT: ACI, BECKLEY, WV | BY: HJD | DATE: 9/14/2011

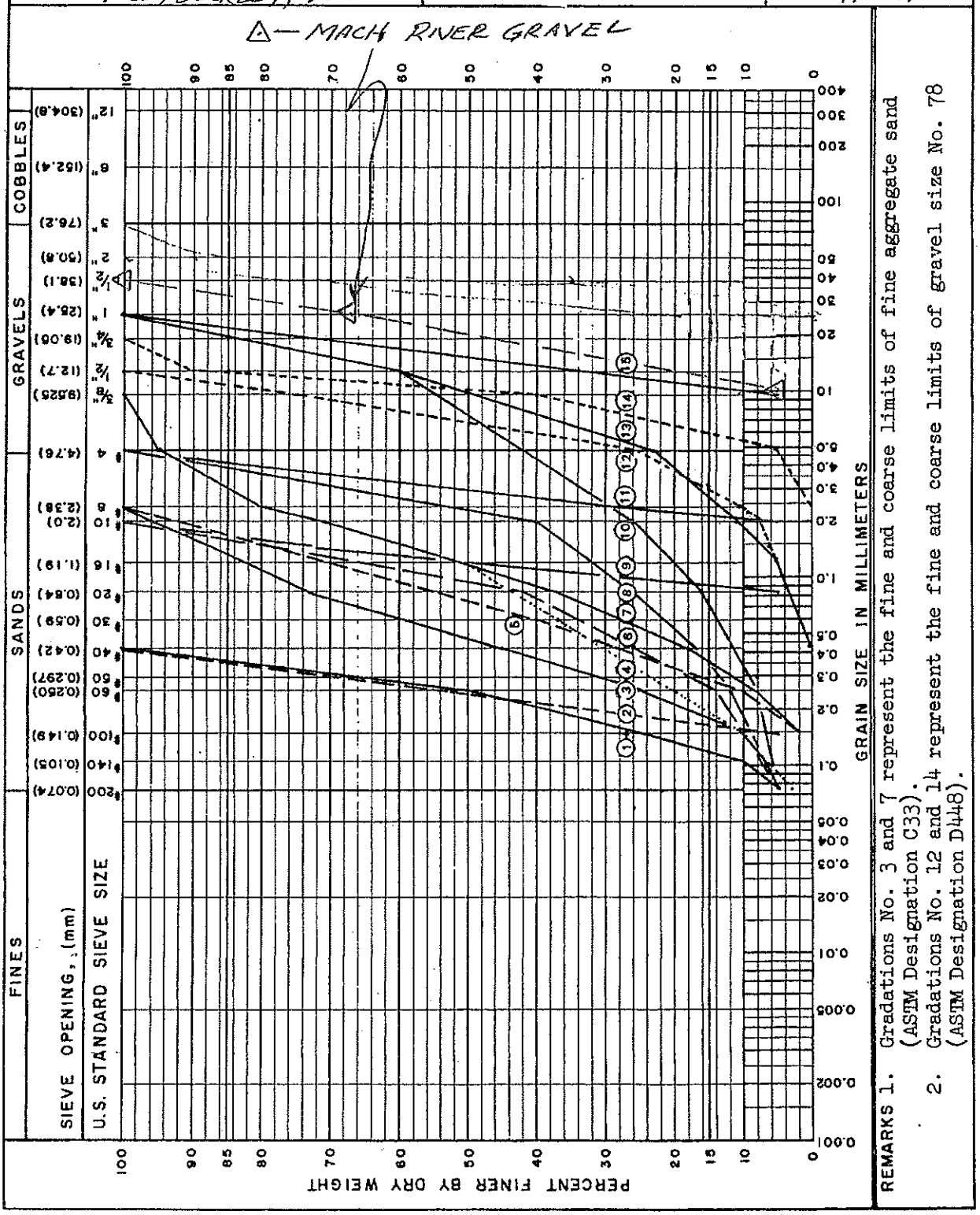
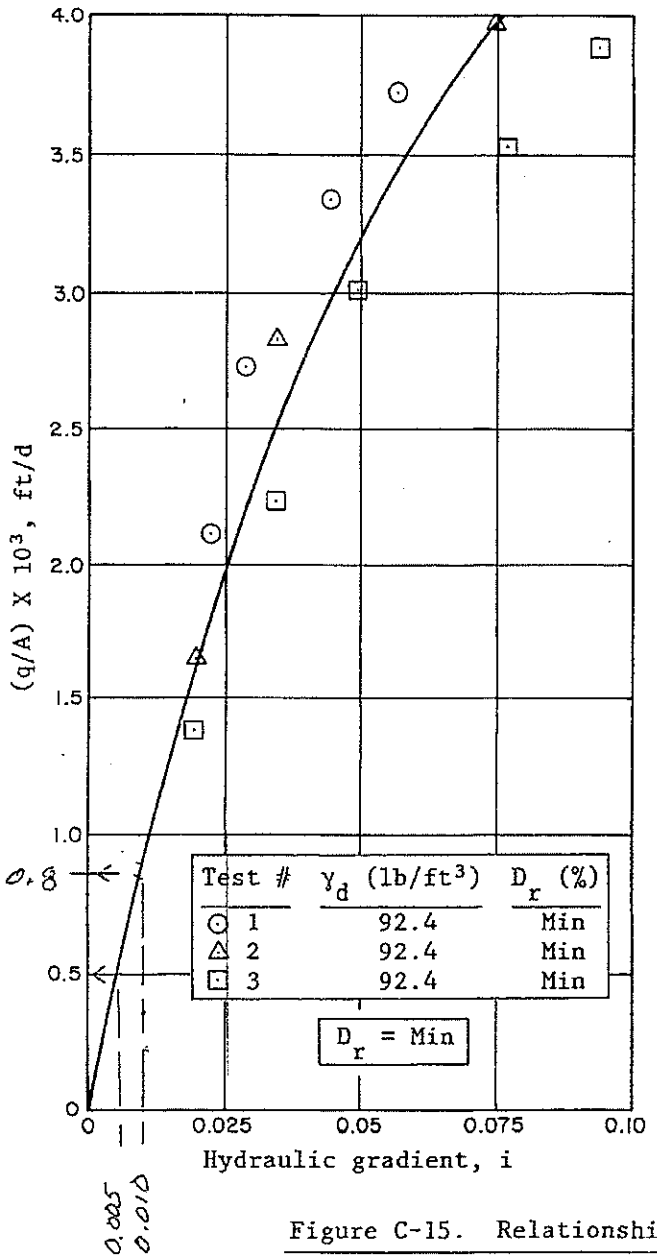
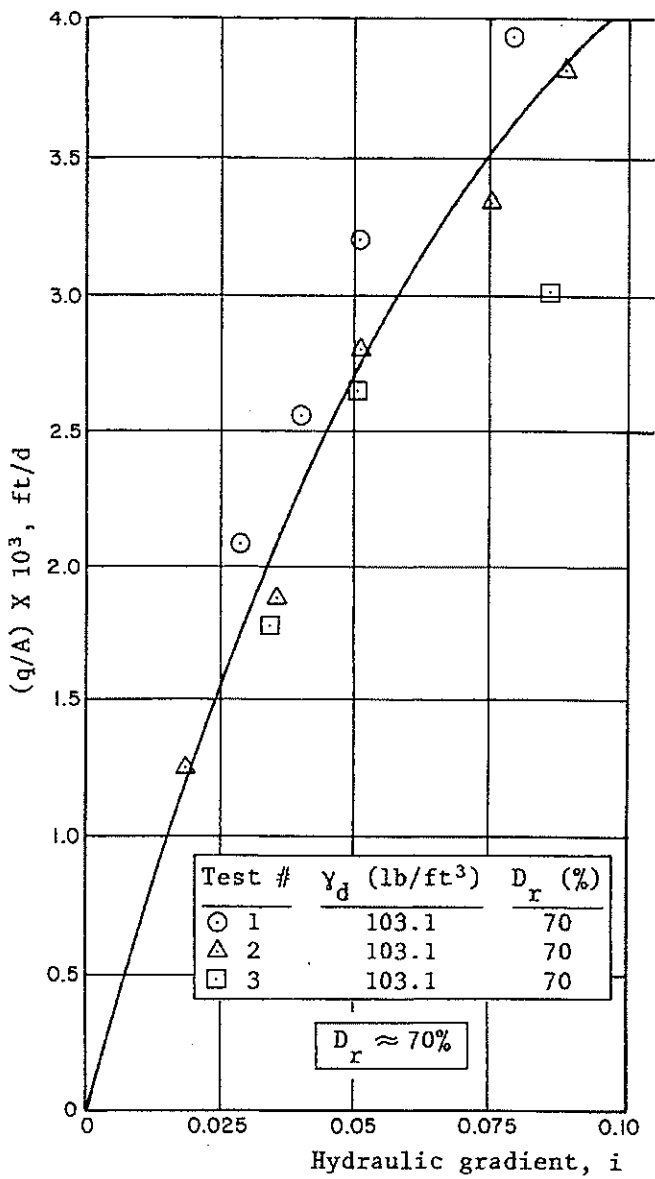


Figure 1. Gradations of sands and gravels tested

SM NOTE No. 9, SCS, USDA, MARCH 1984





GRADATION #15	
GP (rounded particles)	
C_u = 1.7; C_z = 1.0	
Sieve #	% Passing
1"	100
1/2"	34
3/8"	5

Relative Density, D_r
Min γ_d = 92.5 lb/ft³
Max γ_d = 108.7 lb/ft³

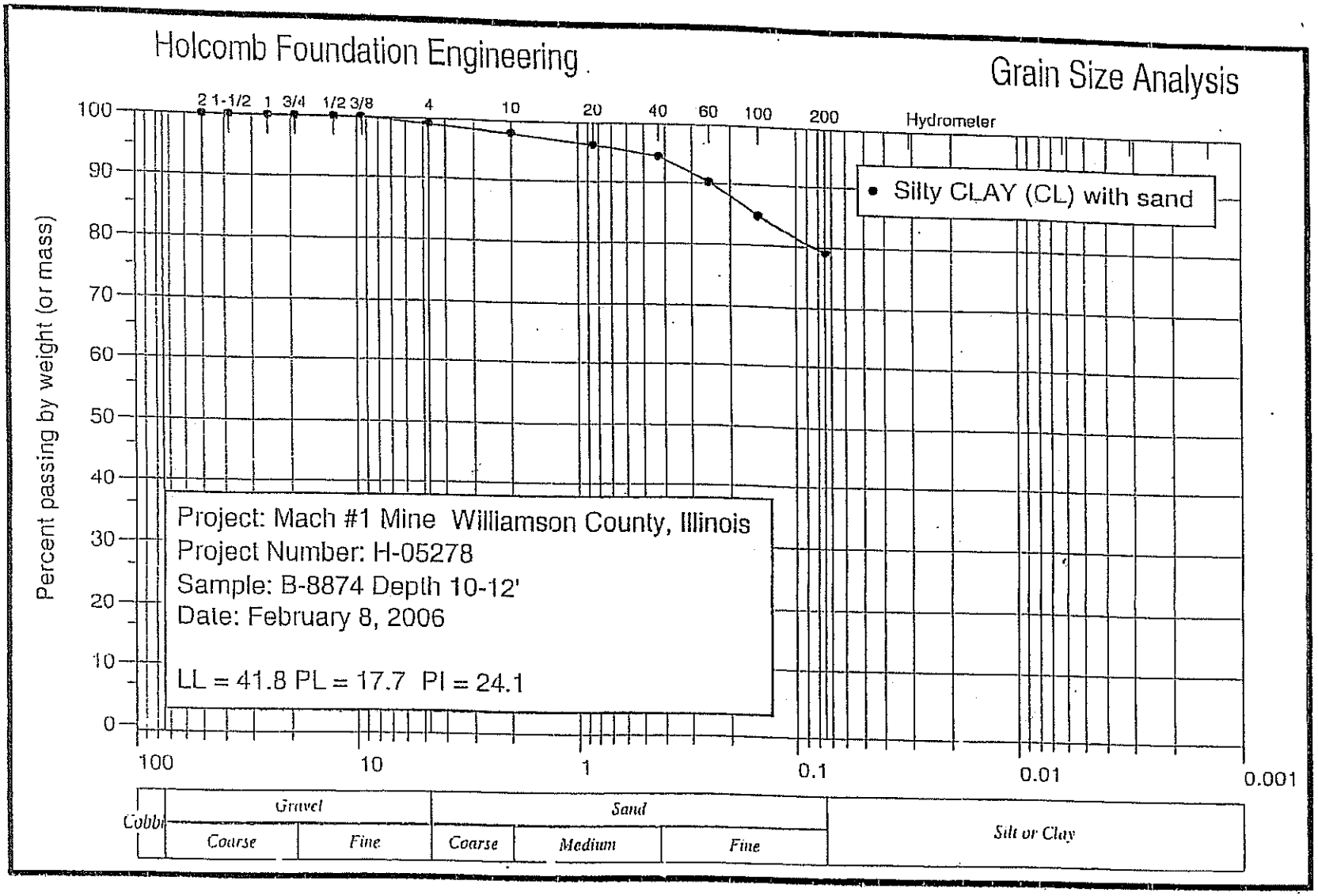
PROJ. NO. B11-550-1413
WILLIAMSON ENERGY, LLC
REFUSE DISPOSAL AREA NO. 2
PHASE 2-3 CONNECTOR
DTE GASLINE ANTISEEP
DESIGN H2O 9/15/12

Figure C-15. Relationship between q/A and i for Gradation No. 15 (GP, rounded)

SM NOTE No. 9, SCS, USDA, MARCH 1984

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-420-921/SCS-528

R11467



NJB
9/14/12

WILLIAMSON ENERGY LLC
PHASE 2-3 CONNECTOR
PROJECT 211-550-1413
DTE GASLINE AMENDED DESIGN

8/11

R11468

(9/11)

WILLIAMSON ENERGY, LLC
REFUSE DISPOSAL AREA NO. 2
PHASE 2-3 CONNECTOR
GTE GASLINE ANTISEEP DESIGN
HJB 9/15/2012

Holcomb Foundation Engineering Company

Laboratory Testing Results

2/8/2006

Project: Mach #1 Mine
Project No: H-05278

Sieve Analysis - ASTM C136-96a

Sample: Silty CLAY (CL)

Sieve Openings		US Standard	Weight	Percent	Percent
Inches	Millimeters	Sieve Size	Retained	Retained	Finer
1.5000	38.1000	1 -1/2"	0.0	0.0	100.0
1.0000	25.4000	1"	0.0	0.0	100.0
0.7500	19.1000	3/4"	0.0	0.0	100.0
0.5000	12.7000	1/2"	0.0	0.0	100.0
3.7500	9.5200	3/8"	0.0	0.0	100.0
0.1870	4.7600	No. 4	2.1	0.9	99.1
0.0790	2.0000	No. 10	4.6	2.0	98.0
0.0469	1.1800	No. 16	4.6	2.0	98.0
0.0331	0.8500	No. 20	8.6	3.8	96.2
0.0165	0.4200	No. 40	12.6	5.5	94.5
0.0117	0.2980	No. 50	12.6	5.5	94.5
0.0083	0.2500	No. 60	22.2	9.8	90.2
0.0059	0.1490	No. 100	34.6	15.2	84.8
0.0029	0.0740	No. 200	47.7	21.0	79.0

Total Weight in Grams 227.20

(10/11)

Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS
393 Wood Road
Carbondale, IL 62901

MAILING ADDRESS
PO Box 88
Carbondale, IL 62903

PHONE 618-529-5262
TOLL FREE 800-333-1740
FAX 618-457-8991

Permeability Tests Results

Pond Creek Mine Refuse Disposal Area
Williamson County, Illinois

Date: 7/21/2009

Client: Williamson Energy
Marion, Illinois

Project No.: H-08283

Boring No.	Depth (Ft.)	Moisture Content (%) Before Test	Moisture Content (%) After Test	Dry Unit Weight (PCF)	Permeability (Cm./Sec.)
GW-12 GW-13 GW-13	16.0-18.5' 16.0-18.5' 26.0-28.5'	11.3	18.8	113.3	1 x 10-7*
GW-14 BH-6	16.0-18.5' 18.5-21.0'	14.4	18.4	110.2	1 x 10-7*
BH-4	13.5-16.0'	17.3	20.9	117.6	2 x 10-7
BH-5	18.5-21.0'	26.6	28.7	100.3	3 x 10-8

Permeability Tests performed in accordance with ASTM D-5084

* - Soil Samples Remolded at 95% Standard Proctor Dry Density

WILLIAMSON ENERGY, LLC
REFUSE DISPOSAL AREA NO. 2
PHASE 2-3 CONNECTOR
DTE GASLINE ANTISEEP DESIGN
#12
9/5/2012

R11471

480
460
490
470
470
470
489.3
463.6
4715

50–FOOT WIDE
CREST AT EL. 502.0

OUTLET NO. 28
6" DR–26 HDPE
DAYLIGHT AT 1%

3:1
3:1

G
G

P–32
P–33

FILTER DIAPHRAGM
OUTLET DRAIN

FILTER DIAPHRAGM

1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00

116'

METHANE PIPELINE

SCALE
50 0 50 100 FEET

6431/12-A

PHASE 2–3 CONNECTOR IMPOUNDMENT BUTTRESS (OPTION)

EXCERPTED FROM DRAWING NO. B11–146–E6

Printed By: rlee
Date : Sep 21, 2
Time : 3:51 PM
\\Aci-acad\caddrawings\11530\WORK\PHASE 2-3 CONNECTOR WORK MAP FOR HAROLD.dwg