BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF: PETITION OF ELECTRIC ENERGY, INC. FOR A FINDING OF INAPPLICABILITY OR, IN THE ALTERNATIVE, AN ADJUSTED STANDARD FROM 35 ILL. ADMIN. CODE PART 845	AS 21-_____ (Adjusted Standard)

NOTICE OF FILING

To: Pollution Control Board, Attn: Clerk
100 West Randolph Street
James R. Thompson Center, Suite 11-500
Chicago, Illinois 60601-3218

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board the attached Petition of Electric Energy, Inc. for a Finding of Inapplicability or, in the Alternative, an Adjusted Standard from 35 Ill. Admin. Code Part 845, Appearances, and a Certificate of Service, copies of which are herewith served upon you.

/s/ Sarah L. Lode
Sarah L. Lode

Dated: May 11, 2021

SCHIFF HARDIN LLP
Attorney for Petitioner Electric Energy, Inc.
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Bina Joshi
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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 11th day of May 2021:

I have electronically served a true and correct copy of the attached Petition of Electric Energy, Inc. for a Finding of Inapplicability or, in the Alternative, an Adjusted Standard from 35 Ill. Admin. Code Part 845 and Appearances on behalf of Electric Energy, Inc., by electronically filing with the Clerk of the Illinois Pollution Control Board and by e-mail upon the following persons:

Pollution Control Board, Attn: Clerk
100 West Randolph Street
James R. Thompson Center, Suite 11-500
Chicago, Illinois 60601-3218

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
epa.dlc@illinois.gov

My e-mail address is slode@schiffhardin.com;

The number of pages in the e-mail transmission is 729.

The e-mail transmission took place before 5:00 p.m.

/s/ Sarah L. Lode
Sarah L. Lode

Dated: May 11, 2021

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APPEARANCE

I, Bina Joshi, hereby file my appearance in this proceeding on behalf of Electric Energy, Inc.

/s/ Bina Joshi

Bina Joshi
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Dated: May 11, 2021

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AS 21-_____
(Adjusted Standard)

APPEARANCE

I, Sarah L. Lode, hereby file my appearance in this proceeding on behalf of Electric Energy, Inc.

/s/ Sarah L. Lode

Sarah L. Lode
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312-258-5500
slode@schiffhardin.com

Dated: May 11, 2021

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35 ILL. ADMIN. CODE PART 845

AS 21-_____
(Adjusted Standard)

I, Joshua More, hereby file my appearance in this proceeding on behalf of Electric Energy, Inc.

/s/ Joshua More

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312-258-5500
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Dated: May 11, 2021

BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

PETITION OF ELECTRIC ENERGY, INC.
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AS 21-_____
(Adjusted Standard)

PETITION FOR A FINDING OF INAPPLICABILITY OR, IN THE ALTERNATIVE, AN ADJUSTED STANDARD FROM 35 ILL. ADMIN. CODE PART 845

Submitted on behalf of
Electric Energy, Inc.

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ILLINOIS POLLUTION CONTROL BOARD

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PETITION FOR A FINDING OF INAPPLICABILITY OR, IN THE ALTERNATIVE, AN ADJUSTED STANDARD FROM 35 ILL. ADMIN. CODE PART 845

Electric Energy, Inc. ("EEI") requests, by and through its attorneys, Schiff Hardin LLP, and pursuant to Section 28.1 of the Environmental Protection Act (415 Ill. Comp. Stat. 5/28.1), that this Board grant a finding of inapplicability of or, in the alternative, an adjusted standard from 35 Ill. Admin. Code Part 845 to its former Joppa West Ash Pond.

This Petition is divided into five parts. Part I introduces this Petition. Part II summarizes the relevant procedural background and EEI's requested relief. Part III provides the factual background relevant to this Petition. Part IV sets forth EEI's argument for a finding of inapplicability. Part V sets forth the legal standards and support for EEI's request for an adjusted standard. And finally, Part VI concludes the Petition.

I. INTRODUCTION

On April 15, 2021, the Illinois Pollution Control Board ("Board") adopted final rules regulating the disposal of coal combustion residuals ("CCR") in surface impoundments, 35 Ill. Admin. Code Part 845 ("Part 845"), which became effective on April 21, 2021. The former Joppa West Ash Pond ("Joppa West") was incorrectly identified by the Illinois Environmental Protection Agency ("IEPA") during the Part 845 rulemaking as a potential "CCR surface impoundment." Joppa West is not a CCR surface impoundment and the Board should find that Part 845 is, therefore, inapplicable to Joppa West. In the alternative, given the unique characteristics of Joppa West, the Board should grant it an adjustment from of the provisions of Part 845 specified herein.

The Board should find that Part 845 is not applicable to Joppa West because it is not a CCR surface impoundment, the type of unit that is regulated under Part 845. The definition of "CCR surface impoundment" in 415 Ill. Comp. Stat. 5/3.143 of the Illinois Environmental Protection Act (the "Act") and Part 845 is identical to the definition in the Federal Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, 40 C.F.R. Part 257, Subpart D ("Federal CCR Rule"). Joppa West is not regulated under the Federal CCR Rule. The United States Environmental Protection Agency ("U.S. EPA") made it clear that the definition of CCR surface impoundment is not intended to include units, like Joppa West, that no longer contained both CCR and liquids as of October 19, 2015. The Illinois Environmental Protection Agency ("IEPA"), when proposing a definition for CCR surface impoundment, not only defined the term consistent with the Federal CCR Rule, it expressed its intention that Part 845 apply to the same units as the Federal CCR Rule. The Illinois Attorney General has similarly stated its understanding that Part 845, like the Federal CCR Rule, is intended to apply to any CCR surface impoundment in existence as of October 19, 2015. While Joppa West may have formerly been a surface impoundment, it closed in the early 1970s and did not met the definition as of October 19, 2015. As such, Joppa West should not be regulated under Part 845 and, instead, should be regulated under 35 Ill. Admin. Code Part 620. Nonetheless, IEPA has identified Joppa West as a unit that may be regulated under Part 845. R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, IEPA's

Statement of Reasons, at 37 (Mar. 30, 2020), attached as Ex. 15[1]; *see* IEPA, Fee Invoice for Joppa West (Dec. 16, 2019), attached as Ex. 5.

EEI sought revisions during the rulemaking process before the Board to clarify that Part 845 applies to the same units as the Federal CCR Rule (i.e. that it does not apply to units that did not and could not impound liquid as of October 19, 2015) and, therefore, does not apply to Joppa West. *See* R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Dynegy's First Post-Hearing Comments, at 7–9 (Oct. 30, 2020), attached as Ex. 16; R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-filed Testimony of Cynthia Vodopivec, at 7–11 (Aug. 27, 2020), attached as Ex. 17. The Board declined to make Dynegy's proposed revisions but stated in its Second Notice Opinion and Order that "[r]egulatory relief mechanisms are available to owners and operators when they disagree with an IEPA determination concerning whether a unit is a CCR surface impoundment." R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Second Notice, Opinion and Order, at 14 (Feb. 4, 2021), attached as Ex. 19. Accordingly, EEI is bringing this Petition to clarify through a holding from the Board that Joppa West is not a CCR surface impoundment under Part 845.

In the alternative, EEI is seeking an adjusted standard for this unique unit, which should not be subject to the closure requirements in Part 845. Joppa West is distinct from the other CCR units considered by the Board when adopting Part 845. Unlike other units, Joppa West is not

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[1] For all exhibits of R 2020-019 materials, we have provided excerpted documents including the relevant and cited page numbers. The page number cited here—and for all R 2020-019 materials—is the page number of the document, not the page number of the exhibit.

regulated as a CCR surface impoundment under the Federal CCR Rule. Additionally, Joppa West stopped receiving CCR almost 50 years ago and has since been capped by soil, clay, grass, and forest and prairie growth consisting of thick vegetation and dense and mature trees. In its current form, Joppa West is stable, covered by a small forest that is home to significant vegetation and wildlife, and poses no risk to groundwater or surface water. Engaging in the closure actions required under Part 845 at Joppa West will require the decimation of the existing vegetative coverage, ultimately resulting in more environmental harm than good. Accordingly, as an alternative to a finding of inapplicability, EEI is seeking an adjusted standard from the closure requirements of Part 845. EEI's proposed adjusted standard would subject Joppa West to the inspection, post-closure care, groundwater monitoring, and corrective action, and financial assurance requirements of Part 845. Thus, it will ensure Joppa West does no harm to human health or the environment.

The finding of inapplicability or adjusted standard requested in this Petition will result in no greater risk to human health or the environment. The CCR at Joppa West currently presents no human health or environmental risks. Regardless, under both requests, EEI will engage in continued actions to ensure groundwater, surface water, and other resources are not endangered. If the Board makes a finding of inapplicability, Joppa West will still be required to comply with Illinois groundwater quality standards ("GWQS") in 35 Ill. Admin. Code Part 620, and EEI is committed to address any exceedances of Part 620 standards by applying for a groundwater management zone ("GMZ") and engaging in additional actions in accordance with that groundwater management zone, as necessary. Should the Board grant EEI's requested adjusted standard, Joppa West will still be required to perform post-closure care, install an expansive groundwater monitoring network, and perform groundwater corrective action in accordance with

Part 845. Accordingly, under both proposals, EEI will be required to take steps to ensure that Joppa West remains stable and does not pose any potential threat to human health or the environment.

II. PROCEDURAL BACKGROUND AND REQUESTED RELIEF

A. Federal Regulation of CCR

Regulations governing the disposal and cleanup of solid wastes have a long history in the United States. The Resource Conservation and Recovery Act ("RCRA"), which was enacted in 1976, provides a national framework for managing solid and hazardous wastes. The Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), which was enacted in 1980, provides a national framework for responding to releases or threatened releases of contaminants. In April 2015, U.S. EPA published the Federal CCR Rule, covering the disposal of CCRs from electric utilities. *See* Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,302 (Apr. 17, 2015), relevant and excerpted pages attached as Ex. 21. As part of the Federal CCR Rule, U.S. EPA developed national minimum criteria for new and existing CCR landfills and surface impoundments. Among other things, the rule established groundwater monitoring, corrective action, and closure requirements at CCR disposal facilities. In addition, in December 2016, the Water Infrastructure Improvements for the Nation ("WIIN") Act, Pub. L. No 114-322 (2016), was passed and signed into law by the President. The WIIN Act created a process for states to create a permit program or other system for the regulation of CCR surface impoundments, as long as the program is at least as protective as the requirements contained in the Federal CCR Rule. 42 U.S.C. § 6945(d)(1)(B).

B. The 35 Ill. Admin. Code Part 845 Rulemaking

On March 30, 2020, IEPA proposed that the Board adopt new rules governing the disposal of CCR in surface impoundments, to be located at Part 845 of Illinois Administrative Code's Title 35. Ex. 19 at 1. The rulemaking was mandated by Section 22.59 of the Act, under which the Illinois General Assembly directed the Board to adopt rules that would regulate "all existing CCR surface impoundments." 415 Ill. Comp. Stat. 5/22.59(a)(4). Specifically, the General Assembly directed the adoption of rules establishing "construction permit requirements, operating permit requirements, design standards, reporting, financial assurance, and closure and post-closure care requirements for CCR surface impoundments." 415 Ill. Comp. Stat. 5/22.59(g).

CCR units subject to the requirements of Part 845 are identified in section 845.100. 35 Ill. Admin. Code § 845.100(a)–(d); R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Transcript of August 11, 2020 Hearing 41:1–16, attached as Ex. 18. They include "new and existing CCR surface impoundments, including any lateral expansions of CCR surface impoundments that dispose of or otherwise engage in solid waste management of CCR," 35 Ill. Admin. Code § 845.100(b), and a subcategory of CCR surface impoundments called "inactive CCR surface impoundments." *Id.* § 845.100(c). CCR surface impoundments and inactive CCR surface impoundments are defined under the rule as follows:

> "CCR surface impoundment" or "impoundment" means a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the surface impoundment treats, stores, or disposes of CCR. [415 ILCS 5/3.143]
>
> . . .
>
> "Inactive CCR surface impoundment" means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains CCR on or after October 19, 2015. Inactive CCR surface impoundments may be located at an active facility or inactive facility.

Id. § 845.120. Inactive CCR surface impoundments are subject to the requirements in Part 845,[2] including the closure requirements in 35 Ill. Admin. Code sections 845.700 through .770.

IEPA has indicated an intent to regulate Joppa West as an inactive CCR surface impoundment under Part 845. EEI first learned of IEPA's intent to interpret the newly adopted definition of "CCR Surface Impoundment" to include Joppa West in December 2019 when IEPA issued an invoice to EEI for Joppa West pursuant to Section 22.59(j)(1) of the Act for an initial fee associated with CCR surface impoundments. *See* Ex. 5. Shortly thereafter, in March 2020, IEPA filed its Part 845 rulemaking proposal with the Board, identifying EEI as owning or operating two units that "may be affected by the Illinois EPA's proposed rule," again, suggesting that Joppa West is a CCR surface impoundment that would be regulated under Part 845.[3] Ex. 15 at 36–37.

EEI, together with is affiliates Dynegy Midwest Generation, LLC; Illinois Power Generating Company; Illinois Power Resources Generating LLC; and Kincaid Generation, LLC (collectively, "Dynegy"), participated in the rulemaking process before the Board for IEPA's proposed Part 845 (Docket No. R 2020-019). One comment and argument made by Dynegy during the rulemaking process was that the definition of "inactive CCR surface impoundment" should be revised so as to avoid any doubt about whether a unit like Joppa West was covered under the rule and to avoid conflict with the definition of "CCR surface impoundment" under both Illinois and federal law. Ex. 17 at 7–10; Ex. 16 at 7–9. Dynegy's suggested revisions on this point were not made. The Board's Second Notice Opinion and Order noted that in situations where a party

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[2] Though not relevant here, the rule carves out an exception for inactive *closed* CCR Surface impoundments, which do not have to comply with certain monitoring and closure-related requirements in Part 845. 35 Ill. Admin. Code § 845.170.

[3] The other EEI unit, known as the Joppa East Ash Pond, is not at issue in this Petition.

disagreed with IEPA's determination concerning whether a unit is a CCR surface impoundment, regulatory relief mechanisms such as adjusted standards or variances were available from the Board. Ex. 19 at 14. Part 845 became effective on April 21, 2021. R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Adopted Rule, Final Order, Opinion and Order, at 5 (Apr. 15, 2021) ("The Board . . . sets April 21, 2021, as the effective date of Part 845).

C. Automatic Stay of Part 845 to Joppa West

Because EEI filed this Petition for an individual adjusted standard within 20 days after the effective date of Part 845, the operation of Part 845 is automatically stayed as to Joppa West pending the disposition of this Petition. 415 Ill. Comp. Stat. 5/28.1(e).[4]

D. Requested Relief

EEI respectfully requests the Board find that Part 845 is inapplicable to Joppa West and hold as follows:

1. The former Joppa West Ash Pond, located at Joppa Power Plant, 2100 Portland Road, Joppa, Illinois 62953, is not a "CCR surface impoundment" under 35 Ill. Admin. Code § 845.120 and is, therefore, not subject to 35 Ill. Admin. Code Part 845.
2. The former Joppa West Ash Pond shall continue to be subject to the applicable requirements in 35 Ill. Admin. Code Part 620. To the extent necessary to achieve compliance with 35 Ill. Admin. Code Part 620, Electric Energy, Inc. ("EEI") shall apply

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[4] The only exception to this automatic stay is for regulations "adopted by the Board to implement, in whole or in part, the requirements of the federal Clean Air Act, Safe Drinking Water Act or Comprehensive Environmental Response, Compensation and Liability Act, or the State RCRA, UIC or NPDES programs." 415 Ill. Comp. Stat. 5/28.1(e). Part 845 was promulgated to implement Section 22.59 of the Act and federal RCRA, Section 4005. It was not promulgated to implement, in whole or in part, the requirements of the federal Clean Air Act, Safe Drinking Water Act, or CERCLA, or the State RCRA, UIC, or NPDES programs.

for a groundwater management zone ("GMZ") for the former Joppa West Ash Pond in accordance with 35 Ill. Admin. Code § 620.250.

In the alternative, EEI requests that the Board grant an adjusted standard for Joppa West from the applicability of Part 845 as follows:

1. Pursuant to Section 28.1 of the Environmental Protection Act, the Board grants Electric Energy, Inc. ("EEI") an adjusted standard from 35 Ill. Admin. Code Part 845 for the former Joppa West Ash Pond located at Joppa Power Plant, 2100 Portland Road, Joppa, Illinois 62953.
2. The former Joppa West Ash Pond at EEI's Joppa Power Station shall be subject to the requirements in only the following sections of 35 Ill. Admin. Code Part 845:
   a. All of Subpart A.
   b. The following Sections of Subpart B: 845.200; 845.210, 845.220(a), (c), (g)(1); 845.230(c) and (d)(4); 845.240; 845.250; 845.270; 845.280; 845.290
   c. The following Sections of Subpart F: 845.600(a); 845.610; 845.620. 845.630(a)-(e), (g); 845.640; 845.650; 845.660; 845.670, 845.680.
   d. The following Sections of Subpart G: 845.760(h); 845.780(b)–(f).
   e. All of Subpart I.
3. The adjusted standard is effective as of the date of this Order.

As demonstrated herein, the relief requested by EEI in this Petition will have a net environmental benefit as opposed to the blanket application of Part 845 to Joppa West and will be protective of surrounding groundwater and surface water bodies. A finding of inapplicability will clarify that Part 845 does not apply to Joppa West; however, Joppa West will remain subject to the groundwater standards in Part 620. Accordingly, any potential impacts from the CCR at Joppa

West to groundwater can be addressed in accordance with an IEPA approved GMZ under 35 Ill. Admin. Code § 620.250. Under the requested adjusted standard, EEI is simply requesting that Joppa West be exempt from the closure requirements in Part 845 given the unique circumstances of the unit. Post-closure care requirements, groundwater standards, monitoring and corrective action, and financial assurance requirements in Part 845 will continue to apply to Joppa West.

III. FACTUAL BACKGROUND[5]

A. General Plant Description – Joppa Power Plant

Joppa West is located at the Joppa Power Plant, a coal-fired generating power plant, in Massac County, Illinois ("Joppa Plant").[6] The Joppa Plant is located in Section 14, Township 15 North, Range 3 East of the 3rd Meridian. *See* Natural Resource Technology, Phase I Hydrogeological Assessment Report 2-1 (July 23, 2013), attached as Ex. 9. A map showing the location of the Joppa Plant is included in Figure 1-1 of Exhibit 2. 35 Ill. Admin. Code § 104.406(d). Joppa West is located on the east half of Section 15. See John Seymour, Engineering Evaluation of Joppa West Ash Pond at Figure 1-2 (May 2021), attached as Ex. 2. The Joppa Plant was constructed in the early 1950s and started operating in 1953. Joppa West was constructed and used for the disposal of CCR by approximately 1957. Joppa West was closed in the early 1970s upon the construction and use of another ash pond on the east side of the Joppa Plant. Natural Resource Technology, Technical Memorandum No. 1: Class II Groundwater Designation and Replacement Wells, Joppa Ash Ponds 3 (Dec. 7, 2012), attached as Ex. 6; Permit Materials for Joppa East Ash Pond, attached as Ex. 8. Currently, the Joppa Plant employs approximately 115

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[5] EEI reserves the right to supplement or amend its Petition to reflect new or additional information discovered in the course of investigating the facts set forth herein.

[6] The Declaration of Cynthia Vodopivec, attached as Exhibit 1 to this Petition, is provided in support of facts stated herein regarding the Joppa Power Plant and its operation and the former Joppa West Ash Pond.

people. EEI has announced plans to retire the Joppa Plant by September of 2022. *See* Vistra Corp., *Joppa Plant to Close in 2022 as Company Transitions to a Cleaner Future* (Apr. 6, 2021), https://www.prnewswire.com/news-releases/joppa-power-plant-to-close-in-2022-as-company-transitions-to-a-cleaner-future-301263013.html.

B. The Former Joppa West Ash Pond

1. Joppa West Description and Geography

Joppa West consists of approximately 103.5 acres, including 79 acres of the former ash pond's disposal area (the "Disposal Area"), a concurrently constructed adjacent area to the south of the Disposal Area (the "Settling Area") consisting of approximately 17 acres, and a 7.5 acre area consisting of crest roadways including the perimeter of Joppa West and separator dikes. Ex. 2 at 2. The area between the Disposal Area and Settling Area is separated by a dike. *Id.* A map showing the location of Joppa West is included as Figure 1-2 of Exhibit 2. Joppa West was closed in place after it stopped receiving CCR in the early 1970s. At that time, there were no regulations governing the closure of CCR surface impoundments, as it was well before the promulgation of the Federal CCR Rule and even before the enactment of RCRA 42 U.S.C. §§ 6901 *et seq*. (effective October 21, 1976). The base elevation of CCR in Joppa West ranges from approximately 305 feet to 350 feet. Brian Hennings, Joppa West Groundwater Evaluation at 6 (May 11, 2021), attached as Ex. 3. The unit is estimated to hold approximately 3,400,000 cubic yards of CCR. Ex. 2 at 15. The CCR contained in Joppa West is a combination of bottom ash and fly ash.

In addition to having closed almost 50 years ago, Joppa West has some unique physical characteristics. This includes a gas pipeline that is buried along the southern margin of the unit and serves a power generating station to the west of Joppa West. *Id.* at 9, 10. Additionally, several transmission lines cross Joppa West and several towers and power poles associated with those lines are located upon Joppa West. *Id.* These are owned and operated by a third party.

The Joppa Plant is located at the southern boundary of the Illinois Basin and the northern edge of the Mississippi Embayment in a relatively low-lying area. Ex. 3 at 7. Groundwater generally flows from north to south at Joppa West, from topographically elevated areas at the north end of the unit towards the Ohio River, which is topographically lower. Andrew Bittner, Human Health and Ecological Risk Evaluation and Relative Impact Assessment at 7 (May 11, 2021), attached as Ex. 4. Joppa West and the area in its vicinity include three hydrostratigraphic units. The uppermost unit (referred to here as the "Upper Confining Unit" or "UCU") is approximately 50-feet thick and is comprised of clay and silty clay with minor intervals of sandy material. Ex. 3 at 8. Groundwater in this layer qualifies as Class II general resource groundwater under 35 Ill. Admin. Code section 620.220.[7] *Id.* The next layer consists of the "uppermost aquifer" as that term is defined under the Federal CCR Rule and 35 Ill. Admin. Code section 845.120, and groundwater in this area qualifies as Class I potable resource groundwater under 35 Ill. Admin. Code section 620.210. *Id.* The final layer, below the uppermost aquifer, is another aquifer layer referred to as the Bedrock Groundwater Unit. *Id.*; Ex. 4 at 6.

2. Joppa West Is Maintained with a Cap and Is Not Designed to Impound Water

Joppa West is not designed to impound water nor has it been since October 19, 2015, and it is capped or otherwise maintained. Ex. 17 at 10; Ex. 2 at 6, 10, 11, 12, 18. After Joppa West stopped receiving CCR in the early 1970s, it developed a layer of coverage consisting of soil and vegetation, and its design changed so that it can no longer hold water.

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[7] As explained by Mr. Hennings in Exhibit 3, this upper-50-foot layer has a hydraulic conductivity of less than 1 x 10^{-4} cm/s and does not meet the qualifications of Class I groundwater as set forth 35 Ill. Admin. Code section 620.210. Ex. 3 at 10.

Joppa West is covered by a cap. Its cap consists of a soil layer ranging in depth from one to two inches to up to fifteen inches in certain areas (primarily the transmission corridor), vegetation, shrubs, and trees. Ex. 2 at 6, 18. After Joppa West stopped receiving CCR in the early 1970s, soil and clay were used to cover power line and pipe corridors crossing the unit. The surface of the Disposal Area was graded to avoid standing water and ponding and to provide for a positive discharge of liquids. *Id.* at 6. Sediments from the Ohio River were placed along the western portion of the Disposal Area. *Id.* at 4. Additionally, the Settling Area was filled and covered with soil and clay in certain areas. *Id.* at 6. The Settling Area was also graded to drain and avoid impounding water. *Id.* at 4. Grass vegetation was established in certain areas of Joppa West and over the years additional areas were naturally vegetated. *Id.* at 3.

Aerials of Joppa West, show the extent of vegetative coverage at the unit. These photographs show the existence of the vegetative cap on Joppa West since 2015. *Id.* at Figure 2-7. Photos and aerials of Joppa West after 2015 show continuing thick vegetation coverage, including large trees with trunk diameters of more than 18 inches. Ex. 17 at 9–10; Ex. 2 at Figure 2-4.

A recent site inspection conducted at Joppa West by Geosyntec Consultants in March of 2021 observed no evidence of erosion at the unit and observed that the vegetative cap on top of Joppa West remains stable. Ex. 2 at 11–13. That inspection found that topsoil currently covers essentially the entire surface of Joppa West, as well as the dike slopes surrounding the perimeter of Joppa West. *Id.* at 2. Additionally, it observed that the entirety of Joppa West "is vegetated with well-developed grasses in the transmission corridors and volunteer vegetation comprised of a mixture of shrubs and trees in the remaining forested areas." *Id.* at 7. In the forested areas, the floor cover of Joppa West is shielded by canopy created by trees and accumulated leaf materials and topsoil. *Id.* The inspection further observed that the dike slopes surrounding Joppa West are stable, not subject to erosion, and remain vegetated with a combination of grass, shrubs, and small trees. *Id.* at 7–8.

Joppa West does not and is not designed to impound water. As described above, the design of Joppa West was changed upon closure, and it was graded to prevent standing water and to promote drainage. *Id.* at 2. Aerials going back to 2015 and the recent site inspection demonstrate a lack of impounded water at Joppa West since at least 2015 and demonstrate that the surface is generally graded to facilitate surface water drainage. *Id.* at 2–3, Figures 2-4, 2-7. Plant personnel who annually inspect Joppa West and who maintain Joppa West similarly have not observed impounding at the unit. A recent investigation of Joppa West also shows the phreatic surface (depth to water) within Joppa West is greater than 10 feet below land surface and approximately 4-feet lower than upgradient groundwater elevations, again, demonstrating there is no impounding of water. Ex. 3 at 8.

EEI has engaged in actions to preserve and maintain the cap at Joppa West and to ensure its historic and continued stability. No digging or clearing activities occur on Joppa West in order to preserve and maintain the existing cover. The vegetative cover is allowed to grow without disturbance, with the exception of some mowing that occurs along the road at the perimeter of Joppa West and under transmission lines in order to allow access for necessary inspections and maintenance activities. Additionally, EEI conducts annual inspections of the diked area around the perimeter of Joppa West to look for erosion or other issues requiring repairs. Over the course of these inspections no erosion or other failures requiring repairs have been observed by the company.

3. Groundwater Sampling and Analysis at Joppa West

Groundwater monitoring conducted at Joppa West has shown CCR contaminants associated with Joppa West are not present in groundwater at levels above regulatory limits, with the exception of boron and sulfate readings at one well. Groundwater monitoring from seven wells, for the inorganic parameters listed in 35 Ill. Admin. Code § 620.410,[8] was conducted at Joppa West between 2010 and 2013. Ex. 9 at 3-2. Groundwater samples during this investigation were analyzed and compared to the GWQS for Class II groundwater in 35 Ill. Admin. Code section 620.420. *Id.* at 5-1–5-2. This sampling found pH exceedances at two monitoring wells and boron exceedances at one monitoring well. *Id.* The pH exceedances were determined to not be associated with coal ash leachate, as that tends to be alkaline. *Id.* Thus, the boron exceedances were the only exceedances potentially related to CCR at Joppa West. *Id.* at 5-2–5-4. The three boron exceedances had concentrations ranging from 3.1 to 3.3 mg/L[9] and occurred at monitoring well G112C, located just south of the southern tip of Joppa West. *Id.* Notably, these boron exceedances were observed in the UCU layer, indicating that they did not impact any potable water source.

Additional groundwater sampling was completed at Joppa West in March 2021. As part of this investigation, the monitoring wells surrounding Joppa West that were previously sampled were redeveloped and five temporary monitoring wells were added. Ex. 3 at 4, Attachment 2 (2021 Field Activities). These additional wells were located in areas selected to evaluate the presence or absence of CCR impacts to water downgradient of Joppa West. *Id.* at 11, Attachment 2. The majority of the wells were screened along the sides or downgradient of Joppa West in the

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[8] The sampling included the parameters in 35 Ill. Admin. Code § 620.410 at the time the groundwater monitoring plan was developed and approved in 2010. *See* Hanson Professional Services, Inc., Ash Pond Hydrogeological Assessment Plan, at 2 (March 2010), attached as Ex. 13.

[9] The Class II GWQS for boron is 2 mg/L. 35 Ill. Admin. Code § 620.420(a)(2).

UCU. *Id.* at 11. One well located south (downgradient) of Joppa West was also screened in the uppermost aquifer. *Id.* Groundwater data was compared to both the standards in 35 Ill. Admin. Code section 620.410 (Class I groundwater standards) and 35 Ill. Admin. Code section 845.600 (groundwater protection standards applicable under Part 845). *Id.* at 15.

Under the March 2021 sampling, again, the only exceedances attributable to CCR from Joppa West occurred at well G112C, where boron and sulfate exceedances were detected in the UCU. The four boron exceedances detected at G112C ranged from 3.09mg/L to 4.25mg/L. Ex. 3 at Table 4. Only one sulfate exceedance was detected at G112C at a level of 532 mg/L. *Id.* The remaining sulfate values detected at the well were well below the sulfate limit and ranged from 60-66mg/L. *Id.* Both in 2013 and today, G112C is the only well outside the limits of Joppa West that was found to have groundwater impacts potentially attributable to CCR from Joppa West.

The boron and sulfate found at monitoring well G112C does not present a risk to human health or the environment. The exceedances found at G112C were located in the UCU, which is not a viable source of potable water. *Id.* at 3, 8. Sampling conducted at greater depths, which could serve as a source of potable water, did not show any exceedances of boron, sulfate, or any other constituents related to CCR at Joppa West. Specifically, groundwater was collected in the uppermost aquifer area at a well that is also located south (downgradient) of Joppa West, well TPZ117D. Sampling results from TPZ117D did not show any impacts from CCR in the uppermost aquifer area. *Id.* at 16. Analysis conducted of groundwater at Joppa West has shown that CCR constituents in groundwater are stable and that groundwater flow conditions in and near Joppa West have reached a state of equilibrium in the almost 50 years since it was closed. *Id.* at 4, 16. Additionally, a well survey was conducted to identify private, semi-private, and non-community water supply wells within a 2,500-foot radius of the Joppa Plant; community water supply wells and surface water intakes within one mile of the Joppa Plant; and wellhead protection areas within the property boundaries of Joppa West. The well survey found there are no wells serving as potable water sources that are downgradient of and potentially impacted by Joppa West. Ex. 4 at 14.

IV. JOPPA WEST IS NOT A CCR SURFACE IMPOUNDMENT

A. Part 845 is Inapplicable to Joppa West

Joppa West should not be considered a "CCR surface impoundment" for purposes of 35 Ill. Admin. Code Part 845, because it does not meet that term's definition. The Board has held that an adjusted standard petition can, in the alternative, seek a finding of inapplicability. *See, e.g.*, *In re Petition of Jo Lyn and Falcon Waste and Recycling Inc. for an Adjusted Standard from 35 Ill. Admin. Code 807.103 and 35 Ill. Admin. Code 810.103, or in the Alternative a Finding of Inapplicability*, AS 2004-002 (Apr. 7, 2005); *In re Petition of Illinois Wood Energy Partners, L.P. for an Adjusted Standard from 35 Ill. Admin. Code 807 or, in the alternative, a Finding of Inapplicability*, AS 1994-001 (October 6, 1994). Accordingly, EEI seeks a finding by the Board that Joppa West is not a "CCR surface impoundment" and that Part 845, therefore, does not apply.

1. Joppa West Does Not Meet the Definition of CCR Surface Impoundment

Joppa West does not meet the plain meaning of the term "CCR surface impoundment," the unit regulated under Part 845. 35 Ill. Admin. Code § 845.100. That term is defined as

> a natural topographic depression, man-made excavation, or diked area, that *is designed* to hold an accumulation of CCR *and liquids*, and the surface impoundment treats, stores, or disposes of CCR. [415 ILCS 5/3.143]

35 Ill. Admin. Code § 845.120 (emphasis added). The definition speaks to the present tense design of a unit to "hold an accumulation of . . . liquids." Joppa West is not "designed to hold an accumulation of . . . liquids" and has not been since before October 19, 2015. Ex. 2 at 10, 18; Ex. 3 at 8; *supra* at 14-17. Accordingly, it cannot be a CCR surface impoundment subject to Part 845.

The effect of the present tense language in the definition of CCR surface impoundment is to exclude requiring already closed units, such as Joppa West, that are no longer able to hold an accumulation of liquids, to reclose. This was made clear by U.S. EPA when promulgating the Federal CCR Rule, under which the term "CCR surface impoundment" is defined identically to Part 845 and the Act. 40 C.F.R. § 257.53 (defining CCR surface impoundment as "a natural topographic depression, man-made excavation, or diked area, which *is designed* to hold an accumulation of CCR *and liquids*, and the unit treats, stores, or disposes of CCR." (emphasis added)). U.S. EPA made clear in the preamble to the Federal CCR Rule its intention to avoid regulating units that were already closed and can no longer impound liquid.

> EPA did not propose to require "closed" surface impoundments to "reclose." *Nor did EPA intend, as the same commenters claim, that "literally hundreds of previously closed . . . surface impoundments—many of which were properly closed decades ago under state solid waste programs, have changed owners, and now have structures built on top of them—would be considered active CCR units.*" Accordingly, the final rule does not impose any requirements on any CCR surface impoundments that have in fact 'closed' before the rule's effective date—*i.e., those that no longer contain water and can no longer impound liquid.*

Ex. 21 at 21,343 (Apr. 17, 2015). U.S. EPA explained that it chose not to regulate "closed" surface impoundments because they are "capped or otherwise maintained" and "can no longer impound water," although they may continue to contain CCR after October 19, 2015, the effective date of the Federal CCR Rule. *Id.* at 21,343.

In other words, U.S. EPA had no intention that CCR surface impoundments under the Federal CCR rule would include units that were no longer designed to hold an accumulation of liquids as of October 19, 2015. The Federal CCR Rule, U.S. EPA explained, was designed to address units that pose the highest level of risk: "units that contain a large amount of CCR *managed with water*, under a hydraulic head that promotes the rapid leaching of contaminants." *Id.* at 21,357 (emphasis added). The term "CCR surface impoundment" and the Federal CCR Rule does not, therefore, cover units like Joppa West that "'closed' before the rule's effective date [October 19, 2015]—i.e., those that no longer contain water and can no longer impound liquid." *Id.* at 21,343.

Given the identical definitions of "CCR surface impoundment" in Part 845 and the Federal CCR Rule, it only makes sense that Part 845 should be interpreted to govern the same units as the Federal CCR Rule. Namely, if a unit is no longer designed to impound liquids as of October 19, 2015, it cannot meet the definition of CCR surface impoundment under Part 845 and be regulated under the same. In fact, IEPA, who proposed the now adopted definition of CCR surface impoundment in Part 845, explicitly stated that its intent was for Part 845 to regulate the same scope of units as the Federal CCR Rule. R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, IEPA's Pre-Filed Answers, at 17 (Aug. 3, 2020), attached as Ex. 7 ("CCR surface impoundments not subject to Part 257, are not subject to the requirements of Part 845. (Agency Response)"); *id.* at 7–8 ("Section 22.59(g)(1) of the Act requires that the rules adopted pursuant to Section 22.59(g), be as protective and comprehensive as Subpart D of 40 CFR 257 governing CCR surface impoundments. It is the Agency's position that the same universe of CCR surface impoundments is intended to be regulated by Part 845."); s*ee also* Ex. 18 at 43:1–44:24 (noting that it was IEPA's intention that "CCR surface impoundment" be defined the same as the Federal CCR Rule and that Part 845 is intended to apply to the same ponds that are subject to requirements under Part 257). The Attorney General has similarly concurred that Part 845 is intended to be applied to the same scope of CCR surface impoundments as the Federal CCR Rule. R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Office of the Attorney General's Comments in Response to Ameren's

Proposed Modifications to the Joint Committee on Administrative Rules, at 5 (Apr. 7, 2021), attached as Ex. 20 (noting "the Board's regulations have the same temporal scope as the federal Part 257 regulations" meaning CCR surface impoundments in existence as of October 19, 2015, are regulated under Part 845).

Furthermore, IEPA has acknowledged that Joppa West is not regulated under the Federal CCR Rule. In its February 11, 2021, comments to U.S. EPA on the advance notice of proposed rulemaking for legacy CCR surface impoundments, IEPA identified Joppa West as a unit that is unambiguously not regulated under the Federal CCR Rule and, therefore, consistent with IEPA and the AG's previous statements, it is not regulated by Part 845.[10] *See* IEPA's Comments on Advanced Notice of Proposed Rulemaking for Hazardous and Solid Waste Management System, at 3 & Attachment: USEPA Comments Table Legacy Pond (Feb. 11, 2021), attached as Ex. 10.

For these reasons, Joppa West does not meet the definition of a CCR surface impoundment under Part 845, and the requirements in Part 845 are, therefore, inapplicable to Joppa West.

2. Regulating Joppa West as an Inactive CCR Surface Impoundment under Part 845 Would Be Inconsistent with the Definition of "CCR Surface Impoundment" in the Act, Part 845, and the Federal CCR Rule

Part 845 regulates three subgroups of CCR surface impoundments: "new CCR surface impoundments," "existing CCR surface impoundments," and "inactive CCR surface impoundments." 35 Ill. Admin. Code § 845.100. The definitions of both "new" and "existing"

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[10] In further support of the fact that the Federal CCR Rule does not apply to Joppa, the Indiana Office of Environmental Adjudication recently rejected an attempted argument that a portion of a former Duke Energy ash pond—which like Joppa has been closed for decades—was subject to the Federal CCR Rule, stating that "an impoundment's regulatory status over three decades ago is not relevant to determining whether it is currently subject to the Federal CCR Rule." *In the Matter of Objection to the Issuance of Partial Approval of Closure/Post Closure Plan Duke Gallagher Generating Station Ash Pond System*, No. 20-S-J-5096, at 14 ¶ 38 (OEA May 4, 2021), attached Ex. 14. What matters is whether Joppa West was a CCR surface impoundment as of October 19, 2015.

CCR surface impoundment require that CCR be placed in the unit after October 19, 2015. 35 Ill. Admin. Code § 845.120. Having stopped the receipt of any CCR in the early 1970s, Joppa West does not meet the definition of a new or existing CCR surface impoundment under Part 845. Further, Joppa West does not meet the definition of an "inactive" CCR surface impoundment. To be an inactive CCR surface impoundment (or any of the three subcategories of CCR surface impoundment) ***<u>a unit first has to meet the definition of CCR surface impoundment</u>***. As discussed *supra* at 19-22, Joppa West does not and, therefore, cannot be regulated as an inactive CCR surface impoundment under Part 845.

Despite consistency between the definitions of CCR surface impoundment under the Act and Part 845 on the one hand and the Federal CCR Rule on the other, Part 845's definition of inactive CCR surface impoundment differs from the federal definition. Consistent with the definition of CCR surface impoundment and U.S. EPA's intent to not require units to reclose, the Federal CCR Rule, defines "inactive CCR surface impoundment" as a CCR surface impoundment that "still contains both CCR *and liquids* on or after October 19, 2015." 40 C.F.R. § 257.53 (emphasis added). Unlike the Federal CCR Rule, Part 845's definition of inactive CCR surface impoundment excludes a reference to the presence of liquids. *See* 35 Ill. Admin. Code § 845.120 ("'Inactive CCR surface impoundment' means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains CCR on or after October 19, 2015. Inactive CCR surface impoundments may be located at an active facility or inactive facility."). This results in potential confusion about the applicability of Part 845 to a unit like Joppa West, which contains CCR but no longer contains liquids and is no longer designed to impound liquids, when the definition of inactive CCR surface impoundment is viewed in isolation.

However, the definition of inactive CCR surface impoundment cannot be viewed and applied in isolation but must be read together with the definition of CCR surface impoundment. While section 845.120 does not require that an inactive CCR surface impoundment contain liquids like section 257.53 of the Federal CCR Rule, a unit must still be <u>designed to hold liquids</u> to qualify as an inactive CCR surface impoundment under Part 845. Because, as the Board explained, to be an inactive CCR surface impoundment, a unit must first be a CCR surface impoundment. Ex. 19 at 16 ("The Board notes that for an impoundment to be an inactive surface impoundment, *first it must be a CCR surface impoundment*, which is defined in Section 845.120 as being *designed to 'hold CCR and liquid*.' The next condition is that CCR should have been placed in the impoundment before but not after October 19, 2015 and still contains CCR on or after October 19, 2015. *See* 35 Ill. Admin. Code 845.120."). Thus, if a unit is not designed to hold liquids as of October 19, 2015, then it is not regulated under Part 845. A contrary interpretation would result in the Part 845 definition of inactive CCR surface impoundment being inconsistent with the definition of CCR surface impoundment in the Act, Part 845, and the Federal CCR Rule.

As acknowledged by IEPA, Joppa West is not regulated by U.S. EPA under the Federal CCR Rule. Further, Joppa West does not meet the definition of a CCR surface impoundment under Part 845 because its design changed such that it could no longer hold liquids prior to October 19, 2015. If it does not meet the baseline definition of CCR surface impoundment, Joppa West cannot be an inactive CCR surface impoundment under Part 845. Accordingly, Joppa West should not be regulated under Part 845, and the Board should hold that Part 845 is inapplicable to Joppa West.

B. Joppa West is Regulated under Part 620

Part 845’s inapplicability to Joppa West will not exempt Joppa West from regulation nor will it result in any additional risk. The groundwater quality standards in 35 Ill. Admin. Part 620 still apply.

Joppa West poses minimal risk to human health or the environment given its cap and the fact that it cannot impound liquids. The only CCR contaminants found in groundwater at levels above regulatory limits are boron and sulfate. The boron and sulfate found at monitoring well G112C do not present a risk to human health or the environment. Namely, the constituents are not located in groundwater that is a viable potable water source. Ex. 3 at 3, 8. There are no impacts observed or expected by CCR in the uppermost aquifer layer in the vicinity of Joppa West. *Id.* at 3. While no CCR impacts from Joppa West to the Ohio River have been observed or measured, it is notable that the Ohio River, which is downgradient from Joppa West, does not serve as a source of drinking water. Ex. 4 at 15. Additionally, Joppa West does not pose any ecological risks. *Id.* at 16, 26–27 (noting there are no ecological receptors associated with groundwater and that Joppa West poses no ecological risk to its neighboring surface water body, the Ohio River).

That said, EEI’s request for inapplicability specifically acknowledges that EEI will engage in actions as necessary to ensure compliance at Joppa West with applicable groundwater standards in 35 Ill. Admin. Code Part 620. Accordingly, EEI’s requested relief proposes to develop a groundwater management plan (“GMZ”) under 35 Ill. Admin. Code section 620.250 to address groundwater, as necessary. Accordingly, any potential impacts to groundwater from Joppa West will be addressed.

Given that Joppa West does not meet the definition of CCR surface impoundment and will continue to exist in a manner that is protective of human health and the environment, EEI respectfully requests the Board hold that Part 845 is inapplicable to Joppa West.

V. PETITION FOR ADJUSTED STANDARD

A. Legal Standard

As an alternative to a finding of inapplicability, EEI requests that the Board grant an adjusted standard based on the unique characteristics of Joppa West.

The Board may adopt substantive regulations specific to individual persons or sites. 415 Ill. Comp. Stat. 5/27(a). When petitioned, the Board may grant an adjusted standard from a rule of general applicability for persons who can justify such an adjustment is consistent with applicable regulations. 415 Ill. Comp. Stat. 5/28.1(a). The rule of general applicability for which EEI is requesting an adjusted standard is 35 Ill. Admin. Code Part 845—Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments. The Board may grant EEI's request for an adjusted standard if EEI sufficiently proves that all Section 27(a) and 28.1(c) requirements and considerations are satisfied. 415 Ill. Comp. Stat. 5/28.1(a), (c).

1. Requirements of a Section 28.1(c) Adjusted Standard

While Part 845 does not specify a level of justification required of a petitioner for adjusted standard forth in Section 28.1(b), the Board may grant a Petition for Adjusted Standard when the petitioner provides adequate proof of all of the following criteria, as set forth in Section 28.1(c)(1)–(4) of the Act: "(1) factors relating to that petitioner are substantially and significantly different from the factors relied upon by the Board in adopting [Part 845]; (2) the existence of those factors justifies an adjusted standard; (3) the requested standard will not result in environmental or health effects substantially and significantly more adverse than the effects considered by the Board in adopting [Part 845]; and (4) the adjusted standard is consistent with any applicable federal law." 415 Ill. Comp. Stat. 5/28.1(c).

2. Section 27(a) Requirements for an Adjusted Standard

Under Section 27(a), as incorporated in the criteria for granting adjusted standards by Section 28.1(a), when granting an adjusted standard "the Board shall take into account the [1] existing physical conditions [of the site], [2] the character of the area involved, [including the] surrounding land uses, [3] zoning classifications, [4] the nature of the . . . receiving body of water, . . . and [5] the technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution." 415 Ill. Comp. Stat. 5/27(a); *see also* 415 Ill. Comp. Stat. 5/28.1(a); 35 Ill. Admin. Code § 104.428(a) ("The Board may grant an adjusted standard for persons who can justify such an adjustment consistent with Section 27(a) of the Act. [415 ILCS 5/28.1(a)]").

B. Discussion

EEI requests an adjusted standard from Part 845 for Joppa West. As described below, EEI's proposed adjusted standard is justified. Several factors make Joppa West unique from the other units regulated under Part 845. Further, EEI's proposal will be just as, and likely more, protective of human health and the environment, while avoiding unnecessary costs as well as forest and wildlife disturbance.

1. Description of Adjusted Standard

Petitioner proposes the following adjusted standard for Joppa West:

1. Pursuant to Section 28.1 of the Environmental Protection Act, the Board grants Electric Energy, Inc.("EEI") an adjusted standard from 35 Ill. Admin. Code Part 845 for the former Joppa West Ash Pond located at Joppa Power Plant, 2100 Portland Road, Joppa, Illinois 62953.
2. The former Joppa West Ash Pond at EEI's Joppa Power Station shall be subject to the requirements in only the following sections of 35 Ill. Admin. Code Part 845:
    a. All of Subpart A.

   b. The following Sections of Subpart B: 845.200; 845.210, 845.220(a), (c), (g)(1); 845.230(c) and (d)(4); 845.240; 845.250; 845.270; 845.280; 845.290
   c. The following Sections of Subpart F: 845.600(a); 845.610; 845.620. 845.630(a)-(e), (g); 845.640; 845.650; 845.660; 845.670, 845.680.
   d. The following Sections of Subpart G: 845.760(h); 845.780(b) – (f).
   e. All of Subpart I.

3. The adjusted standard is effective as of the date of this order.

See 35 Ill. Admin. Code § 104.406(f).

2. The Factors Relating to Joppa West Are Substantially and Significantly Different from the Factors and Circumstances the Board Relied on in Adopting Part 845

As required by Section 28.1(c)(1), "factors relating to [Joppa West] are substantially and significantly different from the factors relied upon by the Board in adopting" Part 845. 415 Ill. Comp. Stat. 5/28.1(c)(1).

Factually, Joppa West is distinct from the other units regulated under Part 845. As an initial matter, as discussed above, unlike other units regulated under Part 845, Joppa West is not regulated under the Federal CCR Rule. *See* Ex. 10, Attachment. As a result, while other units subject to the Federal CCR Rule have had time to start taking steps to come into compliance with similar requirements under Part 845, Joppa West has not had the same benefit. Further, IEPA relied upon U.S. EPA's technical feasibility and economic reasonableness determination for the Federal CCR Rule when adopting Part 845 and did not consider factors specific to a unit like Joppa West (i.e. one that is not subject to the Federal CCR Rule) when addressing these factors in the Part 845 rulemaking. Ex. 15 at 33–34 ("owners and operators of CCR surface impoundments are already subject to 40 CFR 257, [so] many of the technical and economic requirements applicable to owners and operators in the proposed Part 845 are already required under federal law."). Additionally, as of the effective date of Part 845 and RCRA, Joppa West was closed. When closed in the early 1970s, no regulatory requirements for the pond closure existed. Ex. 10 at 3.

Further, unlike most other units considered for the Part 845 rulemaking, Joppa West has been inactive for over 50 years and is stabilized under a layer of placed and natural cover that includes trees and other dense vegetation. As the table in Ex. 10 demonstrates, it is one of only two units that EEI is aware of that IEPA has identified as being subject to Part 845 that stopped receiving CCR and closed more than 40 years ago, before any regulations potentially governing closure were adopted. *See* R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-Filed Testimony of Gary P. King, at 15–16 (Aug. 27, 2020), attached as Ex. 12 (noting Ameren's Old Meredosia Plant also closed in the early 1970s); *see also* Ex. 10. It is also among the rare units to contain tree coverage. Ex. 10, Attachment (listing certain historical ash ponds, identifying only two others with tree coverage).

In fact, virtually all of Joppa West is covered with forest, grassland, and shrubs consisting of a variety of plant life and wildlife. Ex. 2 at 18. Approximately 45% of Joppa West is covered with mature bottomland forests and another approximately 20% of Joppa West is covered with early successional forest and shrubs. *Id.* at 7, 10. The remainder of Joppa West is largely maintained as a right-of-way but, similarly, is home to abundant vegetation including prairie grasses and forbs. *Id.* at 4, 6, 10. Finally, Joppa West also serves as home to wildlife. The U.S. Fish and Wildlife Service has indicated the federally endangered Indiana bat and the federally threatened northern long-eared bat as potentially present in the forest area at Joppa West, noting that in the summer these bats prefer roosting in in areas similar to the bottomland forest located at Joppa West. *Id.* at 9.

Unlike other units considered in promulgating Part 845, requiring closure at Joppa West under Part 845 will result in environmental harm from digging up the existing forest. Ex. 4 at 44–46. It will result in a loss of plant life, a habitat for wildlife, and the carbon sequestration benefits of the existing vegetation. *Id.* It will also result in greater costs associated with closure activities than other units are likely to experience due to the costs associated with removing the vegetation at the unit. It is estimated that vegetation removal at Joppa West will cost approximately $2,600,000. Ex. 2 at 14, 17.

Other physical characteristics and challenges at Joppa West also make it unique. This includes the presence of several transmission towers, owned and operated by a third party, that will require special considerations and result in technical challenges in the event of closure under Part 845. *Id.* at 13, 15–16.

Thus, factors such as the inapplicability of the Federal CCR Rule, historical closure, the presence of an existing well-developed vegetative cap (including the forested and prairie areas and habitat for threatened and endangered bat species), and the presence of the transmission towers, make the facts and circumstances at Joppa West unique from those generally relied upon in the Part 845 rulemaking. Furthermore, the costs, both financial and environmental, of removing approximately 100 acres of vegetation are unique to Joppa West.

3. The Factors Relating to Joppa West Ash Pond—which Differ from those Relied upon by the Board in Passing Part 845—Justify an Adjusted Standard

As required by Section 28.1(c)(2), "the existence of those factors [relating to Joppa West] justifies an adjusted standard." 415 Ill. Comp. Stat. 5/28.1(c)(2); 35 Ill. Admin. Code §§ 104.406(h), 104.428(a).

Given the number of years that have passed since Joppa West closed, the stability of and minimal risk posed by Joppa West under its current natural cap, and environmental harm that will result from requiring EEI to dig up the current vegetative coverage at Joppa West, the adjusted standard is justified. Engaging in closure activities under Part 845 may have some environmental benefit by addressing potential infiltration of CCR to groundwater. Ex. 4 at 36. However, the benefit of such activities will be minimal, particularly when compared to the other adverse impacts closure activities will have. This includes the negative impacts of destroying nearly 100 acres of vegetation, including habitat for threatened and endangered bat species, and eliminating the carbon sequestration benefits of that vegetation. *Id.* at 44–46. It will also result in approximately $2,600,000 in costs associated with clearing vegetation, which are costs that will not be required for the closure of other CCR surface impoundments. Ex. 2 at 14, 17. Additionally, any benefit obtained by addressing the risk of infiltration through closure under Part 845 can also be achieved through groundwater monitoring, corrective action, and post-closure care under Part 845, without having to disrupt this stable unit and it's nearly 50 years of forest growth.

Accordingly, the unique characteristics of Joppa West justify the adjusted standard.

4. The Adjusted Standard Requested by EEI Will Result in a Net Benefit to Human Health and the Environment as Compared to Requiring Closure of Joppa West under Part 845

As required by Section 28.1(c)(3), Petitioner's requested adjusted standard "will not result in environmental or health effects substantially and significantly more adverse than the effects considered by the Board in adopting" Part 845. 415 Ill. Comp. Stat. 5/28.1(c)(3). In fact, EEI's requested relief will have a net environmental benefit.

As discussed, *supra* at 29-30, if Joppa West is required to close under Part 845, it will require removal of thick forest and prairie vegetation that has grown there over approximately the past 50 years. See Ex. 2 at 14, 16. In addition, destroying the approximately 100 acres of vegetation at Joppa West will destroy a habitat for the endangered Indiana bat and threatened northern long-eared bat[11] and eliminate the carbon sequestration benefits from the existing vegetation. *Id.*; Ex. 4 at 44–46. Such closure will also result in adverse air quality impacts associated with construction activities, adverse worker safety impacts, and an increased potential for community nuisance impacts. *Id.* at 38–44. If Joppa West is allowed to close with its current cover, it will avoid these negative impacts and will not otherwise impede Part 845's goal of avoiding adverse effects on health or the environment.

Allowing Joppa to close with its existing cover will not pose a human health risk. Joppa West no longer impounds water. Ex. 2 at 6, 10, 11, 12, 18; Ex. 3 at 8. It poses little risk of leaching or runoff to groundwater or surface water bodies. Groundwater monitoring has shown no exceedances of CCR-related contaminants, with the exception of boron and sulfate at one monitoring well, G112C. *Id.* at 4. The exceedances found are not in any viable potable water source. *Id.* at 3, 8; Ex. 4 at 8–10. Monitoring at all of the wells surrounding Joppa West, other than at G112C, including a downgradient monitoring well closest to the Ohio River did not find any exceedances of boron, sulfate, or any other constituent associated with CCR from Joppa West. Ex. 3 at 15–16; Ex. 4 at 8–10. The groundwater impacts of CCR observed at well G112C occurred in the shallow UCU layer, which is not a viable source of potable water and does not pose a risk to human health. Ex. 3 at 3, 8; Ex. 4 at 13–14. No downstream impacts of CCR from Joppa West have been observed in the uppermost aquifer, indicating there is minimal hydraulic connectivity between Joppa West and the shallowest usable water bearing unit. Ex. 3 at 3, 4; Ex. 4 at 15. Significantly, there are no potential groundwater receptors in the vicinity of Joppa West. A well

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[11] It is possible that destruction of this habitat could require an incidental take permit and habitat conservation plan under Section 10 of the Endangered Species Act. This would require the expenditure of even further costs and time and could interfere with the ability to meet regulatory deadlines related to closure under Part 845 at Joppa West.

survey showed that there are no wells that use groundwater as a source of drinking water that are potentially impacted by Joppa West. Ex. 4 at 13–15.

In addition to not posing a risk to human health through potable groundwater, Joppa West presents no risk to human health through the Ohio River. While it is possible that groundwater containing CCR constituents from Joppa West could potentially interface with surface water in the Ohio River, it is unlikely that there is any migration of groundwater impacted with CCR from Joppa West underneath or beyond the river. *Id.* at 7. Additionally, there is no risk of residential exposure from the Ohio River because it is not used as a source of drinking water. *Id.* at 15. Modeling conducted by Gradient further demonstrates that modeled concentrations of CCR contaminants from Joppa West, when compared to conservative risk-based screening benchmarks, do not pose a risk to human health through other potential pathways in the Ohio River, including to recreational users or anglers who may consume locally caught fish. *Id.* at 24–25. Accordingly, in its current state, Joppa West does not pose a reasonable probability of threat to human health.

Allowing Joppa West to close with its current cover system also poses no environmental risk. There are no ecological receptors associated with groundwater; accordingly, the only potential pathway for ecological risk is the potential interface of CCR-containing groundwater from Joppa West with the Ohio River. *Id.* at 16. Gradient evaluated exposure pathways for ecological receptors in the Ohio River, including aquatic life exposed to surface water and avian and mammalian wildlife exposed to bioaccumulative constituents in surface water and dietary items. *Id.* at 26–27. Again, using conservative assumptions, this modeling found that none of the potential exposure pathways pose an unacceptable risk. *Id.*

A relative impact assessment ("RIA") was conducted to compare the potential impact of EEI's proposed adjusted standard as compared to the scenario where the adjusted standard is not granted and EEI is required to close Joppa West under Part 845, either via closure in place with a new final cover system or closure by removal of CCR.[12] The RIA evaluated 9 different metrics to evaluate and compare the impact of the adjusted standard, closure via removal of CCR, and closure by installation of a cover system. *Id.* at 30–31. The metrics evaluated for each scenario include risk to human health/environment, risks of potential future CCR releases, groundwater quality, surface water quality, air quality, climate change and sustainability, worker safety, community impacts, and habitat impacts. *Id.* The results of that RIA demonstrate that granting the adjusted standard requested in this Petition will result in the greatest environmental benefit (or least adverse impact) for the majority of the metrics evaluated. *Id.* at 47, Table 5.13.

Nonetheless, despite the lack of risk to human health and the environment posed by Joppa West under the proposed adjusted standard, EEI will address any potential risk to human health or the environment, including the boron and sulfate exceedances, through compliance with the groundwater monitoring and post-closure care requirements set forth in Part 845. Specifically, EEI will still be required, among other things, to install groundwater monitoring systems in accordance with section 845.630 and engage in a groundwater monitoring program in accordance with section 845.650 at Joppa West. In the event sampling under Part 845 results in the detection of an exceedance of the groundwater protection standards in section 845.600, EEI will be required to characterize the release and engage in corrective measures as required under section 845.660 to prevent further releases, remediate any releases, and restore the affected area, as necessary. EEI will also have to prepare a corrective action plan as set forth in section 845.670. Furthermore, EEI will be required to engage in post-closure maintenance activities at Joppa West under section

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[12] These closure alternatives and their comparison to the adjusted standard are discussed in greater detail *infra* at 35-40.

845.780 to ensure that the integrity and effectiveness of the existing cover system is maintained and to avoid and correct any impacts from settlement, subsidence, erosion, or other events that might damage the existing cover. EEI will further provide financial assurance in accordance with section 845.900 to ensure the performance of post-closure care and the remediation of releases, if necessary. Accordingly, any risk to human health or the environment will be managed and minimized under the proposed adjusted standard.

5. The Adjusted Standard Requested by EEI is Consistent with all Applicable Federal Law, Specifically the Federal CCR Rule

As required by Section 28.1(c)(4), Petitioner's requested adjusted standard is consistent with the Federal CCR Rule. 415 Ill. Comp. Stat. 5/28.1(c)(3); 35 Ill. Admin. Code § 104.406(i). As explained *supra* 20-24, 28, Joppa West is not regulated under the Federal CCR Rule. Accordingly, granting EEI's petition will not result in any inconsistency between the requested adjusted standard and federal law.

6. The Costs, Technical Feasibility, and Environmental Impacts of Requiring Joppa West to Close under Part 845 Outweigh any Environmental Benefit

The benefits of requiring Joppa West to complete re-closure as a CCR surface impoundment under Part 845, which would require closure of the unit through removal of all CCR or through installation of a new cover system, are outweighed by the technical feasibility, costs, and environmental impacts of such closure. Details regarding the closure options available for Joppa West, including the scope of construction activities, technical challenges, and environmental impacts are included in Exhibits 2 and 4.

a) Closure by Removal

Closure by removal, as set forth in section 845.740, is one option for closure at Joppa West if this Petition is not granted. This method of closure would generally entail tearing down the existing forest cover at Joppa, excavating an estimated 3,400,000 cubic yards of CCR, and transporting that CCR by truck for offsite disposal. Ex. 2 at 15-16. Removal will also require dealing with the technical challenges and risks associated with the presence of the transmission towers and lines that currently cross Joppa West. *Id.* Specifically, the current transmission towers will have to be removed and replaced with new towers on either side of the Joppa West (and relocating the power lines to the new towers). *Id.* In order to implement this, EEI will have to obtain permission from the owner of the transmission lines, which is not guaranteed. In the alternative, EEI may be able to implement a new technology called in-situ stabilization, whereby the CCR at the base of each transmission tower is solidified by mixing the CCR with grout. *Id.* This methodology has not been applied before and would add significant complexity and risk to the project. *Id.* Accordingly, there are risks, including uncertainties related to feasibility and the ability to receive proper authorizations, associated with removing CCR around the transmission towers.

Costs associated with the CCR removal are also significant. First, the current forest and prairie cover at Joppa West will have to be removed at a cost of approximately $2,600,000. Ex. 2 at 17. Additionally, as set forth in Rudy Bonaparte’s testimony in the Part 845 rulemaking record, the cost to conduct closure by removal at a unit that is approximately 60 acres and contains 2,700,000 cubic yards of CCR is estimated to be about $152 million. R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-filed Testimony of Rudolph Bonaparte, at 18 (Aug. 27, 2020), attached as Ex. 11. Joppa West is over 100 acres large and contains an estimated 3,400,000 cubic yards of CCR, consequently the costs associated with closure by removal at Joppa West would likely be even greater. The timeframe for completing the construction work for this method of closure—including obtaining needed authorizations, removing the existing cap, removing and hauling CCR, and completing restoration activities—is estimated to be approximately 9 years. Ex. 2 at 16.

Meanwhile, there are adverse environmental impacts associated with closure by removal. Specifically, it will require excavating the approximately 100 acres of vegetation currently at Joppa West, including the bottomland forest that serves as a viable habitat for endangered and threatened bat species. Ex. 2 at 16. There are also adverse impacts associated with construction dust, vehicle emissions from the transport of CCR, and the loss of vegetation for carbon sequestration. Ex. 4 at 38-46. Ultimately, closure by removal may have the greatest impact on reducing any long-term infiltration of rainwater into CCR materials at Joppa West. Ex. 4 at 36. However, this benefit does not outweigh the environmental and financial costs, as well as the technical feasibility issues associated with closure by removal under Part 845. This is particularly true because any infiltration risk to groundwater can be managed under the adjusted standard through post-closure care, monitoring and corrective action under Part 845.

b) Closure in Place with New Final Cover System

If EEI is required to close Joppa West pursuant to Part 845, its other option for closure is via installation of a new final cover system in accordance with section 845.750. Like closure by removal, this method of closure will require removal of the existing vegetative coverage at Joppa West. Ex. 2 at 13. This method of closure will further involve construction of a geomembrane low permeability layer and construction of a protective silty clay soil layer, followed by installation of additional topsoil. *Id.* at 13–14.

There are technical complications associated with the transmission towers that will arise as part of closure via a new final cover system. The area surrounding the transmission towers will require special cover details and a final cover design will have to take into account an increase in ground surface elevation and a corresponding decrease in the distance between the ground surface and the power transmission lines, adding complexity to the design of the final cover system and an increased risk of defects in that system. *Id.* at 13.

There are several environmental costs associated with such closure. Again, there will be adverse environmental impacts from destroying approximately 100 acres of forest and prairie vegetation that has been establishing for the past 50 years, including destroying a habitat for endangered and threatened bat species and eliminating the carbon sequestration benefits of the existing vegetation. *Id.* at 14; Ex. 4 at 44–46. There will also be negative environmental and health impacts associated with airborne emissions from construction activities. Ex. 4 at 38–44. In the long-term, closing Joppa West with a cover system may have the benefit of reducing infiltration. *Id.* at 36. However, given the lack of significant groundwater impacts currently at Joppa West, this is not likely to have a significant benefit or impact as compared to leaving the existing cover at Joppa West in place.

The costs associated with installing a new final cover system will vary depending upon the thickness of that system. Again, the current forest and prairie cover at Joppa West will have to be removed at a cost of approximately $2,600,000. Ex. 2 at 14. As set forth in Rudy Bonaparte's testimony in the Part 845 rulemaking record, the total estimated cost for a final cover system meeting the design standards in section 845.750 for a 60 acre unit containing 2,700,000 cubic yards of CCR is $28 million. Ex. 11 at 18. Joppa West is larger and, accordingly, the total cost to implement this method of closure at Joppa West will likely be even greater. Implementation of this closure method at Joppa West will take approximately 5 years. Ex. 2 at 14.

c) Closure with Minimal Disturbance—the Adjusted Standard

The adjustment EEI is seeking through this petition is to allow Joppa West to close by keeping its current cover system in place without having to reclose through removal of CCR or installation of a new final cover system. As noted *supra* at 32–34, Joppa West does not present a risk to human health or the environment. The adjusted standard will allow the approximately 100 acres of forest and prairie land that has developed at Joppa West to continue to sequester carbon and serve as a habitat for threatened and endangered bats. Ex. 4 at 44–46. Any environmental benefit achieved through closure under Part 845 at Joppa West can also be achieved by maintaining the existing coverage at Joppa West and undertaking post-closure care, groundwater monitoring, and corrective action under Part 845, as necessary, as proposed by EEI in this Petition. This method of closure will also result in the least costs. Ex. 2 at 13. It does not require expending the $2,600,000 to tear down the existing vegetation at Joppa West and does not require the capital costs associated with closure by removal or closure with a new cover system.[13] *Id.* at 11–12. It will also take the least time to implement. *Id.* at 12.

d) Relative Impact Assessment of Adjusted Standard v. Closure Under 845

The RIA included in Exhibit 4 evaluates the benefits and adverse impacts associated with the three closure scenarios discussed above. In almost every category evaluated, EEI's proposed adjusted standard results in the least amount of risk or negative impact. Specifically, allowing Joppa West to close with its existing cover will result in the least impacts to air quality by avoiding emissions and energy consumption associated with closure construction activities. Ex. 4 at 38–39. It will also result in less risk to worker safety than closure under Part 845. *Id.* at 40–41.

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[13] EEI anticipates post-construction annual operating and maintenance expenses to be similar among each of the alternative closure scenarios.

Negative community impacts from accidents, traffic, noise, and environmental justice issues associated with hauling soil or CCR in local neighborhoods are also the lowest under the proposed adjusted standard. *Id.* at 41–44. Significantly, the proposed adjusted standard will result in the least amount of negative habitat impacts as it will not require all of the vegetation covering Joppa West to be removed. *Id.* at 44–46. And, finally, it is the lowest cost alternative for closing Joppa West. Ex. 2 at 13; Ex. 4 at 46.

The RIA further demonstrates that the risk posed to human health and the environment and surface water quality from the three closure scenarios are all comparable. Namely, in all three scenarios, including under the adjusted standard, there will be minimal risk posed to human health, the environment, and surface water quality. Ex. 4 at 34–35. Closure under Part 845 only performs better than allowing Joppa West to close with its existing cover under one metric—the risk of potential future CCR releases, which is low under all three scenarios. *Id.* at 35–37. But that risk is mitigated since under the adjusted standard, Joppa West will still be subject to post-closure care, which will be implemented to reduce the risk of future releases.

Ultimately, any benefit achieved through closure at Joppa West in accordance with Part 845 is outweighed by the cost of that closure, technical feasibility issues, and by the relative environmental impacts.

C. Hearing Request

EEI Requests a hearing for this adjusted standard pursuant to 35 Ill. Admin. Code 104.406(j).

D. Supporting Documentation

Documents and legal authorities supporting the Petition are cited herein (and, where applicable, on the attached Index of Exhibits) when they are used as a basis for the Petitioner's proof. Relevant portions of the documents and legal authorities, other than Board's final order, State regulations, statutes, and reported cases, are attached to this Petition. 35 Ill. Admin. Code 104.406(k).

VI. CONCLUSION

EEI respectfully requests that the Board grant its request for inapplicability of Part 845 to Joppa West or, in the alternative, an adjusted standard as set forth herein.

Respectfully Submitted,

ELECTRIC ENERGY, INC.

By: /s/ Bina Joshi
One of its attorneys

Dated: May 11, 2021

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BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

PETITION OF ELECTRIC ENERGY, INC.
FOR AN ADJUSTED STANDARD FROM
35 ILL. ADMIN. CODE PART 845

AS 21-_____
(Adjusted Standard)

INDEX OF EXHIBITS FOR ELECTRIC ENERGY, INC.'S PETITION FOR ADJUSTED STANDARD

Exhibit 1	Declaration of Cynthia Vodopivec on behalf of Electric Energy, Inc.
Exhibit 2	John Seymour, Engineering Evaluation of Joppa West Ash Pond (May 2021).
Exhibit 3	Brian Hennings, Joppa West Groundwater Evaluation (May 11, 2021).
Exhibit 4	Andrew Bittner, Human Health and Ecological Risk Evaluation and Relative Impact Assessment (May 11, 2021)
Exhibit 5	IEPA, Fee Invoice for Joppa West (Dec. 16, 2019)
Exhibit 6	Natural Resource Technology, Technical Memorandum No. 1: Class II Groundwater Designation and Replacement Wells, Joppa Ash Ponds (Dec. 7, 2012)
Exhibit 7	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, IEPA's Pre-Filed Answers (Aug. 3, 2020) (excerpted)
Exhibit 8	Permit Materials for Joppa East Ash Pond
Exhibit 9	Natural Resource Technology, Phase I Hydrogeological Assessment Report (July 23, 2013)
Exhibit 10	IEPA's Comments on Advanced Notice of Proposed Rulemaking for Hazardous and Solid Waste Management System (Feb. 11, 2021)
Exhibit 11	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-filed Testimony of Rudolph Bonaparte (Aug. 27, 2020) (excerpted)

Exhibit 12	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-Filed Testimony of Gary P. King (Aug. 27, 2020) (excerpted)
Exhibit 13	Hanson Professional Services, Inc., Ash Pond Hydrogeological Assessment Plan (March 2010)
Exhibit 14	*In the Matter of Objection to the Issuance of Partial Approval of Closure/Post Closure Plan Duke Gallagher Generating Station Ash Pond System*, No. 20-S-J-5096 (Ind. OEA May 4, 2021)
Exhibit 15	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, IEPA’s Statement of Reasons (Mar. 30, 2020) (excerpted)
Exhibit 16	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Dynegy’s First Post-Hearing Comments (Oct. 30, 2020) (excerpted)
Exhibit 17	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Pre-filed Testimony of Cynthia Vodopivec (Aug. 27, 2020) (excerpted)
Exhibit 18	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Transcript of August 11, 2020 Hearing (excerpted)
Exhibit 19	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Second Notice, Opinion and Order (Feb. 4, 2021) (excerpted)
Exhibit 20	R 2020-019, *In the Matter of Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Proposed new 35 Ill. Adm. Code 845*, Office of the Attorney General’s Comments in Response to Ameren’s Proposed Modifications to the Joint Committee on Administrative Rules (Apr. 7, 2021) (excerpted)
Exhibit 21	Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,302 (April 17, 2015) (excerpted)

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 1

DECLARATION OF CYNTHIA VODOPIVEC ON BEHALF OF ELECTRIC ENERGY, INC.

I, Cynthia Vodopivec, affirm and declare as follows:

1. I am Senior Vice President, Environmental Health and Safety at Vistra Corp., the indirect corporate parent of Electric Energy, Inc. As part of my duties, I oversee permitting, regulatory development, compliance (air, water, and waste issues), and health and safety at the Company, including Electric Energy, Inc.'s Joppa Power Plant in Massac County, Illinois. I have worked in this role for 6 years. I received a Bachelor's Degree in Engineering from Dartmouth College in 1998 and an MBA from Rensselaer in 2009.

2. I participated in the preparation of the Petition of Electric Energy, Inc. ("EEI") for a Finding of Inapplicability or, in the Alternative, an Adjusted Standard from 35 Ill. Adm. Code Part 845 ("Petition").

3. I have read the Petition and, based on my personal knowledge and belief, the facts stated therein regarding the Joppa Power Plant and its operation and the former Joppa West Ash Pond ("Joppa West") are true and correct.

4. In further support of the Petition, I state that:

    a. Joppa West was closed in the 1970s. This unit has not received new coal combustion residuals ("CCR") since the 1970s. At the time it was closed, Joppa West was graded to direct precipitation off of the unit into drainage ditches. Soil cover was brought in to cover certain areas of Joppa West, including power line and pipeline corridors and grass cover established. Over approximately the past 50 years, Joppa West has become heavily vegetated, including with large trees with trunk diameters of more than 18 inches. Personnel at the Joppa Steam Generating Plant take actions, including annual inspections, to inspect and maintain the current cap at Joppa West. Over the years, no erosion or other failures of the cap at Joppa West requiring repair have been observed.

    b. Joppa West is not regulated under the federal rules promulgated to govern CCR surface impoundments, 40 C.F.R. Part 257, Subpart D. Due to the grading, soil accumulation and vegetation at Joppa West, it was not designed to impound liquids as of October 19, 2015, the effective date of the Federal CCR Rule, and it is, therefore, not a CCR surface impoundment regulated under the Federal CCR Rule.

    c. The Company is committed to responsibly maintaining Joppa West and addressing and minimizing any impacts from CCR at Joppa West.

FURTHER, Declarant sayeth not.

Cynthia Vodopivec

Dated:

this 11th day of May 2021.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 2

EXPERT ENGINEERING EVALUATION FOR ADJUSTED STANDARD FOR PART 845

Joppa Power Station
Joppa West
Joppa, Illinois

Submitted to

Electric Energy, Incorporated (EEI)

Submitted by

Geosyntec
consultants

engineers | scientists | innovators

134 N. La Salle St.
Suite 300
Chicago, IL 60602

May 2021

John Seymour, P.E.
Senior Principal

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SECTION 1

INTRODUCTION

This engineering evaluation has been prepared for Electric Energy, Incorporated (EEI) for the Joppa West former surface impoundment at the Joppa Power Station (Plant) located in Joppa, Massac County, Illinois. The Site Location is shown on **Figure 1-1** and Joppa West is shown on **Figure 1-2**. The purpose of the analysis is to provide information in support of an adjusted standard to Subchapter j: Coal Combustion Waste Surface Impoundments, Part 845 (Part 845) (Board, 2021).

This report has been prepared by John Seymour, P.E. Mr. Seymour is a licensed professional engineer (IL P.E. No. 062.040562), has over 40 years of civil and geotechnical engineer experience, and over 20 years working at power plants regarding coal combustion residuals (CCR) in landfills and surface impoundments, and dams. The Curriculum Vitae of John Seymour is presented in **Appendix A**.

SECTION 2

BACKGROUND

The Joppa West former surface impoundment was in use by 1957 and was removed from service in the 1970s when the Joppa East surface impoundment was brought into service.[1] A review of aerial photography and topographic maps from before and after 1957 confirm the use of the former surface impoundment. **Figures 2-1** and **2-2** are aerial photographs and topographical maps, respectively, that bracket the time period of imitation of service.

The ground surface prior to construction is depicted in the 1932 USGS aerial photograph shown in **Figure 2-2**. The area had an unnamed intermittent stream valley within the Joppa West footprint that carried surface water southward to the Ohio River. After construction, the surface water was diverted to the east around the eastern perimeter dike and then southward to the Ohio River. The centerline of the valley ranges in elevation from estimated[2] El. 305 ft in the south end of the SA, El. 315 ft below the separator dike, and El. 335 ft in the north end of Joppa West. The base of CCR within Joppa West varies from approximately El. 350 feet on the eastern and western flanks of the former stream valley, to approximately El. 305 feet the southern end of the former stream valley.

Joppa West was apparently constructed by excavating clay soils from within the footprint and constructing containment dikes. Joppa West is approximately 103.5 acres in area. The southern portion of Joppa West was constructed as an area for final clarification through gravity settling. This area, known as the "Settling Area" (SA), is approximately 17 acres in area. The northern portion and the SA are separated by a separator dike. The separator dike crosses the former stream valley.

Coal combustion residuals (CCR), including fly ash and bottom ash (collectively referred to as "ash") were sluiced into the northern portion of Joppa West from pipes coming from the Plant to the east of Joppa West. The sluice pipes were located along the east side of the northern portion and ash discharge areas are depicted by fan deltas of deposited ash that can be seen in the 1965 aerial shown on **Figure 2-3**.

The dike crest of the northern area of Joppa West was originally constructed to a minimum of El. 350 ft. The Settling Area dike crest was constructed to an estimated elevation of approximately 345 ft. The dike on the northern portion of Joppa West was apparently raised 15 ft to elevation 365 ft after 1965 and before cessation of operations based on the historical and current (2020) topography as shown in plan and cross sections on **Figures 2-4** and **2-5**, respectively.

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[1] The Site background was developed from interviews of site personnel, review of historical aerial photographs and topographic maps, and a current (2020) survey of land surface topography; there are no known records of Joppa West construction and operation.

[2] Elevations are estimated from the 1932 USGS topographic map which has 20 ft contour intervals. Consequently, the elevations are estimates based upon the average slope of the valley in the area.

Originally, the ash was treated by settling and the clarified water was apparently discharged into pipes through the separator dike into the Settling Area. The discharge pipe area is depicted on **Figure 2-3**. These pipes could not be located during the 2021 site inspection because they were buried. Water then drained through a vertical concrete box decant structure, shown on **Figure 2-3**, located along the Settling Area southern perimeter dike and horizontally through three pipes, also shown on **Figure 2-3**, to the south into the Ohio River.

After the dike raise and until the end of operations in the 1970s, clarified sluice water drained through an outlet structure near the north corner of Joppa West consisting of a vertical decant drain and a horizontal, approximately 36-inch diameter, reinforced concrete pipe, toward the north to a small pond. The clarified discharge water drained from the pond to the southeast from the small pond and then southerly along the toe of the dike in a surface water drainage ditch and into the Ohio River as shown on **Figure 2-6**. No drawings could be found that depict the design or construction of the Settling Area or any discharge structures.

Joppa West was constructed and operated prior to the passage of the National Environmental Policy Act (NEPA) in 1969 and subsequent promulgation of the Clean Water Act (CWA) regulations in 1972. The National Pollution Discharge Elimination System (NPDES) regulations (Agency, 1972) were promulgated to permit discharges.

With the passage of the CWA, EEI went through a process to permit a separate ash treatment/disposal area to the east of the Joppa Plant. This became the East Ash Pond (EAP) and is located approximately 1,300 feet east of Joppa West. The Illinois Environmental Protection Agency (IEPA) granted a discharge permit on July 2, 1974 and the US EPA granted an NPDES permit on July 26, 1974 and Joppa West was likely no longer used after these permits were granted. Documentation of the permit process are included in **Appendix B.**

The current surface elevations of the northern portion of Joppa West ranges from 352 ft in the far northern end to 375 ft near the separator dike in the south. The surface elevation of the SA ranges from 343 to 347 ft. Joppa West is crossed by a number power transmission lines and one gas pipeline. After use of Joppa West ceased, soil cover was placed to cover power line and pipeline corridors crossing Joppa West. Grass vegetation was established and maintained in these areas. Other areas appear to have some clay cover and have been allowed to become naturally vegetated and topsoil has been developed essentially over all of Joppa West precluding contact with CCR.

The surface of Joppa West was graded to drain and avoid low areas that would result in permanent standing water. The grades were lowered at the locations of the transmission and pipeline corridors along the east and west perimeter dikes to provide positive drainage and preclude ponding. Other areas of Joppa West also appear to have been graded to preclude ponding. Ponding was not observed since the CCR Rule became effective in 2015 based on review of the 2015 aerial photograph presented in **Figure 2-7,** the 2020 aerial photograph shown in **Figure 2-4**, and the 2021 site inspection and personnel interviews.

Filling of the SA was reportedly completed around the year 2000 and certain areas were covered with soil and a grass cover was developed. Other areas were allowed to become vegetated through a natural process. The SA was graded to drain and avoid low areas that would result in permanent, impounded water.

Sediments dredged from the Ohio River near the original discharge structure were placed along the western side of Joppa West as shown on **Figure 2-4**. This area has an estimated 90% grass cover but has limited topsoil; the remainder is exposed sediments.

Joppa West ceased receiving CCR prior to October 19, 2015 and was capped or otherwise maintained as of October 19, 2015 and therefore is not subject to Title 40 of the Code of Federal Regulations (40 C.F.R.) Part 257 Subpart D in accordance with 40 C.F.R. § 257.50(d).

SECTION 3

CURRENT CONDITIONS ASSESSMENT

3.1 Current Conditions Assessment Process

The current conditions of Joppa West were assessed through a site inspection on March 10, 2021 by John Seymour, P.E., Lucas P. Carr, P.E., Zachary Fallert, E.I., and Nathan Higgerson of Geosyntec Consultants (Geosyntec). .

The Northern Area and Settling Area of Joppa West were constructed at the same time and are a part of the same water treatment system but they currently have different characteristics and will be discussed separately.

The following activities were conducted to assess current conditions:

- Surface conditions inspection of all dike exteriors, dike crest roads, portions of the interior vegetated areas and are documented by photographs. The Photograph Log and photo location plan are included in **Appendix C**.
- Completion of 15 test pits at Joppa West using a track hoe and logged by an experienced geotechnical professional. Test Pit Logs are included in **Appendix D**.
- Consultation with a biologist to understand the threatened and endangered species that could be present.
- Review of historical aerial photography and topographic maps presented in the figures.
- Interview of personnel familiar with the site.
- Review of photographs of Joppa West from 2015 presented in the figures.
- Review of the results of the groundwater assessment.

3.2 Results of Current Conditions Assessment

3.2.1 Clay Cover

Northern Area

Up to several feet of clay and silty clay material were observed in the test pits and inspector probes along and near the utility corridors and perimeter dikes. The thinnest clay cover is in the forested areas, where approximately two inches of clay cover was observed; very few areas had no clay cover.

Test pits indicated clay with topsoil thicknesses from approximately 2 inches to 15 inches. Below the clay was ash.

Settling Area

The Settling Area has clay cover consistent with the Northern Area; however, ash was observed on the surface in a portion of the transmission corridor.

Test pits indicated clay with topsoil thicknesses up to six inches. One relatively very small area had exposed ash. Below the clay was ash.

3.2.2 Topsoil Cover

Topsoil cover was observed to be over essentially the entire surface and perimeter dike side slopes of Joppa West. The western portions of the transmission corridor in the Settling Area did not have significant topsoil.

3.2.3 Surface Water Drainage

Northern Area.

The surface is generally graded to facilitate surface water drainage. A review of the aerial topography in 2015 (**Figure 2-7**) and 2020 (**Figure 2-4**) and the 2021 site inspection did not indicate impounded water nor any localized ponding.

No surface water overtopping of the dikes was observed.

There is a low area of approximately 10 acres in the northern most end of Joppa West. A vertical, grated, culvert drain is located in this area that transmits any surface water through the perimeter dike to a perimeter drainage area. There was no evidence of a drainage ditch north of the perimeter dike and no evidence of erosion.

The surface is sloped outward to promote drainage over the perimeter crest road in the areas of the transmission corridors. The transmission corridors have effective, erosion resistant grass covers and no erosion gulleys were observed.

Settling Area.

The Settling Area does not impound water. Surface water drainage is generally effective, and only rainwater was observed in equipment ruts and several low depressions (less than one-foot deep); an example is shown on Photo JW-23, Appendix C). On February 28th, 1.86 inches of rain fell (USGS, 2021), and cool weather precluded evaporation in March.

Water appears to run off in sheet flow from the center to the perimeter. The area also receives run-on from the exterior ponds immediately west of Joppa West; run-on is directed towards the Settling Area through two culverts that flow from west to east beneath the Settling Area access road. Surface water drains easterly and through two culverts under the eastern perimeter road and southward to the Ohio River.

There also is a drainage ditch that directs surface water from west to east and exits the cover through a culvert to a rip rap lined channel. The channel flows to the eastern exterior ditch southward to the Ohio River.

Rain water runoff drains south and over the southern dike and to the flood plain of the Ohio River. Erosion gulleys up to several feet in depth were observed in several locations on the dike slopes. The overflow appears to be occasional based on the lack of exposed soil in the gulleys and presence of organic litter in the erosion features.

3.2.4 Vegetation

Northern Area.

The entire cover is vegetated with well-developed grasses in the transmission corridors and volunteer vegetation comprised of a mixture of shrubs and trees in the remaining forested areas. The forested areas do not have consistent understory vegetation, but the floor is shielded by the canopy of tree vegetation above and accumulated leaf litter and accumulated topsoil. The vegetation is judged to be effective by the lack of erosion features and the lack of bare areas. The habitat is further discussed later in this section.

There are nearly 40 acres of mature bottomland forests. Another approximately 20 acres are early successional forest of dense shrubs including a one-acre area in the northern end with phragmites.

The approximately 20 acres of maintained right-of-way (ROW) has prairie grasses and forbs.

Settling Area.

Vegetation in the Settling Area was consistent with the Northern Area. The grass vegetation in the transmission corridor was well developed in many areas but not as well developed as in the transmission corridors of the Northern Area. Standing water in equipment ruts and some low depressions appears to have inhibited grass growth. Thick grass growth and phragmites were also observed in several areas.

The Settling Area contains mature habitat, including several large diameter (>30 inch DBH) trees. The transmission corridor had mowed grass and phragmites.

There are approximately 10 acres of forest. The approximately seven acres of maintained right-of-way (ROW) has prairie grasses and forbs.

3.2.5 Dike Slopes

Northern Area.

The perimeter dikes are vegetated with a combination of well-developed grasses in many areas, and shrubs and small trees in the remaining areas.

The dike slopes are estimated to range from approximately 2 horizontal (H) to 1 vertical (V) to 6H: 1V. The slope heights ranged from approximately 2 ft up to 26 ft. Erosion features were not observed on the slopes. Much of the slope area was not easily accessible because of heavy vegetation; therefore, this conclusion was supported by the many transects inspected on foot up and down the slopes and the lack of any erosion features along the outer edge of the crest road/top of slope.

No evidence of slope instability (i.e., tension cracks, non-vertical tree trucks, scraps, sloughs) was observed.

Settling Area.

The dike slopes are estimated to range from approximately 1.5 horizontal (H) to 1 vertical (V) to 4H: 1V. Slope heights ranged from approximately less than 2 ft up to 24 ft based on a current (2020) aerial topographic survey shown in **Figure 2-4**. Much of the slope area was not easily accessible because of heavy vegetation; therefore, this conclusion was supported by the observations from the top and bottom of the slopes.

The perimeter dikes are vegetated with a combination of well-developed grasses in some areas and shrubs to mature trees in the remaining areas. The habitat is further discussed later in this section.

Rainfall run off has caused several erosion gulleys on the order of 5- to 10-ft wide and 4- to 5-ft deep along the southern perimeter dike slope. The overflow appears to be occasional based on the lack of exposed soil in the gulleys and presence of organic litter in the erosion features.

No evidence of slope instability (i.e., tension cracks, non-vertical tree trucks, scraps, sloughs) were observed, the dikes appeared to be constructed out of compacted clay.

3.2.6 Discharge Structure

Northern Area.

The discharge structure at the north side of the Northern Area includes an approximately 36-inch diameter reinforced concrete pipe (RCP) riser structure with an expanded metal trash rack. The outfall structure leads to a horizontal spillway that penetrates the dike and discharges from south of the access road northward from the Northern Area.

Settling Area.

The discharge structure was located along the southern perimeter dike. It was a concrete, rectangular vertical overflow that dropped down into three concrete pipes that discharged to the Ohio River. It can be seen in the 1965 aerial photograph (**Figure 2-3**). It was filled in and buried sometime after the cessation of operation and before the year 2000.

3.2.7 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (FWS) identified the federally endangered Indiana bat and federally threatened northern long-eared bat as potentially occurring in the site area. The FWS report is provided in **Appendix E**. These bats summer roost in larger trees and snags with exfoliating bark and cavities, particularly in certain types of forests. The approximately 45 acres of forest provide potential summer roosting habitat for these bat species.

The Illinois Natural Heritage Database (2020) identified 61 state-listed threatened or endangered species as potentially occurring within Massac County and are listed in **Appendix F**.

3.2.8 Electrical Transmission and Gas Lines.

There are six transmission lines across the Joppa West with as many as 11 significant towers (up to 345 KVA) and 5 smaller power poles/towers.

A buried gas pipeline crosses Joppa West just north of the separator dike.

3.2.9 Overview of Groundwater Conditions

There are three major groundwater units at the site:

- Upper Confining Unit (UCU)- located below Joppa West extending to approximately El 290 ft comprised of native low-permeability silts and clays with a geometric average hydraulic conductivity of 5.9 x 10^{-6} cm/sec (Natural Resource Technology, 2013). Monitoring wells are screened in the UCU near the bottom of the CCR. Groundwater flow in the UCU is generally southward toward the Ohio River. The UCU doesn't produce sufficient yield for Class I designation and therefore Illinois Class II groundwater protection standards apply.

- Uppermost Aquifer (UA)- located below the UCU and is a sand and gravel aquifer. Groundwater monitoring is conducted in the UA downgradient of Joppa West. Groundwater flow in the UCU is generally southward toward the Ohio River. Illinois Class I groundwater protection standards apply because the UA produces sufficient groundwater yield.

- A limestone bedrock unit (BU) which lies beneath the UA and is composed of the Mississippian Aged Salem Limestone. It is considered Class I groundwater.

The following constituents were detected above groundwater standards in UCU wells near Joppa West (Ramboll, 2021):

- Boron, sulfate, and cobalt at G112C;

- pH at G113;

- Arsenic, cobalt, and lead at TPZ114; and

- Arsenic, beryllium, cobalt, and lead at TPZ117.

Only boron and sulfate are attributable to Joppa West (Ramboll, 2021). Groundwater monitoring was conducted in 2011 through 2013 and again in March 2021. Monitoring well G11Cl is located in the Ohio River floodplain. The flood plain between the Ohio River and Joppa West is regularly flooded, and it was flooded at the time of the March 10th site inspection.

There are no groundwater users downgradient of Joppa West. There are no drinking water wells or farm wells as previously reported (Natural Resource Technology, 2013, Ramboll, 2013) in the UCU downgradient of Joppa West.

3.3 Summary of Current Conditions

Joppa West has a covering of vegetation over essentially all its surface as follows:

- Approximately 45% of mature bottomland forests that provide potential summer roosting habitat for the federally endangered Indiana bat and federally threatened northern long-eared bat
- Approximately 20% are early successional forest/shrubs
- Approximately 35% of maintained right-of-way (ROW) that has prairie grasses and forbs.

No water was impounded. No evidence of overtopping was identified except for very small portions of the southern dike where occasionally, rainfall runoff occurs.

Electrical transmission lines and a gas pipeline cross Joppa West. The towers are founded within the ash and foundation details are not known.

SECTION 4

CLOSURE ALTERNATIVES

4.1 Overview

Joppa West is a former surface impoundment that was closed or otherwise maintained for approximately 50 years. It did not impound water when the CCR Rule became effective and continues to not impound water. It has a soil cover and the surface conditions are vegetated and stable.

This section identifies four feasible closure options. Alternative 1 would be implemented if Joppa West is not required to reclose under Part 845. Alternatives 2 through 4 are options that would likely be evaluated under Part 845.710 if Joppa West were required to reclose.

The following feasible alternatives were determined to be feasible for Joppa West:

- Alternative 1: Closure In Place (CIP)- Minimal Disturbance
- Alternative 2: CIP- New Cover System
- Alternative 3: Closure By Removal (CBR) with Off Site Disposal

A fourth alternative, closure by removal with disposal in an onsite landfill, was evaluated and determined to not be viable; it is evaluated briefly with Alternative 3.

4.2 Alternative 1: Closure In Place (CIP) with Minimal Disturbance

4.2.1 Description

4.2.1.1 Clearing and Revegetation of Dikes, Maintenance and Monitoring

This alternative would include:

- Clearing of the dike outside slopes from undesirable vegetation, including trees and smaller woody vegetation, that preclude thorough dike inspection and could lead to dike instability caused by root penetrations and/or eventual tree death. Of the 12.6 acres of outer slopes, vegetation from an estimated 1/3 (4 acres) would require removal. Grasses will remain.
- Revegetation of disturbed areas of slopes with appropriate native grasses.
- Groundwater monitoring and, if necessary, groundwater corrective action.
- Periodic visual inspections of the cover and dike side slopes.
- Repair of erosion features on the southern perimeter dike.

- Maintenance to include repair of erosion and management of undesirable woody vegetation on the perimeter dike outer slopes.

4.2.1.2 Time to Implement

The time to implement this activity is expected to be just over one year. The activities would include:

- Design- approximately two months
- Contractor procurement- approximately two months
- Remove vegetation and revegetation- one to two months
- Establishment of vegetation- one growing season, approximately eight months

4.2.1.3 Post-Closure Monitoring and Maintenance

Monitoring and maintenance will either be governed by Part 845 or an approved groundwater management zone under Part 620.

4.2.1.4 Groundwater Monitoring and Remediation

Groundwater monitoring and remediation, if necessary, will be governed by either Part 845 or an approved groundwater management zone under Part 620.

4.2.2 Discussion

The implementation of Alternative 1 has minimal impacts to the environment and preserves habitat for the federally endangered Indiana bat and federally threatened northern long-eared bat that summer roost in larger trees and snags with exfoliating bark and cavities, particularly in the forests. Alternative 1 provides for a stable containment system.

The following has been observed after 50 years since cessation of operations and closure:

- The CCR at the bottom of Joppa West is separated from the uppermost aquifer by an estimated 25 to 40 ft of low permeability silty clay.
- There were no observed releases (loss of containment) of CCR.
- Water is not impounded in Joppa West.
- The existing cover is performing adequately based on the lack of erosion gulleys on the perimeter dikes and vegetative cover with the exception of a very small area on the southern perimeter dike.
- This alternative provides post closure monitoring and maintenance.

- Any groundwater impacts above the groundwater protection standards would be addressed pursuant to Part 845 or an approved groundwater monitoring zone pursuant to Part 620.

Based on the observed conditions, the existing cover is stable and is performing adequately to preclude exposure to human health and the environment.

4.2.3 Cost

The cost estimate for Alternative 1, minimal disturbance, would be on the order of $500,000. The portion of this cost estimate for clearing and restoration is approximately one- half.

The estimates are only to put the cost into perspective compared to other alternatives.

4.3 Alternative 2: Closure in Place with a New Cover System

4.3.1 Description

New Cover System

In summary, the new cover system would include clearing the existing vegetation, regrading the CCR to achieve subgrade and construction of a new cover. The cover could be a low permeability soil cover or geomembrane with a protective layer and vegetated layer. A geomembrane cover could include 18 to 36 inches of protective layer and vegetated layer. A geotextile cushion on top of the geomembrane would only be used if necessary.

The new cover system would include the following:

- Clearing of the existing cover and dike side slopes of vegetation.
- Grading to promote surface water drainage to low points around the cover by cutting and filling of existing CCR within Joppa West.
- Construction of a cover system compliant with Part 845 that may be comprised of a geomembrane low permeability layer with 18 to 36 inches of protective soil and vegetative soil and other design features, as necessary.
- Special cover details for the transmission towers will be required to allow the towers to remain in place and the cover to be integrated into the cover system. This adds complexity to the design and an increase in risk of defects.
- The design must account for an increase in ground surface elevation and a corresponding decrease in the distance between the ground surface and the power transmission lines. A minimum distance must be maintained. This adds complexity to the design and an increase in risk of safety incidents.

- The gas pipeline may be removed when the gas peaking generating units are shut down in late 2022, prior to closure construction.

- Post closure monitoring and maintenance to demonstrate compliance with groundwater standards and effectiveness of the new cover system.

4.3.2 Time to Implement

The following are the estimated times to implement the different phases of the work:

- Design- approximately 12 to 15 months

- Contractor procurement- approximately three months

- Construction- approximately two years

- Establishment of vegetation - one growing season, from 8 to 12 months

The total length of time for permitting, design and construction is estimated to be around five years.

4.3.3 Post Closure Monitoring and Maintenance

Any groundwater impacts above the groundwater protection standards would be addressed pursuant to Part 845 or an approved groundwater monitoring zone pursuant to Part 620.

4.3.4 Discussion

Implementation of Alternative 2 has significant impacts to the environment and destroys the habitat for the federally endangered Indiana bat and federally threatened northern long-eared bat that summer roost in larger trees and snags with exfoliating bark and cavities. The forested areas of Joppa West are approximately 45% of the site.

Integration of the cover system with the transmission towers adds complexity to the implementation and increases risk of defects. The conditions and type and depth of foundations are not known; therefore, designing a method to keep them in place and stable will be require further research and development.

Alternative 2 provides monitoring and maintenance to keep the containment system protective.

Any groundwater impacts above the groundwater protection standards would be addressed pursuant to Part 845 or an approved groundwater monitoring zone pursuant to Part 620

4.3.5 Cost

The cost of Alternative 2, Closure in Place with a Final Cover System, would be significantly more than Alternative 1 and have not been calculated given the range of final cover systems that could be utilized.

The cost of clearing the forested and shrub vegetation is on the order of $2,600,000.

4.4 Alternative 3: Closure By Removal

4.4.1 Description

Closure by Removal (CBR)

In summary, CBR would include the following:

- Clearing the existing cover and side slope vegetation with disposal of woody vegetation offsite in a landfill.

- Excavation of cover soils and segregation of clay and topsoil for later site restoration use.

- Excavation of an estimated 3,400,000 cubic yards (cuyd) of CCR and dewatering to remove liquids, and/or water treatment (particle settling) prior to discharge, and temporary onsite CCR stockpiling requiring double handling.

- The onsite landfill is located approximately one-mile northwest of Joppa West. It has a capacity of 1,600,000 cuyd. It was constructed in 2009 to receive scrubber by-products as an owner-owned and operated landfill for its sole use. However, the landfill was never made operational. Currently the landfill is unusable because of the deterioration of the landfill cell freeze protection layer and damage to the leachate collection system cell perimeter berms (Burns & McDonnell, 2020). Further, it does not have the capacity to receive the required 3,400,000 cuyd of CCR without expansion. Expansion of the landfill to the east and south were considered but is not feasible because there is not enough property access. The properties to the east and south of the landfill are easements given to Ameren for electrical transmission lines and it is highly improbable that they would be made available for a landfill for safety and security reasons. Expansion to the north and west are not possible because of regulatory set back requirements. Consequently, onsite disposal is considered not a feasible alternative.

- Truck transport, using a transportation plan, and offsite disposal. The disposal location could be one of four disposal areas, the closest is nearly 50 miles away, a one-hour drive from the site (2-1/2 hour round trip including unloading).

- The transmission tower foundations are located in areas where the CCR is up to 35-ft-thick. There are two options to manage a CBR in the tower foundation area:
  - Construct new towers on either side of Joppa West (a span of around 1,500 ft) and move the five lines to the new towers. This requires the approval of the owner, Ameren.
  - Solidify the CCR at the bases of each tower by in situ stabilization (ISS) that utilizes mixing the CCR around the foundations in place with grout using soil drilling augers.

It is unknown whether this technology has been applied before around tower foundations, which would add significant complexity and risk to the project.

- The gas pipeline provides fuel to the power generation station west of the Northern Area; it is owned by EEI. It is likely that if construction is to occur, the pipeline will be removed when the peaking plant is decommissioned in late 2022.
- Construction of stormwater drainage ditches to convey runoff to stormwater ponds prior to discharge to the Ohio River.
- Site restoration including grading the site using perimeter dike soils and stockpiled clay and topsoil and planting native grasses.

4.4.2 Time to Implement

The following are the estimated times to implement the different phases of the work:

- CBR Design- approximately 18 months
- Tower foundation ISS support design and owner approval: two years
- Contractor procurement- approximately four months
- CBR construction- approximately six years
- Establishment of vegetation- one growing season, from 8 to 12 months

The time for design, permitting, obtaining owner authorizations, and construction is estimated to take nine years.

4.4.3 Monitoring and Maintenance

Monitoring and maintenance would be conducted in accordance with Part 845 or an approved groundwater management zone under Part 620

4.4.4 Discussion

In the short term, the implementation of Alternative 3 has significant impact to the environment and destroys the potential habitat for the federally endangered Indiana bat and federally threatened northern long-eared bat that summer roost in larger trees and snags with exfoliating bark and cavities, particularly in bottomland and mesic forests. There would be up to 200,000 truckloads hauling over approximately 100 miles (round trip) causing road wear, safety and nuisance concerns, and use of non-renewable fossil fuels.

Rail and barge transport were examined and ruled out as impractical and overly expensive. Although rail lines are available at the site, to implement rail transport the loading facility will require a new spur and loading facilities. The receiving disposal facility would need to add a rail spur and unloading facility, along with all of the necessary permitting, to be able to manage CCR.

There is significant risk associated with removal of CCR in the areas of the transmission towers. The risks include:

1. The uncertain time, feasibility, and cost to obtain permits and authorizations to relocate the transmission towers or for the approval for foundation stabilization.
2. The type of foundations (drilled piers, driven piles, etc.), level of deterioration and depths are not known making it difficult to assess and select a method to shore up/stabilize the CCR around the foundation.
3. The ISS method for stabilizing the transmission tower foundations have not been proven and the consequences of failure are great, leading to power disruption and safety incidents.

Alternative 3 provides monitoring to continue to assess any residual groundwater impacts.

4.4.5 Cost

The cost for Alternative 3 would be significantly higher than Alternatives 1 and 2 and have not been calculated given the uncertainty of the actual offsite disposal location and costs associated with managing the risks relating to excavations around the transmission tower foundations.

For perspective, the Tennessee Valley Authority (TVA), evaluated the cost surface impoundment closure with a final cover system at six power plants using an environmental impact statement (EIS) approach. Based on information in the Part 1 (Summary) and Part 2 (power plant specific evaluations), TVA found the cost for CBR was at least five times more expensive than CIP and took at least two times longer to complete (TVA, 2016).

The cost of clearing the forested and shrub vegetation is on the order of $2,600,000.

SECTION 5

CONCLUSIONS

The following overview conclusions are presented:

1. Joppa West is not a surface impoundment. It has been closed or otherwise maintained since the 1970s. There was no impounded water observed in historical aerials when the CCR Rule came into effect in 2015, impounded water was not observed is subsequent aerial photographs up to 2020, and no impounded water was observed in the March 2021 site inspection.

2. The physical surface conditions are stable. The site is essentially completely vegetated with forest, prairie grassland, and shrubs. There is soil cover over Joppa West that ranges from < 2 inches to 15 inches. No CCR releases were observed, no slope stability concerns were identified, no evidence of surface water overtopping was observed except for one very small area on the southern dike slope where occasionally, rainfall runoff occurs.

3. Three feasible alternatives for closure were assessed.

   - Alternative 1: Closure in Place with Minimal Disturbance

   - Alternative 2: Closure in Place with a New Cover System

   - Alternative 3: Closure by Removal

   Alternative 1 provides the least land disturbance, preserves the habitat favorable to endangered bat species, least short-term environmental impact, and remains protective in the long term with monitoring.

   Alternatives 2 and 3 provide the most land disturbance, destroys the habitat favorable to endangered bat species, most short-term environmental impact, and are protective in the long term with monitoring.

   Overall, removal of the current vegetation for either the construction of a new cover system or for removal of the CCR would be very environmentally disruptive and more expensive than leaving it in place.

SECTION 6

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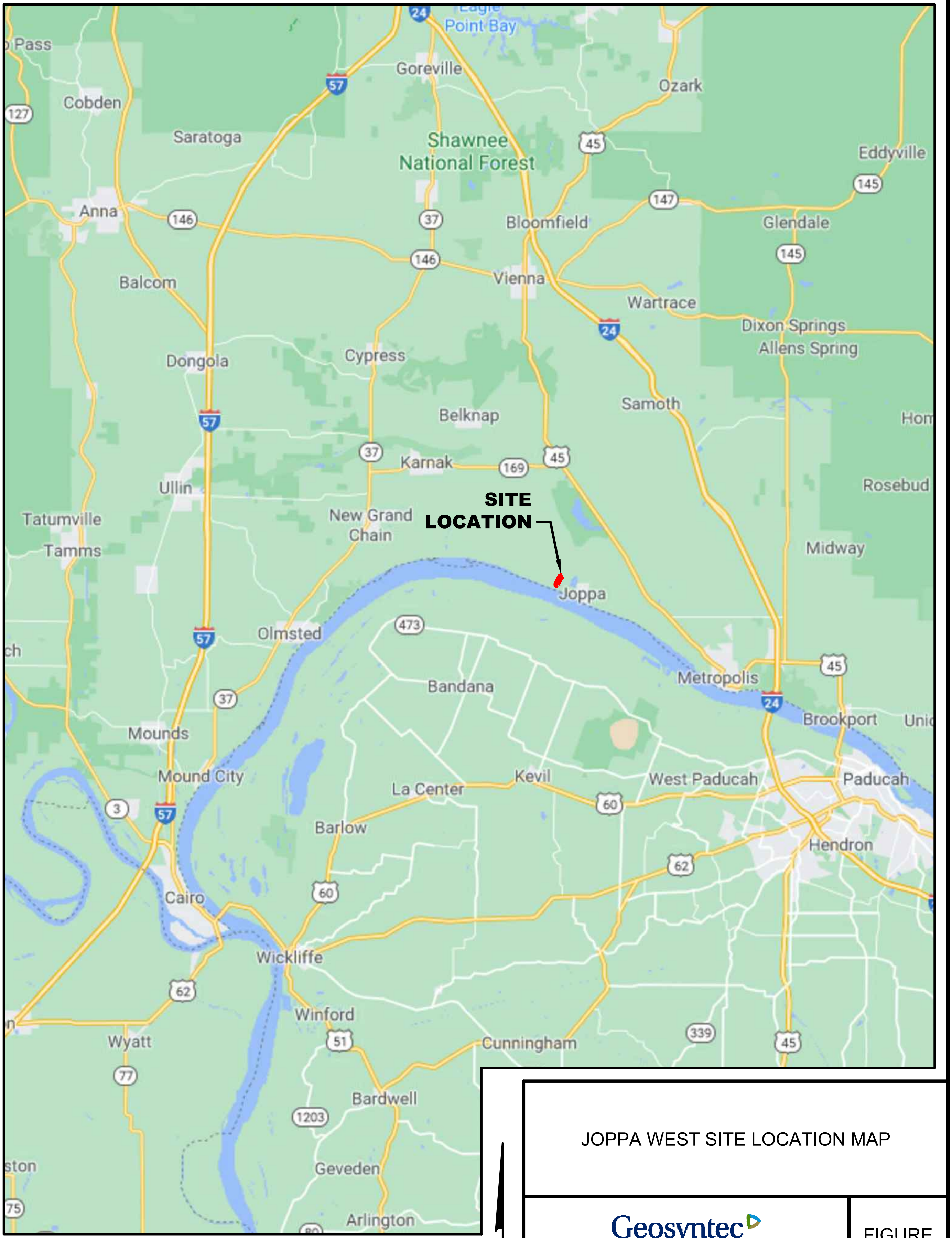

MAP IMAGE TAKEN FROM GOOGLE MAPS (2021)

DRAFT DESIGN DRAWING - NOR FOR CONSTRUCTION

0 6
SCALE IN MILES

N

JOPPA WEST SITE LOCATION MAP

Geosyntec consultants

PROJECT NO: GLP8024

MAY 2021

FIGURE
1-1

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MAP IMAGE TAKEN FROM GOOGLE MAPS (2021)

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SCALE IN FEET

N

JOPPA WEST SITE AREA

Geosyntec consultants

PROJECT NO: GLP8024

MAY 2021

FIGURE

1-2

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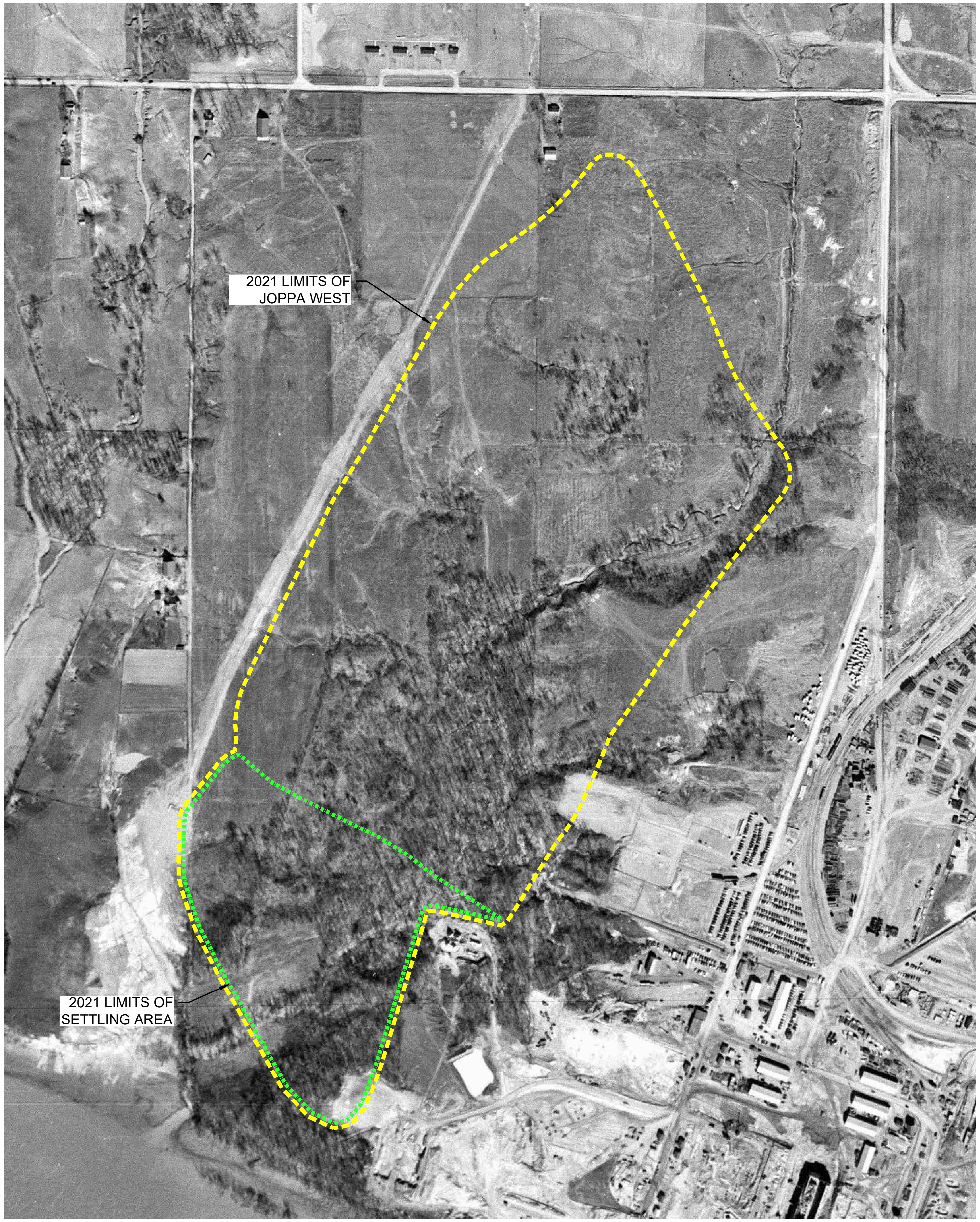
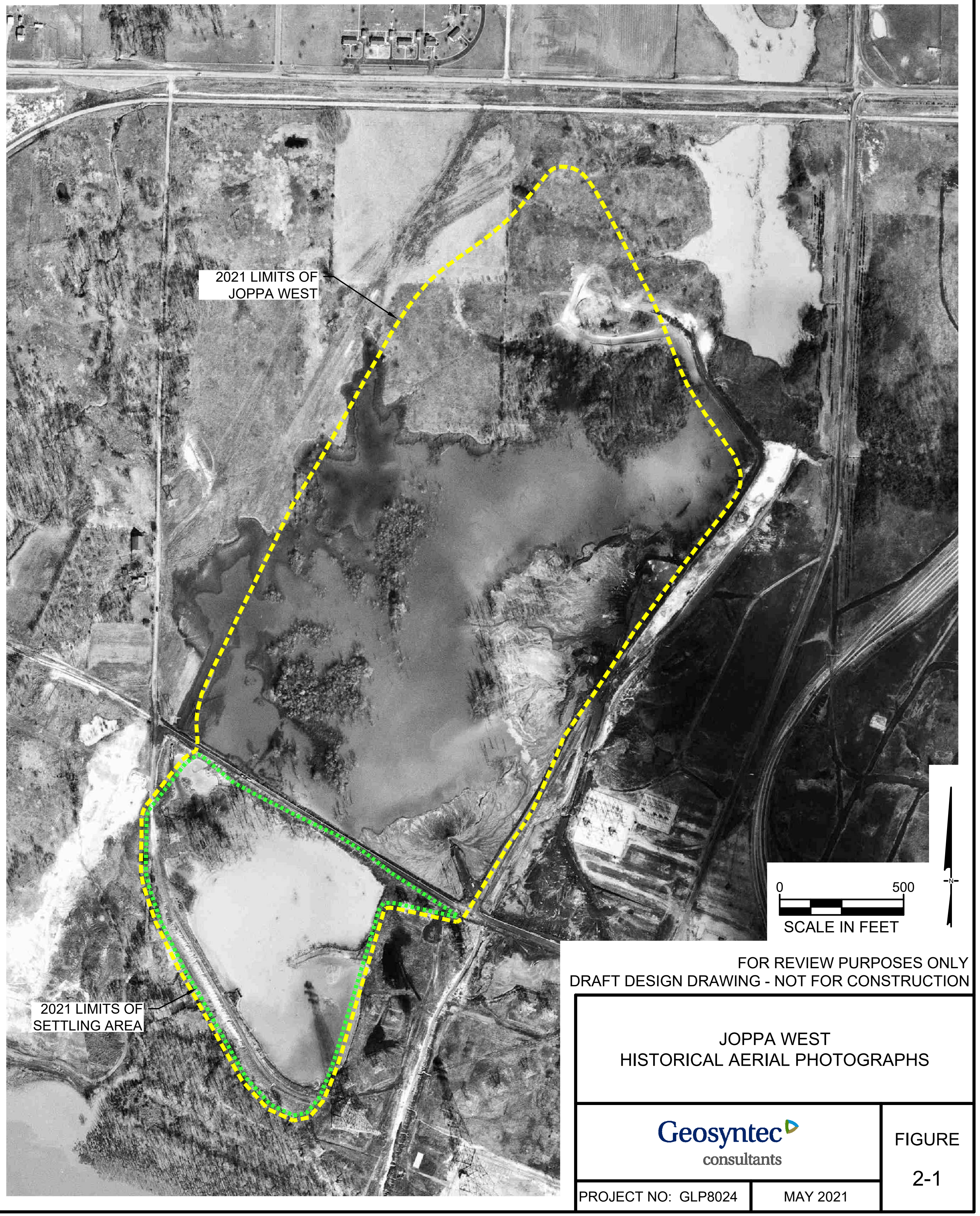
1952 HISTORICAL AERIAL PHOTO



1965 HISTORICAL AERIAL PHOTO



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JOPPA WEST
HISTORICAL AERIAL PHOTOGRAPHS

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consultants

FIGURE
2-1

PROJECT NO: GLP8024

MAY 2021

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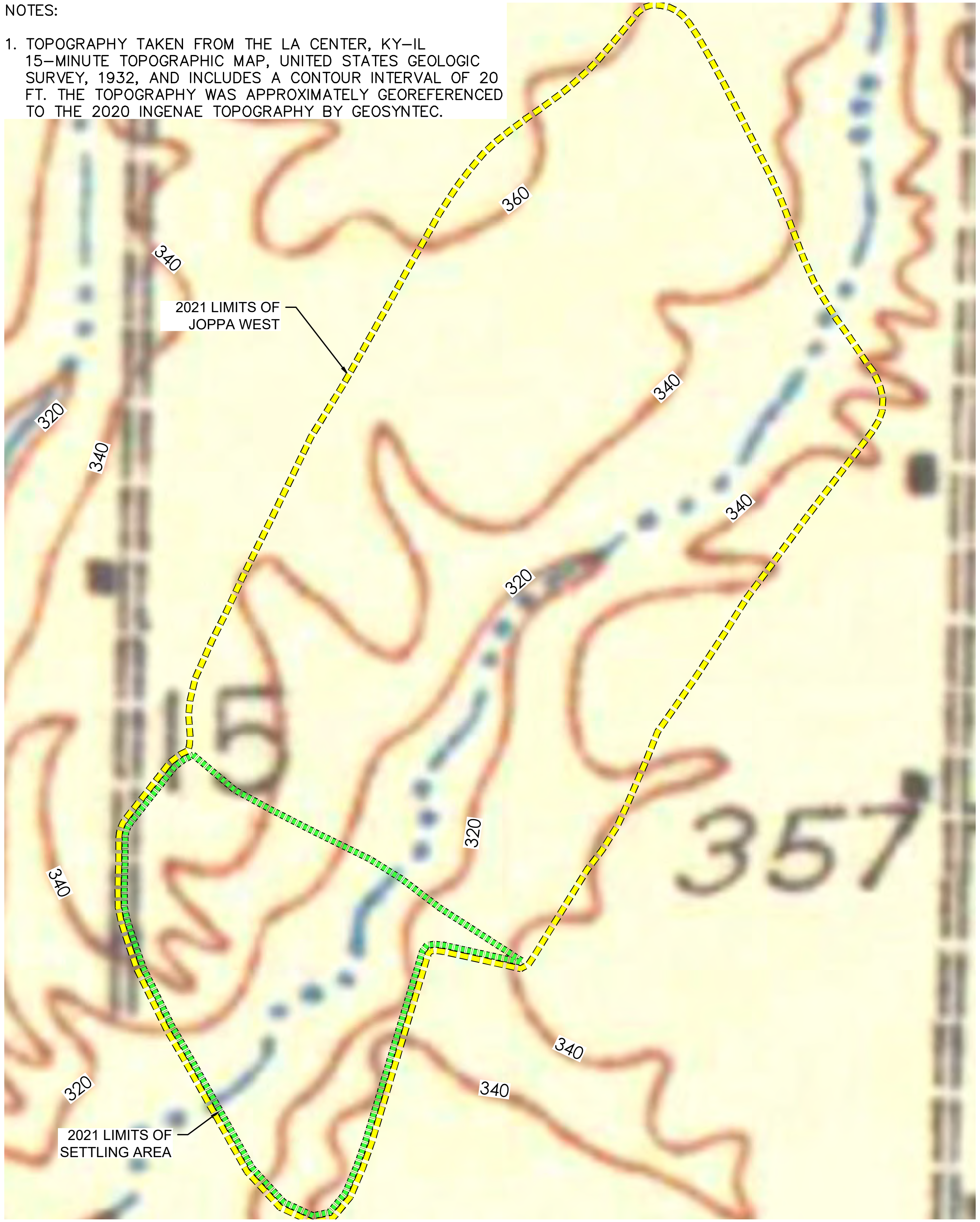
Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

1932 USGS TOPOGRAPHIC MAP

NOTES:

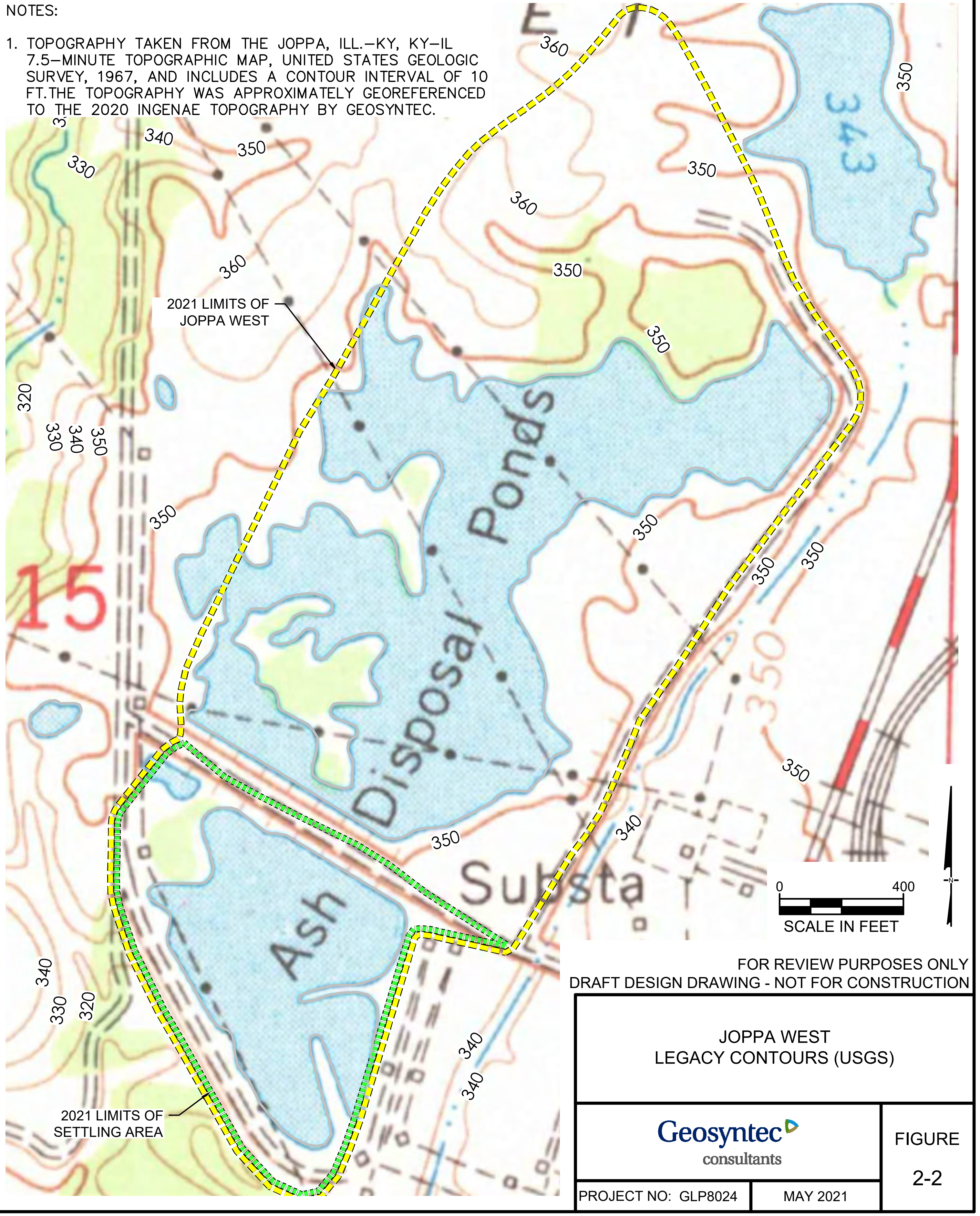
1. TOPOGRAPHY TAKEN FROM THE LA CENTER, KY–IL 15–MINUTE TOPOGRAPHIC MAP, UNITED STATES GEOLOGIC SURVEY, 1932, AND INCLUDES A CONTOUR INTERVAL OF 20 FT. THE TOPOGRAPHY WAS APPROXIMATELY GEOREFERENCED TO THE 2020 INGENAE TOPOGRAPHY BY GEOSYNTEC.



1967 USGS TOPOGRAPHIC MAP

NOTES:

1. TOPOGRAPHY TAKEN FROM THE JOPPA, ILL.–KY, KY–IL 7.5–MINUTE TOPOGRAPHIC MAP, UNITED STATES GEOLOGIC SURVEY, 1967, AND INCLUDES A CONTOUR INTERVAL OF 10 FT. THE TOPOGRAPHY WAS APPROXIMATELY GEOREFERENCED TO THE 2020 INGENAE TOPOGRAPHY BY GEOSYNTEC.



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JOPPA WEST
LEGACY CONTOURS (USGS)

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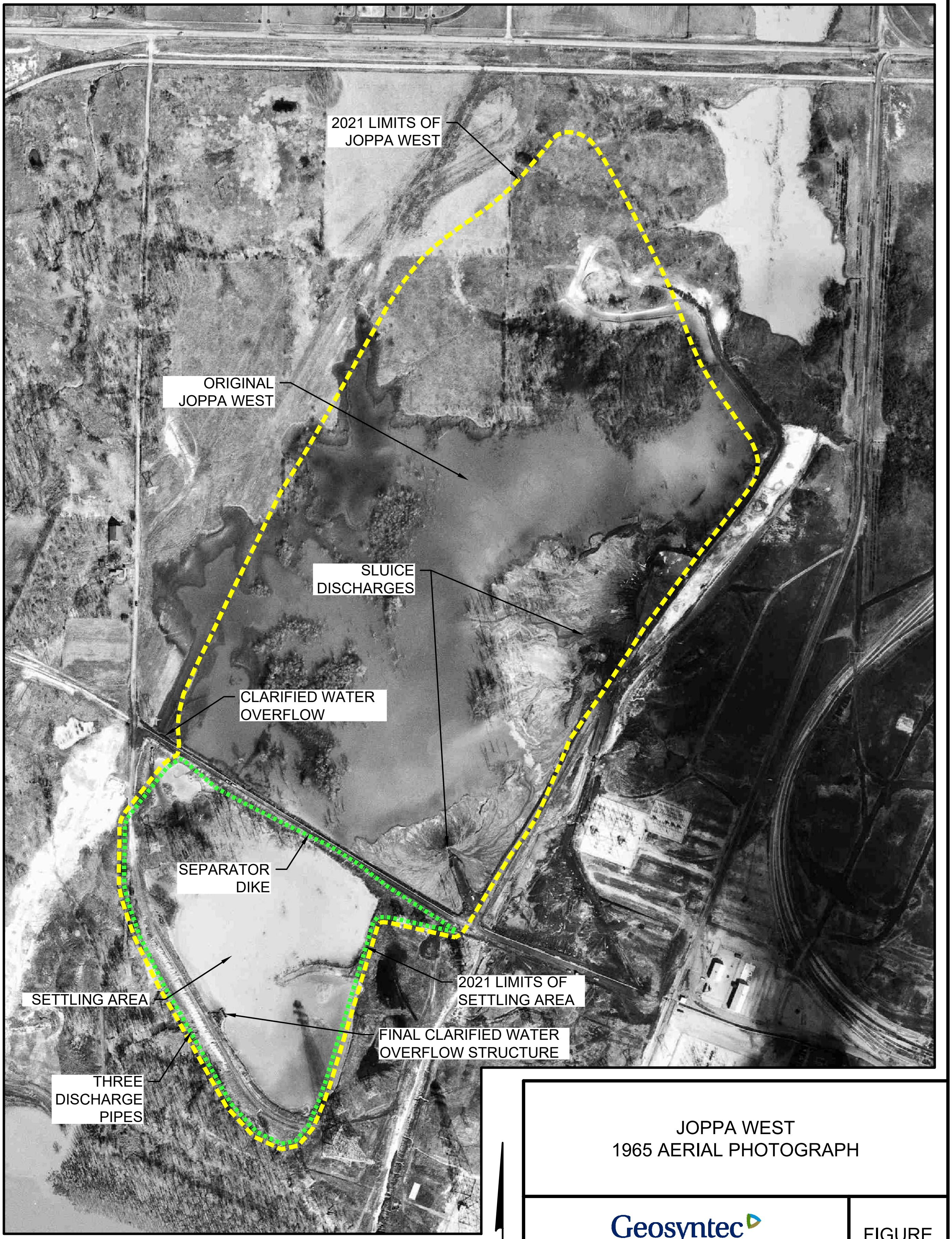
consultants

PROJECT NO: GLP8024

MAY 2021

FIGURE
2-2

S:\PRJ1\CWP\GLP8024-JOPPA\553 - CONCEPTUAL DESIGN\03_FIGURES\GLP8024-JOPPA - FIGURE 2-2 - Last Saved by: TMyers on 5/5/21



JOPPA WEST
1965 AERIAL PHOTOGRAPH

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FIGURE
2-3

PROJECT NO: GLP8024

MAY 2021

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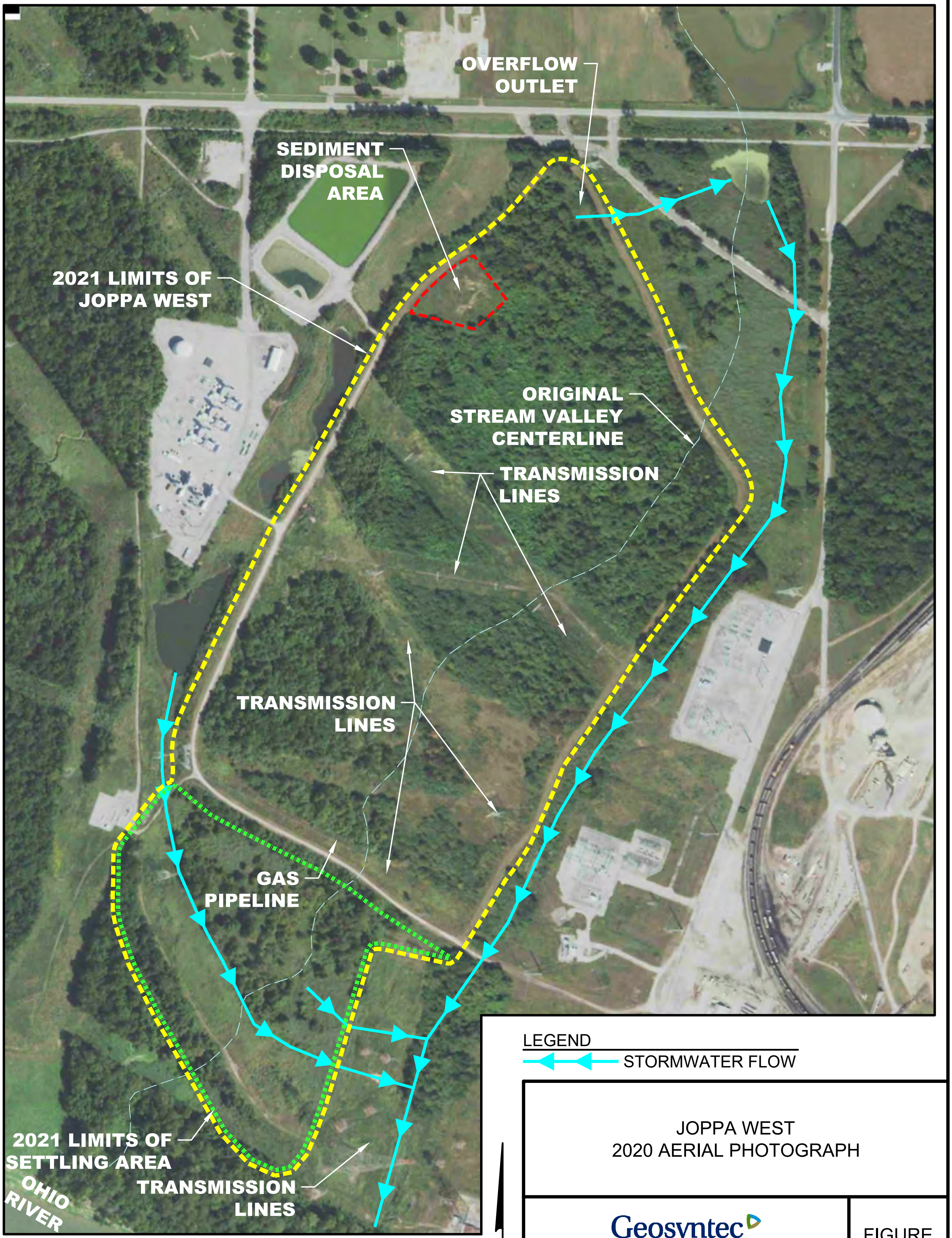
S:\PRJ1\CWP\GLP8024-JOPPA\553 - CONCEPTUAL DESIGN\03_FIGURES\GLP8024-JOPPA - FIGURE 2-3 - Last Saved By: TMyers on 4/22/21



JOPPA WEST
2020 AERIAL PHOTOGRAPH

Geosyntec consultants

FIGURE
2-4

PROJECT NO: GLP8024

MAY 2021

MAP IMAGE TAKEN FROM GOOGLE MAPS (2021)

DRAFT DESIGN DRAWING - NOR FOR CONSTRUCTION

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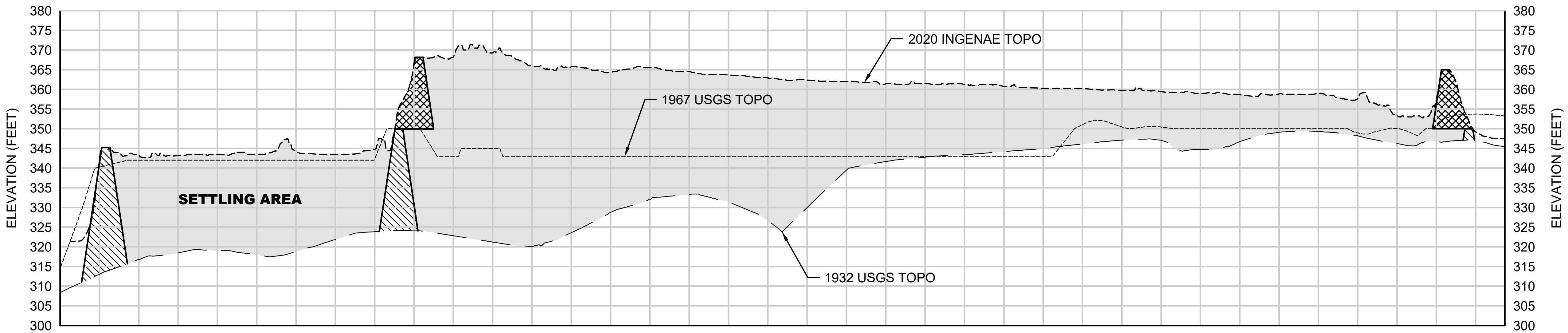
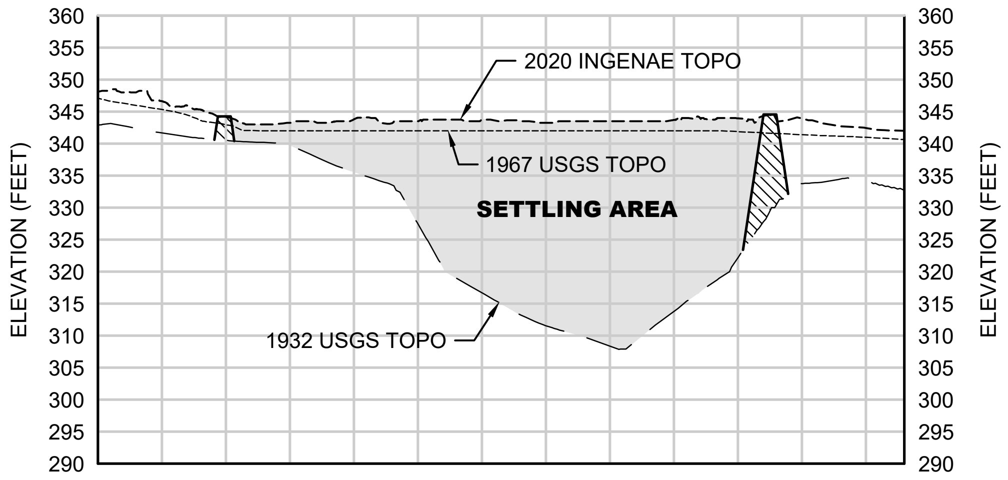


SECTION - AA PROFILE
HORIZONTAL: 1" =300'
VERTICAL: 1" =30'



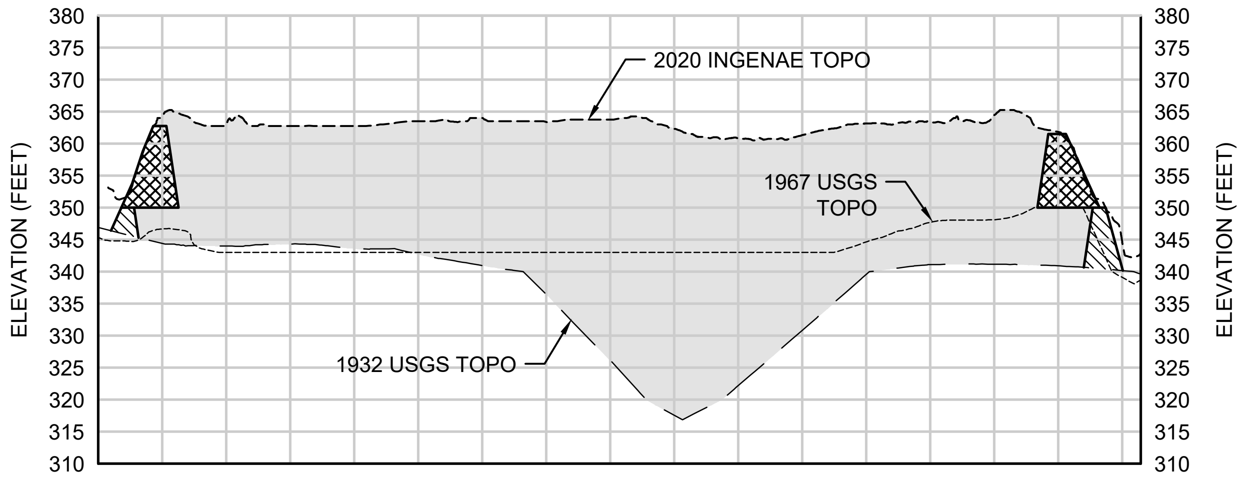
SECTION - BB PROFILE
HORIZONTAL: 1" =300'
VERTICAL: 1" =30'

ESTIMATED CCR VOLUMES

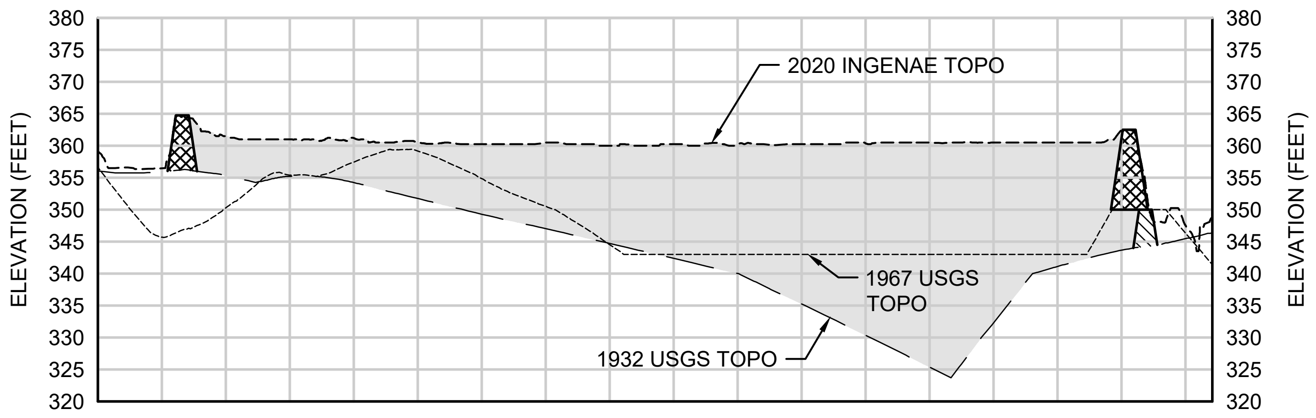
WEST ASH POND: 2,900,000 CY
SETTLING POND: 520,000 CY

LEGEND

▨	1965 DIKE
▦	POST 1965 DIKE RAISE
☐	CCR AREAS
— —	1932 USGS TOPO
-------	1967 USGS TOPO
– – – –	2020 INGENAE TOPO



SECTION - CC PROFILE
HORIZONTAL: 1" =300'
VERTICAL: 1" =30'



SECTION - DD PROFILE
HORIZONTAL: 1" =300'
VERTICAL: 1" =30'

NOTES:

1. DIKE GEOMETRY WAS ASSUMED AS A 20-FT WIDE CREST AND 1.5H:1V SLOPES, BASED ON SITE OBSERVATIONS. A DIKE RAISE FROM EL. 350 FT TO APPROXIMATELY EL. 365 FT WAS ASSUMED BASED ON THE OBSERVED DIKE HEIGHTS FROM THE 1967 USGS TOPO RELATIVE TO THE 2020 INGENAE TOPO.
2. THE 1932 AND 1967 USGS TOPOS UTILIZE 20-FT AND 10-FT CONTOUR INTERVALS, RESPECTIVELY. THE GROUND SURFACE BETWEEN TOPOGRAPHIC CONTOURS WAS INTERPOLATED BY GEOSYNTEC; THE ACTUAL SURFACE MAY VARY.
3. VOLUME ESTIMATES ARE BASED ON A COMPARISON OF THE 2020 INGENAE TOPO TO THE 1932 USGS TOPO, WITH AN ALLOWANCE MADE FOR DIKE VOLUMES. DIKE BORROW WAS ASSUMED TO HAVE BEEN OBTAINED FROM WITHIN THE LIMITS OF THE WEST ASH POND AND SETTLING POND, THEREFORE BORROW AREAS FOR THE DIKES NOT YET PRESENT IN THE 1932 TOPO WERE ASSUMED TO HAVE BEEN FILLED WITH CCR.

LOCATION OF CROSS-SECTIONS SHOWN ON FIGURE 4-1

FOR REVIEW PURPOSES ONLY
DRAFT DESIGN DRAWING - NOT FOR CONSTRUCTION

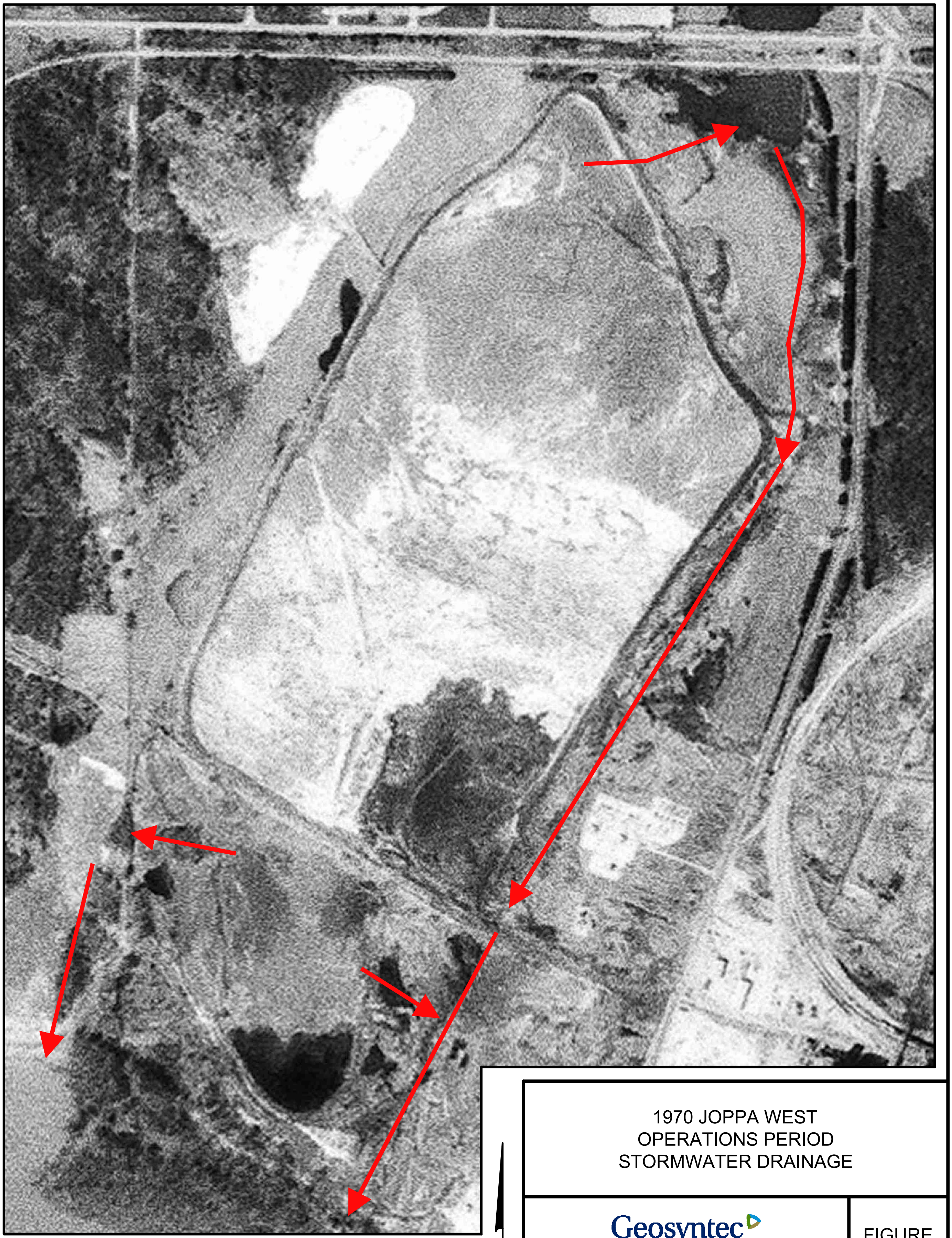
JOPPA WEST
CROSS-SECTIONS AND
CCR VOLUME ESTIMATES

Geosyntec consultants

FIGURE
2-5

PROJECT NO: GLP8024
MAY 2021

S:\PRJ1\CWP\GLP8024-JOPPA\553 - CONCEPTUAL DESIGN\03_FIGURES\GLP8024-JOPPA - FIGURE 2-5 - Last Saved by: TMyers on 5/5/21



LEGEND

🡐 STORMWATER FLOW

DRAFT DESIGN DRAWING - NOR FOR CONSTRUCTION

1970 JOPPA WEST
OPERATIONS PERIOD
STORMWATER DRAINAGE

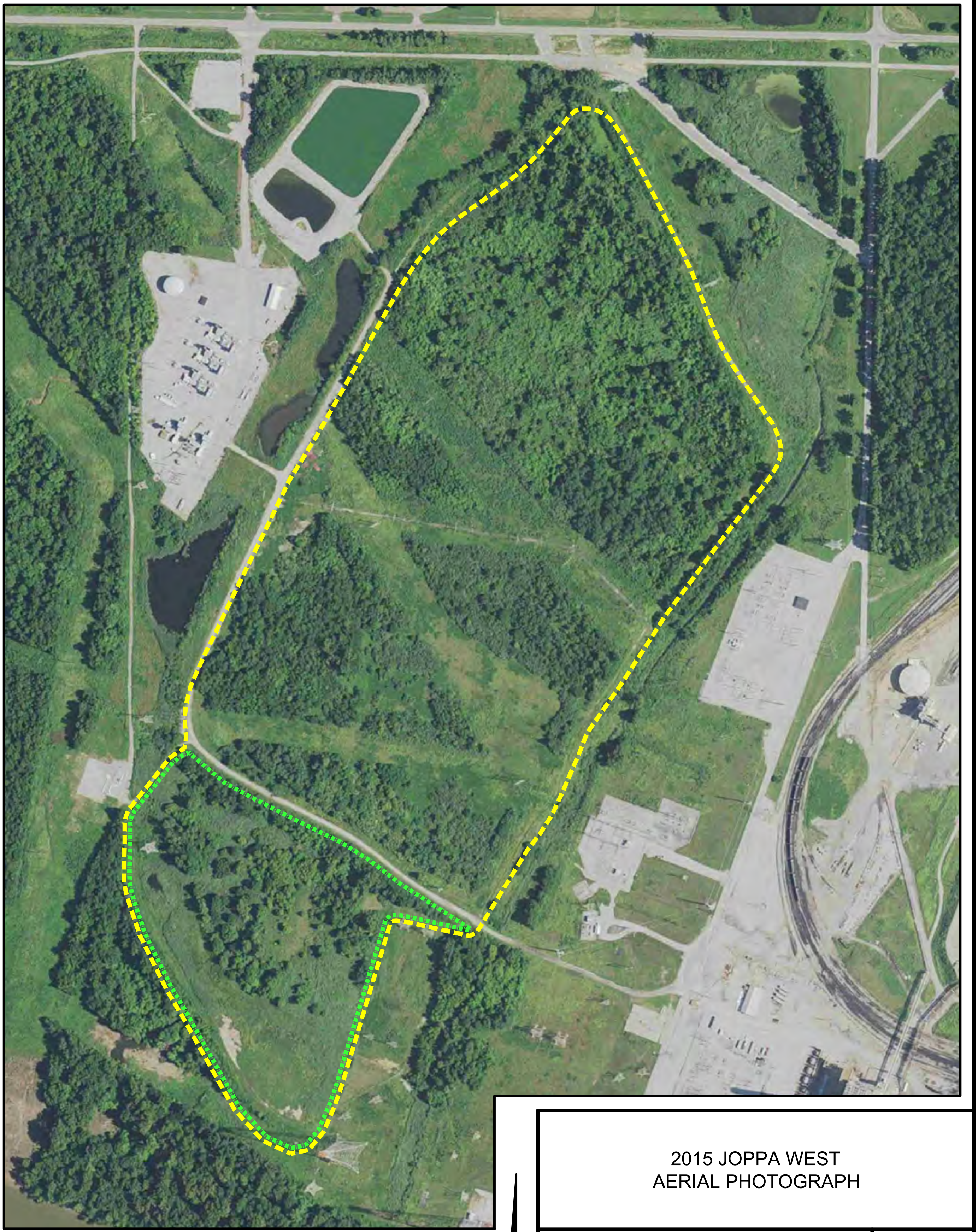
Geosyntec
consultants

FIGURE
2-6

PROJECT NO: GLP8024

MAY 2021

S:\PRJ1\CWP\GLP8024-JOPPA\553 - CONCEPTUAL DESIGN\03_FIGURES\GLP8024-JOPPA - FIGURE 2-6 - Last Saved By: TMyers on 4/27/21



DRAFT DESIGN DRAWING - NOR FOR CONSTRUCTION

2015 JOPPA WEST
AERIAL PHOTOGRAPH

Geosyntec consultants

FIGURE 2-7

PROJECT NO: GLP8024

MAY 2021

S:\PRJ1\CWP\GLP8024-JOPPA\553 - CONCEPTUAL DESIGN\03_FIGURES\GLP8024-JOPPA - FIGURE 2-7 - Last Saved By: TMyers on 4/22/21

APPENDIX A

CURRICULUM VITAE FOR JOHN SEYMOUR, P.E.

JOHN SEYMOUR, P.E.

coal combustion residuals management
remediation
geoenvironmental engineering
geotechnical engineering

EDUCATION

M.S., Geotechnical Engineering, University of Michigan, Ann Arbor, Michigan, 1980
B.S., Civil Engineering, Michigan Technological University, Houghton, Michigan, 1976

PROFESSIONAL REGISTRATIONS

Illinois P.E. Number 062-040562
Indiana No. PE12000172
Michigan P.E. Number 6201033056
Ohio P.E. Number E-85326
West Virginia P.E. Number 017091
Wisconsin P.E. Number 26727

CAREER SUMMARY

Mr. Seymour is a geotechnical engineer with over four decades of experience in the areas of surface impoundments, landfills, site remediation, deep foundations, and construction management. He has focused on waste management and remediation (Superfund (CERCLA) and RCRA) projects for over 35 years, having had significant involvement in many sites providing professional services in the areas of project management, expert witness, client representative, site characterization, feasibility studies, bench/pilot studies, civil/geotechnical design, remedial design, construction quality assurance (CQA), and operation and maintenance.

He has provided coal combustion residuals (CCR) engineering services regarding waste management of fly ash, bottom ash and flue gas desulfurization (FGD) waste for surface impoundments and landfills for 20 years. These services have included geotechnical and environmental evaluations of waste disposal expansions, groundwater assessments, operations, closure, and disposal permit application preparation, for 15 U.S coal power generation clients. Overall, he has provided consulting engineering services for 55 CCR impoundments and 14 CCR landfills. He has translated some of his experience into 11 technical papers and 2 research guidance documents on CCR impoundments (co-investigator), 1 research guidance document on CCR corrective action planning, and provided 13 technical presentations at conferences including at conferences focusing on CCR management.

Highlights of Mr. Seymour's representative CCR experience include:

***Former CCB Surface Impoundment Closure Assessment**, Confidential Client, Kentucky.* Closure alternatives were assessed for a former coal combustion byproduct impoundment. Mr. Seymour led the analysis of long-term closure alternatives that included closure by removal, closure in place, containment by a slurry cutoff wall, and localized remediation of karst conditions.

***Belle River Power Plant Alternate Liner Demonstration Investigation**, DTE China Township, Michigan.* Mr. Seymour is the technical director for the investigation of CCR bottom ash ponds and a diversion basin to demonstrate the glacial clay till layer acts as a technical equivalent to a composite liner as specified by the amended CCR Rule (November 2020).

***Monroe Power Plant Alternate Liner Demonstration Investigation**, DTE Monroe, Michigan.* Mr. Seymour is the technical director for the investigation of a 410-acre CCR fly ash basin to demonstrate the glacial clay till layer acts as a technical equivalent to a composite liner as specified by the amended CCR Rule (November 2020).

***Monroe Power Plant Beneficial Reuse and Geotechnical Investigations**, DTE Monroe, Michigan.* Mr. Seymour was the technical director to evaluate the efficacy of beneficial reuse of fly ash. The investigation was conducted concurrently with a geotechnical investigation to obtain data for the upcoming closure design. The investigations included borings over exposed fly ash and over water. Samples were analyzed for both beneficial reuse and geotechnical parameters.

***Surface Impoundment (SI) CCR de minimis Evaluation,** Confidential Client, Illinois.* Mr. Seymour evaluated the amount of CCR in a recycle pond that demonstrated the pond was not a CCR SI. The recycle pond was the final pond in a CCR treatment pond system and the water was recycled into the power plant. He provided a certified statement attesting to the *de minimis* condition.

***Consulting Expert- Illinois Proposed Part 845 CCR Surface Impoundment Regulation Testimony Support**, Confidential Client, Illinois.* Mr. Seymour supported the testifying expert in the areas of comparative costs of closure by removal v. closure in place, final cover design, inspections, long term monitoring, landfills in floodplains, the costs of closure for several cover designs, and practicality of use of rail and barge transportation of CCR.

CCR Surface Impoundments (SIs) and Landfill Closure, *Confidential Client, Illinois.* Mr. Seymour is the project manager for studies related to the closure of two SIs and one landfill that has been covered as a landfill. The work includes: (i) support of a relative impact assessment in support of the proposed closure option, (ii) design of a river erosion protection plan, (iii) a slope stability reliability assessment, (iv) basis of design document, (v) history of construction report, and (vi) geomorphologic, hydraulic and hydrologic studies in support of river erosion protection measures.

Baldwin Energy Complex CCR Surface Impoundment Closure Construction, *Dynegy Midwest Generation, Illinois.* Mr. Seymour was the engineer of record for the construction closure of a 250-acre CCR surface impoundment system. The work includes monitoring the engineering submittals and design changes for a design completed by the preceding design firm and certifying the closure in accordance with the design. Construction was completed in 2020.

CCR Corrective Action Planning Desktop Reference (CAP DR)*, EPRI, Nationwide.* Mr. Seymour was the technical leader and co-author of this innovative reference document that illustrates how the RCRA corrective action process occurs under the CCR Rule. The CAP DR is formatted in a presentation style pdf with interactive links tied to a process flow chart of the process. The links are also set to different sections of the document and to reference literature and two example cases that includes a surface impoundment and landfill that impact groundwater.

Monroe Power Plant Area 15/Bottom Ash Surface Impoundment Emergency Action Plan*, DTE Energy, Monroe, MI.* Mr. Seymour was the engineer in charge of preparing an EAP for a 100-acre CCR surface impoundment long Lake Erie.

Hennepin Power Station West Ash Pond System Closure, Feasibility Study, Design and Construction*, Dynegy Midwest Generation, IL* Mr. Seymour was the Engineer of Record and Technical Leader during design and construction of a CCR pond closure. He completed a feasibility study to decide on the final closure plan, including assessing a cut-off wall with gradient control, CCR removal, and covering using either soil or geomembrane cover, and the results of a fate and transport model that estimated the time to achieve groundwater protection standards. The closure plan design included a new cover system in accordance with the 2015 U.S. Environmental Protection Agency (EPA) RCRA 40 CFR 257 (CCR Rule). One area was closed by removal and consolidation onto the adjacent area, and the two areas were separated by a steel sheet pile retaining wall and a low-permeability buttress and covered with a soil and geomembrane cover.

Wood River Plant CCR Surface Impoundment Closure Design, *Dynegy Midwest Generation, Illinois.* John was the engineer of record and technical leader for the design of a CCR pond complex for submittal for construction. The services included developing a new closure concept, (revising work done by others), to significantly reduce the closure construction costs. The closure design services included conducting a dewatering study to help decide how to dewater the SI. The design includes a new cover system in accordance with the 2015 U.S. EPA RCRA CCR Rule (40 CFR 257). The design and construction documents have been prepared.

Annual Inspections of CCR Landfills and Surface Impoundment, *DTE Energy, Michigan.* Mr. Seymour completed one annual inspection of a landfill and one surface impoundment and was the technical reviewer for two landfill inspections. The inspections were completed in accordance with 40 CFR 257 (federal CCR Rule).

Alternate Cover Systems for Coal Combustion Residuals Landfills and Surface Impoundments, Product ID 3002010902, *EPRI, Nationwide.* Mr. Seymour was the project manager and technical reviewer to prepare a summary of existing technologies for solid waste landfill covers for closed coal combustion residuals and surface impoundments.

CCR Pond Closure Strategy Development*, DTE Energy, Michigan.* Mr. Seymour prepared a preliminary closure strategy for a 40-acre surface impoundment. The closure must meet the CCR Rule.

CCR Remediation Barrier Wall Profile*, EPRI, Nationwide.* Mr. Seymour was the project director and technical reviewer to prepare a summary of existing technologies of barrier walls for remediation at groundwater impacted CCR facilities.

Leachate Collection Systems for Coal Combustion Residuals Landfill, State-of-the-Practice Technical Report, *EPRI, Nationwide.* Mr. Seymour is the project manager and technical reviewer to prepare a summary of existing technologies for CCR leachate collection systems.

Slope Stability Peer Reviews, Three Power Plant Surface Impoundments, *Confidential Power Generating Company, Midwest.* Mr. Seymour was the Project Director for the completion of peer reviews for CCR surface impoundment containment dikes.

J. C. Weadock Plant CCR Facility CCR Landfill Regrading, *Consumers Energy Company, Michigan.* Mr. Seymour was the engineer of record and certifying engineer for construction for regrading of CCRs to avoid ponding.

CCR Rule Landfill Annual Inspections, *DTE Energy, Michigan.* Mr. Seymour is the project manager for to complete annual inspections of three CCR landfills. He was the chief inspector for one landfill and technical reviewer for the other two landfills.

CCR Rule Compliance Assessments, *AEP, Two Plants in Ohio and one in Kentucky.* Mr. Seymour was the project director and coordinator at eight CCR units (two landfills and six surface impoundments) for: (i) the assessment of groundwater monitoring systems compliance with the US EPA CCR rule (40 CFR 257); (ii) assessment and certification of compliance with location standards, and (iii) the installation of additional monitoring wells and closure of some wells.

Coal Combustion Residuals CCR Rule Templates, *Electric Power Research Institute, Nationwide.* Mr. Seymour is the co-investigator to prepare guidance documents and templates to assist companies in meeting the 2015 USEPA CCR Rule. The documents include: (i) website reporting guidance, (ii) guidance for inspections and templates for weekly and annual inspections, (iii) module to train operators to function as the "qualified person", (iv) dust control plan template, and (v) Emergency Action Plan template (draft).

Confidential CCR Landfill, *Michigan.* Study of closure options for a CCR landfill that has a long-term groundwater pumping system to suppress groundwater levels to below the bottom of this unlined landfill. A fill plan was developed to bring the grades up to final conditions that included a conveyor system to move waste, rerouting a haul road, and concept design of the CCR handling facilities.

J. C. Weadock Plant CCR Facility Engineering Study, *Consumers Energy Company, Michigan.* Mr. Seymour was the project director and senior technical reviewer for a study of the existing CCR facility. The study was to assess the future use and closure of the facility considering current regulations and future proposed federal regulations regarding CCRs under RCRA and the effluent limitation guidelines and standards for the steam electric power generating industry under the Clean Water Act.

Rivesville and Albright Power Plants, *FirstEnergy, West Virginia.* Engineer of Record for the design of the closure of two CCR landfills that included new *landfill cover* systems that met state regulations.

Coal Combustion Residuals Pond Closure Guidance Documents, *Electric Power Research Institute, Nationwide.* Mr. Seymour was a co-investigator/author and project manager for the completion of two guidance documents relating to CCR pond closures. They include: (i) "Coal Combustion Residuals Pond Closure- Dewatering and Capping Guidance", and (ii) "Coal Combustion Residuals Pond Closure- Construction over Closed Ponds".

General James M. Gavin Power Plant Stingy Run Fly Ash Reservoir Closure, *American Electric Power, Cheshire Ohio.* Mr. Seymour is the project manager for the permit to install design and construction document design of a 300-acre fly ash disposal pond closure. The pond will be closed in place by covering with a cap meeting the requirements of RCRA CCR Rule. The pond is contained by a 145-ft high earthen dam and the ponded water must be lowered and the fly ash covered in accordance with the proposed U.S. EPA RCRA Subtitle D (solid waste landfill) regulations (2010). The design includes lowering the dam such that no water will be retained after closure; a dam "repair" design was submitted to and approved by the Ohio Department of Natural Resources. The closure design also included examining several closure alternatives and included flood studies and associated hydraulic modeling to safely pass the Probable Maximum Flood (PMF), 100-yr, 24-hr flood event and meet NPDES discharge permit limits for TSS and pH and concrete spillway design to manage the probable maximum flood (PMF). The work also included assessment of acid mine drainage (AMD) and design of both an active and a passive treatment system. He was the project director and technical reviewer for the preparation of construction documents. The project is under construction.

General James M. Gavin Power Plant Residual Waste Landfill Expansion, *Gavin Power, LLC, Cheshire, Ohio.* Mr. Seymour was the technical reviewer for the next phase of landfill expansion for the new plant owner. The work includes revising the sequence of phase construction, preparation of revised permit drawings and plans, completion of construction documents, revisions to leachate pond design.

General James M. Gavin Power Plant Residual Waste Landfill Expansion, *American Electric Power, Cheshire, Ohio.* He managed the design of and the PTI application for a 47,000,000 cuyd residual waste landfill for the solid waste PTI application under existing OEPA rules which incorporated met the RCRA CCR Rule. The design included bottom liner and cover design, stormwater runoff design for the 25-year, 24-hour storm event. The PTI application was submitted in August 2011 and included four volumes and 67 design drawings and was given approval approximately 14 months after submittal, well ahead of the client's goal of 18 months. He followed up by managing the completion construction documents (summary of work, drawings, QA/QC Plan and Specifications, quantities, bid form, measurement and payment) for bid. He was the project director and reviewer for preparation of the construction documents. The first phase of construction has been completed. He recently was the technical director and reviewer for an examination of changing the sequence of construction for the next cell/phase.

General James M. Gavin Power Plant Residual Waste Landfill Expansion Focused Feasibility Evaluation, *American Electric Power, Cheshire, Ohio.* Mr. Seymour was the project manager for the focused feasibility evaluation (FFE) for a coal combustion residuals (CCR) landfill expansion and the resulting design and permit application for a landfill expansion. The expansion is partially over an existing fly ash impoundment with over 90-ft depth of ash and partly on an existing CCR landfill. The viability of the expansion site was compared to a greenfield site. The FFE included document review, a site reconnaissance, a site investigation (soil borings, ash borings, cone penetration testing of ash, and laboratory testing), conceptual layout of five configurations, liquefaction analysis, slope stability analysis and settlement analysis. Economic studies were completed to compare the different layouts. The FFE also addressed the regulations proposed by U.S. EPA in June 2010 related to closing the existing ash impoundment.

Monroe Power Plant Vertical Extension CCR Landfill, *DTE Energy, Monroe, MI.* Mr. Seymour was the project director for the site investigation for a vertical extension landfill over the ash basin in support of the permit application and design submitted to MDEQ. He also was the owner's technical representative for review of the permit application and design. In 2015, 2016 and 2017, he provided the annual inspection and reports under the CCR Rule.

Monroe Power Plant Ash (CCR) Basin, *DTE Energy, Monroe, MI***.** Mr. Seymour was the project director and engineer of record to conduct an evaluation of slope stability of the side slopes of the earthen containment dike around the ash basin (CCR surface impoundment) and to assess the potential for a failure due to operating issues. The 3.5-mile long, up to 44-ft high dike was inspected and a remedy for observed sloughing was developed that included flattening the slopes and relocating a county drain (drainage ditch). The design has been broken up into several construction seasons.

In late 2009 he was the project director, engineer of record and certifying engineer for the relocation of a county drain (creek) and temporary erosion mitigation on the side slopes of the ash basin embankment to prepare the site to flatten the slopes of the ash pond embankment in 2010.

In 2010, 2011 and 2012, he was the project director, engineer of record, and certifying engineer for flattening of 4,000 ft of the ash basin embankment slopes including relocation of a stormwater pump house.

In 2013 he was the project manager, engineer of record, and certifying engineer for final slope mitigation consisting of removal and re-vegetation of the surface and flattening of 2,500 ft of the ash basin embankment and design of a new access/haul road.

He also was the project director for: (i) a study of the source of seepage observed at the toe of the embankment, (i) the completion of a potential failure mode analysis for the entire ash basin disposal facility, and (iii) a global stability assessment that utilized a reliability approach.

In 2014 he was the project manager for the development of an Emergency Action Plan (EAP) under FERC guidelines for the ash basin.

For the ash basin, he managed the preparation of and certification of: the closure and post closure plans, hazard potential assessment, safety factor assessment, structural stability assessment, hydraulic capacity assessment, and construction completion report under the CCR Rule in 2015 and 2016.

In 2016 through 2019, he was the technical director and engineer of record of studies and design for mitigation of continued sloughing and the design and construction of further mitigation measures.

Monroe Power Plant Ash Basin Disposal Options Analysis, *DTE Energy, Monroe, MI***.** Mr. Seymour was the project manager for the FGD Gypsum Disposal Facility Preliminary Engineering Study and was the project manager to assess disposal options for new flue gas desulphurization (FGD) gypsum that will be generated at this coal fired electrical generating station. Three options were evaluated: disposal at a “greenfield” site that has wetland impacts, disposal over the top of a 400-acre ash pond, and 3) temporary disposal at an offsite DTE coal ash landfill. Further, wet and dry handling options were evaluated.

Planta Las Palmas CCB Landfill Development Studies, *Duke Energy International Guatemala, Guatemala***.** Mr. Seymour has completed studies to optimize the development of a new coal ash landfill and prepare site investigation bid specifications. The study identified the most economical number and size of the cells. Subsequently, he was the project manager to prepare the detailed design and construction bid documents for the coal storage area, Cell 1 of the ash landfill, leachate treatment pond with discharge structure, and the power plant water intake structure.

Planta Arizona, CCB Landfill Design Consulting, *Duke Energy International Guatemala, Guatemala*. Mr. Seymour provided consulting to DEIG to layout a new coal ash disposal facility for a coal-fired electrical generating station. The work included defining the design and operating criteria to meet the World Bank policy for solid waste landfills. The criteria were presented in a Design Framework report that was provided to the engineering, procurement and construction contractor to complete the design and construction. In addition, the same information will be provided to the local regulatory authority with the addition of environmental management criteria, including safety, operations, closure and post-closure.

R. Paul Smith CCB Landfill Expansion, *Allegheny Energy Supply, Berkeley County, WV***.** Mr. Seymour was the project manager for the design and construction quality assurance of a coal combustion byproducts landfill at a coal-fired power plant in Maryland with the landfill located in adjacent West Virginia. He managed the evaluation of the most economical landfill expansion approach, which considered vertical and lateral expansion options. The selected method of expansion included three elements: lateral expansion using a composite liner system, vertical expansion using a mechanically stabilized earth (MSE) retention system, and a vertical expansion over the top of the existing disposal area. He managed the design of the landfill for the solid waste permit application and construction bid package.

Mr. Seymour prepared the construction bid documents for the cleanout of the ash treatment surface impoundment. He also managed the CQA for the cleanout.

He most recently managed the CQA of the construction of the Phase A portion and prepared the construction certification report.

Cardinal Plant Landfill Studies, *American Electric Power, Brilliant, OH.* Completed a feasibility study to assess the potential to develop a new flue gas desulphurization (FGD) waste landfill over an existing fly ash disposal area at a coal-fired power plant. The study included utilization of mine spoil as a building product and examination of foundation settlement potential for this landfill that will be located over 90 ft thick layer of saturated coal ash in a “valley fill”.

Lake Lansing Coal Ash Disposal Site, *Lansing Board of Water and Light, Lansing, MI.* Mr. Seymour developed the scope of work for a groundwater investigation to assess impacts from the site and guided the investigation and interpretation of the results. He guided the client through the process of complying with a new Michigan rule for site investigations and remedial action process.

Litigation Assignments

Mr. Seymour has been an expert witness services for ten matters. He has prepared expert reports, been deposed, and provided testimony at trial. The following summarizes his experience.

Tanners Creek Fly Ash Pond Closure*, Indiana, Tanners Creek Development, LLP.* Mr. Seymour evaluated a technical comment report regarding the closure in place of an inactive fly ash pond. A response report was prepared by Mr. Seymour and submitted in 2020. He was deposed in 2021.

Town of Pines Site*, Indiana, NiSource, Plews Shadley Racher & Braun LLP.* Mr. Seymour was the expert for insurance cost recovery litigation. He has prepared and submitted the expert opinion report in March 2020. The matter involved cost recovery for remediation of groundwater impacts from CCRs. It was settled in 2021.

FirstEnergy Bankruptcy Litigation*, Debtor’s Company, Akin Gump Straus Hauer and Feld, LLP, 2019, Ohio, Pennsylvania and West Virginia.* Mr. Seymour was the expert to calculate environmental liabilities for the new owner of 12 properties that are a part of the new company emerging from bankruptcy. The properties include three operating coal-fired power plants, one shuttered coal-fired plant, one major CCR surface impoundment undergoing closure (Little Blue Run), two CCR landfills, one property with landfilled CCR, one property after the plant was demolished, and three nuclear power stations. The expert report was submitted, he prepared a rebuttal report for opposing experts' reports, and was deposed. The parties came to agreement prior to trial and entered Mr. Seymour's expert report into the court record without objection at trial. Before the US Bankruptcy Court, Northern District of Ohio, Eastern Division, Case No. 18-50757.

Expert Witness for Groundwater Impacts at four Power Plants, 2015-2020, *Midwest Generation, Illinois.* Mr. Seymour was been retained as an expert in the field of groundwater impacts and potential remediation at and around CCR waste treatment and leachate ponds at four power plants in Illinois. He provided the expert report, deposition, rebuttal report, and eight hours of testimony at the hearing before the Illinois Pollution Control Board, PCB No-2013-015.

Confidential Client, 2014. Mr. Seymour was retained as an expert in the field of CCR landfill design constructed over a closed coal ash pond ("overfill"). His work was to provide a response to environmental group comments that were in opposition to the proposed landfill.

Kingston Dredge Cell Failure Insurance Arbitration, 2013, *Tennessee Valley Authority.* Mr. Seymour was retained as a consulting expert in the field of CCR ponds for the arbitration of the denial of a major insurance claim. He represented the plaintiff who was denied insurance coverage for the failure of a CCR dredge cell. He drafted the expert witness report which included research into all of the CCR ponds that were inspected by USEPA from 2009 to 2012. The research was utilized to successfully obtain full relief and insurance coverage.

Confidential Landfill Remedial Action Litigation Support Services, 2007-2010, *Republic Services, north-central IL.* Provided technical support to legal counsel for the remedy selection process at a 40-acre solid waste facility closed in the 1970s and developed into a park.

AmForge Site Expert Witness Engineering, 2006, *Arvin-Meritor, Chicago, IL.* Provided engineering support in the areas of contaminant fate and transport, risk assessment, and site characterization for expert witness services in this cost recovery case. The cost recovery was undertaken by private parties brought under CERCLA. The AmForge Site is a former foundry that was sold in the early 1980s. It was later acquired and remediated and the plaintiff sought cost recovery from Mr. Seymour's client for contamination related to the former foundry.

Yeoman Creek Landfill Superfund Site PRP Contribution Litigation, Illinois 2004-2005. Mr. Seymour was hired as the expert for a PRP Group suing a party for contribution for remediation of a CERCL site in Illinois. He provided expert testimony under deposition.

CCP v. Kent County, Michigan**, **Kent County Aeronautics Board, Grand Rapids, MI, 1996. Mr. Seymour was retained as the expert for the defendant who was being sued for $15,000,000 in damages after the public taking of a former hazardous waste treatment, storage and disposal property formerly owned by the plaintiff for the expansion of an airport. He prepared the expert report, deposition and testimony at trial. The client was found to be not liable for all but approximately $200,000 in damages, and the client considered this a very favorable result.

City of Howell, Michigan v. VCF Films, 1994. Mr. Seymour assisted in an arbitration case on behalf of the City of Howell, Michigan in pursuit of cost contribution to remediate a closed municipal waste facility. He provided an expert report regarding the allocation of cost to address a specific compound found in groundwater at the facility from the defendant's manufacturing process. The arbitration was considered successful by the client.

Carter Lumber V. LTV Steel, Lancaster, Ohio, 1995. Provided expert witness consulting services for the defendant in the area of contamination site assessment in this cost recovery case litigated under CERCLA. The former lumber retail site was previously used to store wastes, in particular, PCB transformers. The plaintiff sought relief for remediation of the PCBs. He provided an expert witness report. The case was favorably settled.

National Industrial Environmental Services, 1985, *Chemical Waste Management, Inc., near Wichita, KS****.*** Provided engineering and hydrogeologic support to the expert witness on behalf of the plaintiff who was seeking cost recovery under CERCLA for costs to remediate a RCRA hazardous waste treatment, storage and disposal facility.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Chicago, IL, 2001-present
URS Corporation, Detroit, MI, 1997 – 2001
Woodward-Clyde Consultants (later URS), Chicago, IL and Detroit, MI, 1980-1997
Townsend and Bottum, Ann Arbor, MI, 1978-1979
Stone & Webster, Shippingport, PA, 1976-1978

AWARDS AND RECOGNITIONS

Best Technical Paper, Woodward-Clyde Consultants, 1995
Young Professional of the Year Award, Woodward-Clyde Consultants, 1987

AFFILIATIONS

American Society of Civil Engineers

Midwest Coal Ash Association

REPRESENTATIVE PUBLICATIONS

19-10 "Corrective Action Planning Desktop Reference", EPRI Technical Report 3002016499, Palo Alto, CA, J. Seymour, J. Sirk

15-08 "EPA's Coal Combustion Residuals Rule: Review of Applicability, Exemptions, and Technical Requirements", American Bar Association Section of Environment, Energy, and Resources, Vol. 15, No. 1, August 2015, Mike Houlihan, John Seymour, and Steven Burns,

15-05 "Conditions of Coal Ash Embankments", World of Coal Ash Conference, Nashville, KY, May 2015; John Seymour, P.E., Omer Bozok, Amanda Hughes, PhD, Brad Bodine, P.E., CHMM

15-04 "Conditions of Coal Ash Embankments", U.S. Society on Dams Conference, Louisville, KY, April 2015; John Seymour, P.E., Omer Bozok, Amanda Hughes, PhD, Brad Bodine, P.E., CHMM

14-08 "Utilities Need to Prepare to Comply with EPA's Upcoming Coal Ash Rule", American Bar Association, Section of Environment, Energy and Resources, Waste and Resource Recovery Committee Newsletter, Volume 14, No.1, Mike Houlihan and John Seymour

14-05 "Coal Combustion Residuals Pond Closure, Guidance for Dewatering and Capping", EPRI Technical Report 3002001117, Palo Alto, CA, J. Seymour, W. Steier, C Li, P Sabatini, M Lodato, M. Bardol, M. Gross.

14-05 "Coal Combustion Residuals Pond Closure, Guidance for Construction Over Closed or Closing Ponds", EPRI Technical Report 3002001143, Palo Alto, CA, P. Sabatini, R. Kulasingam, J. Seymour,

13-04 "Challenges of Closing Large Fly Ash Ponds", World of Coal Ash Conference, Lexington, Kentucky, April 2013.

11-05 "Advances in Design of Landfills over CCR Ponds and CCR Landfills", Proceedings from the World of Coal Ash conference, Denver, CO, John Seymour, P.E. and Michael F. Houlihan, P.E. BCEE, May 2011.

11-06 "Case Study: Stability of Two Horizontal to One Vertical Embankment", Proceedings from ASCE Geo-Frontiers 2011, Advances in Geotechnical

Engineering, Burak Tanyu, PhD, W. Neal, P.E., J Seymour, P.E., M ASCE, D. Bodine, P.E. M ASCE, and O. Bozok.

INVITED PRESENTATIONS

He has presented the following presentations at conferences:

19-06 “Corrective Action Plan Desktop Reference, Hypothetical Scenario 1 Walkthrough”, EPRI Technical Seminar, Whitefish, Montana

19-05 “A Summary of CCR Disposal Facility Design, Operations, and Closure”, World of Coal Ash Short Course, St Louis, Missouri

19-05 “Harvesting of Coal Combustion Residuals from Landfills for Cement Production-an Update”, World of Coal Ash, St Louis, Missouri

18-10 “Harvesting of Coal Combustion Residuals from Landfills for Cement Production” ACAA/EPRI/CAER Workshops, Louisville, Kentucky

18-10 “Construction Risk Management Considerations for CCR Surface Impoundment Closures”, ACAA/EPRI/CAER Workshops, Louisville, Kentucky

17-05 “Geotechnical Considerations in Surface Impoundment Management and Closure”, World of Coal Ash, Lexington, Kentucky.

16-02 “Slope Stability Considerations under the New CCR Rule”, Utility Solid Waste Activities Group Workshop, Washington, D.C.

16-02 “Structural Integrity Considerations under the CCR Rule”, Teaching Position for the American Coal Ash Association/University of Kentucky Center for Applied Energy Research/Electric Power Research Institute Workshop on Current Issues in Ponded Ash, Winter Meeting, Tampa, FL.

15-10 “Response to the New Coal Combustion Residuals (CCR) Rule”, to the American Bar Association Energy, Environment and Resources Annual Meeting, Chicago, IL.

15-06 “Slope Stability Considerations under the CCR Rule” and “Inspections and Monitoring of CCR Surface Impoundments”, to the Electric Power Research Institute Program 49 Companies, Bar Harbor, ME.

15-05 “Geotechnical Considerations for Surface Impoundment Closure to Meet the CCR Rule & Avoid Compliance and Constructability Pitfalls”, Technical Short Course Teacher at the World of Coal Ash conference, Nashville, TN.

15-04 “Conditions of Coal Ash Embankments”, at the U.S. Society on Dams Conference, April 2015 I Louisville, KY, John Seymour, P.E., Omer Bozok, Amanda Hughes, Ph.D., Brad Bodine, P.E.

14-03 "CCB Wet Pond Assessment, Closure, and Redevelopment", presentation provided to FirstEnergy, March, 2014.

13-12 "CCR Pond Closures: Major Difficulties and Solutions", presentation to the Utility Solid Waste Activities Group, Washington, D.C., December, 2013.

13-11 "CCR Pond Closures: Major Difficulties and Solutions", presentation and workshop for the Tennessee Valley Authority, Chattanooga, Tennessee, November 2013.

13-04 Presentation of: "Challenges of Closing Large Fly Ash Ponds", at the World of Coal Ash Conference, Lexington, Kentucky, April 2013.

13-04 "Hot Topics Regarding Coal Combustion Residuals Management, presentation to Winston & Strawn Environmental Group, Chicago, Illinois, April 2013.

12- 08 "Landfills over CCR Ponds", Webinar with CETCO serving over 140 participants, August 2012, repeated in September 2012.

11-05 Presentation of: "Advances in Design of Landfills over CCR Ponds and CCR Landfills", at the World of Coal Ash conference, Denver, CO, May 2011.

09-04 "Geotechnical Design Considerations for Landfill Construction Over an Ash Pond", World of Coal Ash, Lexington, KY, May 2009

APPENDIX B

IEPA EAST ASH POND PERMIT CORRESPONDANCE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
WATER POLLUTION CONTROL

PERMIT NUMBER: 1974-EA-1070-OP

DATE ISSUED: July 2, 1974

PROJECT LOG NUMBERS: 155-74;161-74;712-74; 1020-74;1127-74

SUBJECT: ELECTRIC ENERGY, INCORPORATED (Joppa)-Non-Contact Cooling Water

PERMITTEE TO OWN AND OPERATE: Electric Energy, Incorporated
P.O. Box 165
Joppa, Illinois 62953

Permit is hereby granted to the above designated permittee to discharge wastewater described as follows:

Non-contact cooling water from miscellaneous heat exchangers discharged thru outfall #008 having an average daily flow of 432,000 gallons per day, non-contact cooling water from main steam condensers 1, 2, 3 and 4 discharged thru outfall #006 having an average daily flow of 378 MGD, non-contact cooling water from main steam condensers 5 and 6 discharged thru outfall #007 having an average daily flow of 165.8 MGD, all being discharged to the Ohio River.

The final plans, specifications and supporting documents approved by this permit were prepared by Electric Energy, Inc. and Wapora, Inc. and are identified in the records of the Illinois Environmental Protection Agency, Division of Water Pollution Control, Permit Section, by the log numbers designated in the subject heading above.

The expiration date is July 2, 1975.

The Standard Conditions of issuance of this permit are itemized below.

READ ALL CONDITIONS CAREFULLY:

STANDARD CONDITIONS

Pertaining to both construction and operation permits.

1. If any statement or representation is found to be incorrect, this permit may be revoked and the permittee thereupon waives all rights thereunder.

2. During or after the construction or the installation of the sewage works, any agent duly authorized by the Environmental Protection Agency shall have the right to inspect such work and its operation.

3. The issuance of this permit (a) shall not be considered as in any manner affecting the title of the premises upon which the sewage works are to be located; (b) does not release the permittee from any liability for damage to person or property caused by or resulting from the installation, maintenance or operation of the proposed sewage works; (c) does not take into consideration the structural stability of any units or parts of the project; and (d) does not release the permittee from compliance with other applicable statutes of the State of Illinois, or with applicable local laws, regulations or ordinances.

4. Treatment works will be operated or supervised by a duly qualified sewage works operator certified under the Regulations of the Environmental Protection Agency.

5. The treatment works or wastewater source covered by this permit shall be constructed and operated in compliance with the provision of the Environmental Protection Act and Chapter 3 of the Rules and Regulations as adopted by the Illinois Pollution Control Board.

6. Plans, specifications and other documentation submitted shall constitute a part of the application and when approved shall constitute part of the permit.

7. This Permit may not be assigned or transferred without a new permit from the Illinois Environmental Protection Agency.

Pertaining only to construction permits.

1. There shall be no deviations from the approved plans and specifications unless revised plans, specifications, and application shall first have been submitted to the Environmental Protection Agency and a supplemental written permit issued.

2. The installation shall be made under the supervision of an inspector, who is familiar with the approved plans and specifications provided by and approved by the owner, and said inspector shall require that construction complies with the plans and specifications approved by this Agency.

3. Unless otherwise stated by Special Condition, construction must be completed in three years for treatment works and two years for sewers and wastewater sources.

4. Unless otherwise stated by Special Condition, the issuance of this permit shall be a joint construction and operation permit provided that
   a) All standard and Special Conditions, are complied with.
   b) This Agency is notified within ten (10) days, respectively, of the start of construction and the date of testing and start-up of full operation.
   c) The submission of operating reports of the treatment works covered under this permit shall be at a frequency specified by this Agency.
   d) The operation permit shall expire one year from the date of start-up of operation.
   e) At least 90 days prior to the expiration date of the operation permit, the permittee shall apply for a renewal of the operation permit.

This permit is issued in accordance with the Illinois Environmental Protection Act of 1970 and the Chapter III Water Pollution Regulations adopted by the Illinois Pollution Control Board in March of 1972.

TRW:RAF:df

cc: Grants and Tax
Reg. V/U.S.EPA
Ray Bogardus, Wapora
Division of Waterways
Massac Co. Health Dept.

DIVISION OF WATER POLLUTION CONTROL

W H Busch by

William H. Busch, P.E.
Manager, Permit Section

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
1 NORTH WACKER DRIVE
CHICAGO, ILLINOIS 60606

	~~G. Rice~~	
	~~P. Bollone~~	
	V. Clark	
	J. Thomas	
	H. Chambers	
	G. Femmer	
	J. Armstrong	
	L. Stanton	
	B. Harris	
	C. Remy	
✓	J. Jacob Copy of letter	
	C. Stairs & all attachments	
	D. Jordan	
	M. Gregory	
	F. Rutherman	
✓	File Water Pollution	

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

JUL 26 1974

Mr. George A. Rice
Vice President
Electric Energy, Inc.
Post Office Box 165
Joppa, Illinois 62953

Re: NPDES Permit
No. IL 0004171

Dear Mr. Rice:

Your application IL 072 OYE 2 000465 for a National Pollutant Discharge Elimination System (NPDES) Permit has been processed in accordance with Sections 402 and 405 of the Federal Water Pollution Control Act Amendments of 1972, (86 Stat. 816; Public Law 92-500, 33 U.S.C. 1251 et. seq.).

The enclosed NPDES Permit covers your operations which discharge into the Ohio River at Joppa, Illinois. All discharges from this facility shall be consistent with the terms and conditions of this permit.

Very truly yours,

James O. McDonald

James O. McDonald, Director
Enforcement Division

Enclosures
Permit
Reporting Forms

cc: Mr. W. H. Busch, Illinois Environmental
Protection Agency, w/Permit

Permit No. IL 0004171

Application No. IL 072 OYE 2 000465

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et seq; the "Act"),

ELECTRIC ENERGY, INC.

is authorized by the United States Environmental Protection Agency, Region V,

to discharge from a facility located at Joppa, Illinois

to receiving waters named the Ohio River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on the date of issuing authority's signature.

This permit and the authorization to discharge shall expire at midnight, June 30, 1979 . Permittee shall not discharge after the above date of expiration. In order to receive authorization to discharge beyond the above date of expiration, the permittee shall submit such information, forms, and fees as are required by the Agency authorized to issue NPDES permits no later than 180 days prior to the above date of expiration.

Signed this JUL 2 6 1974

Director, Enforcement Division

PART I

A: EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 001.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow M^3/Day (MGD)	-	-	-	-	Monthly	Continuous during sampling
Suspended Solids	-	-	-	15 mg/l	Monthly	24 hour composite
Oil & Grease	-	-	10 mg/l	15 mg/l	Monthly	Grab
Total Dissolved Solids	-	-	-	△750 mg/l	Monthly	24 hour composite
Total Iron	-	-	-	2.0 mg/l	Quarterly	24 hour composite
Total Lead	-	-	-	0.05 mg/l	Quarterly	24 hour composite
Total Cadmium	-	-	-	0.01 mg/l	Quarterly	24 hour composite
Total Manganese	-	-	-	1.0 mg/l	Quarterly	24 hour composite

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored by weekly grab samples.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

Compliance with the numerical effluent standards is not required when effluent concentrations in the excess of the standards result entirely from influent contamination, evaporation; and/or the incidental addition of trace materials not utilized or produced in the activity that is the source of the waste.

If the permittee after monitoring for at least 6 months determines that he is consistently meeting the effluent limits contained in Part I, A (1), the permittee may request of the Regional Administrator and the Director that the monitoring requirements be reduced to twice or once per year or be eliminated. Upon written notification by the Regional Administrator and the Director, the permittee will monitor as directed.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. During the period beginningon the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 005- intake screen wash.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-M^3/Day (MGD)	-	-	-	-	Daily	-

There shall be no discharge of debris from intake screen washing operations.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

3. During the period beginning on the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 006 & 007.

The total of the discharges from all of these outfalls shall not exceed the limitations specified below. Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-M^3/Day (MGD)	-	-	-	-	Continuous	-
Temperature	-	-	-	-	Continuous	-
Total Chlorine Residual	-	-	-	* 0.2 mg/l	Weekly	Grab

*To be determined in the discharge channel after mixing of discharges 006 and 007.

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored by weekly grab samples.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

Permit No. IL 0004171

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

4. During the period beginning on the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 008 - aeration tank effluent.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-M^3/Day (MGD)	-	-	-	-	Measure when sampling	
BOD_5	-	-	*30 mg/l	45 mg/l	Monthly	24 hour composite
Suspended Solids	-	-	*30 mg/l	45 mg/l	Monthly	24 hour composite
Fecal Coliform	-	-	200/100 ml	400/100 ml	Monthly	Grab

*Or 85% removal, whichever is less.

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored monthly, grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

5. During the period beginning on the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 008.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-M^3/Day (MGD)	-	-	-	-	Measure when sampling	
Oil & Grease	-	-	10 mg/l	15 mg/l	Monthly	Grab
Suspended Solids	-	-	-	15 mg/l	Monthly	24 hour composite

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored monthly, grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

Compliance with the numerical effluent standards is not required when effluent concentrations in excess of the standards result entirely from influent contamination, evaporation, and/or the incidental addition of trace of material not utilized or produced in the activity that is the source of the waste.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

6. During the period beginning on the effective date of this permit and lasting until June 30, 1979 the permittee is authorized to discharge from outfall(s) serial number(s) 010.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-M^3/Day (MGD)	-	-	-	-	Measure when sampling	
Oil & Grease	-	-	10 mg/l	15 mg/l	Monthly	Grab
Suspended Solids	-	-	-	15 mg/l	Monthly	24 hour composite

The pH shall not be less than 6.0 nor greater than 9.0 and shall be monitored monthly, grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At a point representative of the discharge but prior to entry into the Ohio River.

Compliance with the numerical effluent standards is not required when effluent concentrations in excess of the standards result entirely from influent contamination, evaporation, and/or the incidental addition of trace of materials not utilized or produced in the acitivty that is the source of the waste.

B. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three months shall be summarized and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on October 28, 1974. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

U. S. Environmental Protection Agency
Region V, Enforcement Division
ATTN: Chief, Compliance Section
1 North Wacker Drive
Chicago, Illinois 60606

Environmental Protection Agency
State of Illinois
Division of Water Pollution Control
2200 Churchill Road
Springfield, Illinois 62706

3. Definitions

a. "Daily Average" Discharge

1. Weight Basis -- The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

2. Concentration Basis - The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during the calendar day.

b. "Daily Maximum" Discharge

1. Weight Basis - the "daily maximum" discharge means the total discharge by weight during any calendar day.

2. Concentration Basis - the "daily maximum" concentration means the daily determination of concentration for any calendar day.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report From (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

C. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Alternative schedule providing for off stream cooling facilities in conformance with the requirements of Section 301 of the Act.

Completion of Preliminary Plans by - December 31, 1975
Final Plans by - June 30, 1976
Contract Awarded by - September 30, 1976
Commencement of Construction by - December 31, 1976
Progress Report - June 30, 1977
Progress Report - March 31, 1978
Progress Report - December 31, 1978
*Progress Report - September 30, 1979
*Completion of Construction by - March 31, 1980
*Attainment of Operational Level by - June 30, 1980

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

*These dates are included in the schedule of compliance to alert the Permittee to the proposed requirements for off-stream cooling as set forth in 39 Federal Register 8294-8307 (March 4, 1974).

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. Noncompliance Notification

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying disharge.

5. Bypassing

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed from or resulting from treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

7. Power Failures

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if no date for implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of one or more of the primary sources of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. Transfer of Ownership or Control

In the event of any changes in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. Toxic Pollutants

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

1. THERMAL LIMITATIONS AND MONITORING REQUIREMENTS

Beginning with the effective date of this permit and lasting until June 30, 1979, the permittee is authorized to discharge from outfalls 006 & 007 a heated effluent which shall at no time raise the natural temperature of the Ohio River more than 2.8^{o}C (5^{o}F) at the edge of a mixing zone which shall not exceed the area of a circle with a radius of 183 meters (600 feet). In addition, the water temperature outside the mixing zone shall not exceed the maximum limits in the following table during more than ~~one~~ percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature outside the mixing zone exceed the maximum limits in the following table by more than 1.7^{o}C (3^{o}F):

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
^{o}C	10.0	10.0	15.6	21.1	26.7	30.6	31.7	31.7	30.6	25.6	21.1	13.9
^{o}F	50	50	60	70	80	87	89	89	87	78	70	57

The mixing zone shall not extend over more than 25% of the cross-sectional area of the river.

The permittee shall determine the 2.8^{o}C (5^{o}F) contour, the contour of the applicable monthly maximum temperature, and the areas within these contours at three month intervals for a period of one year after the effective date of this permit. After the initial year of measurements, the permittee shall continue to determine these contours and areas every three months but may use estimating procedures based on the first year's data. The results of these determinations shall be reported to the Regional Administrator and the Illinois EPA on a quarterly basis.

If, as a result of the above thermal monitoring, the permittee determines that compliance with the above thermal limitations is not acheived at all times, the permittee shall, within 60 days, submit a schedule for compliance with the above thermal restrictions by July 1, 1977.

By August 31, 1974 the permittee shall submit to the Regional Administrator for approval a plan of study for the investigation of the effects of the heated effluent on the ecology of the receiving waters. After one year of study the permittee shall submit annual status reports. In addition, a summary status report of this study shall be submitted as a part of the application for renewal of this permit.

PART III

All data and records associated with this study shall be retained in their entirety by the permittee and shall be made available subject to the request of the Regional Administrator and/or the Illinois Environmental Protection Agency.

The permittee shall report the quarterly average load factor for the plant along with other monitoring data.

2. THERMAL DISCHARGE WAIVER

Permittee has requested a waiver of requirements for off-stream cooling under the provisions of Section 316(a) of the Act. By August 31, 1974, the permittee shall submit a plan of study to show that the requirements of off-stream cooling are not necessary to assure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife on and in that body of water. Semi-annual interim reports will be submitted, and the study will be completed and a report submitted to the Regional Administrator by not later than December 31, 1975. Results from the first year of the investigation of the thermal effects upon the ecology may be utilized as part of the requirement for this demonstration.

Development of the demonstration shall be guided by the draft "Proposed Guidelines for Administration of the 316(a) Regulations" as proposed by the U.S. EPA.

3. INTAKE STRUCTURES

Within fourteen months of the effective date of this permit, the permittee shall submit a report to the Regional Administrator and the Illinois Environmental Protection Agency providing proposals for measures to be taken by the permittee to meet the requirements of Section 316 of the Act for the best cooling water intake technology available. The report shall contain a detailed demonstration that the proposed measures will minimize the adverse environmental impact and a summary of monitoring data collected to determine the effects of the present intake on the various species and life stages of fish. Such monitoring data shall also be submitted quarterly with other reports.

Development of the report shall be guided by the "Development Document for Best Technology Available for Minimizing Adverse Environmental Impact of Cooling Water Intake Structures" as proposed by the U.S. EPA.

If the permittee represents his existing system or some minor modification of it, or best available technology, the monitoring program shall include at a minimum a tabulation of all fish trapped by the present intake structure. This tabulation shall be performed every fourth day (or according to some other schedule requested by the applicant and approved by the Regional Administrator and the Illinois Environmental Protection Agency within 15 days after the effective date of this permit). The tabulation shall begin within 30 days after the effective date of this permit and ending within one year of the

PART III

the effective date of this permit and shall include the number, weight, size, and species of each fish entrapped.

The report shall be evaluated with regard to Section 316(b) of the Act. As a result of this evaluation, the Regional Administrator may modify the permit in accordance with Part II.B.4. to establish an implementation schedule to insure compliance with Section 316(b).

4. ADDITIONAL REPORTING OF MONITORING TO ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

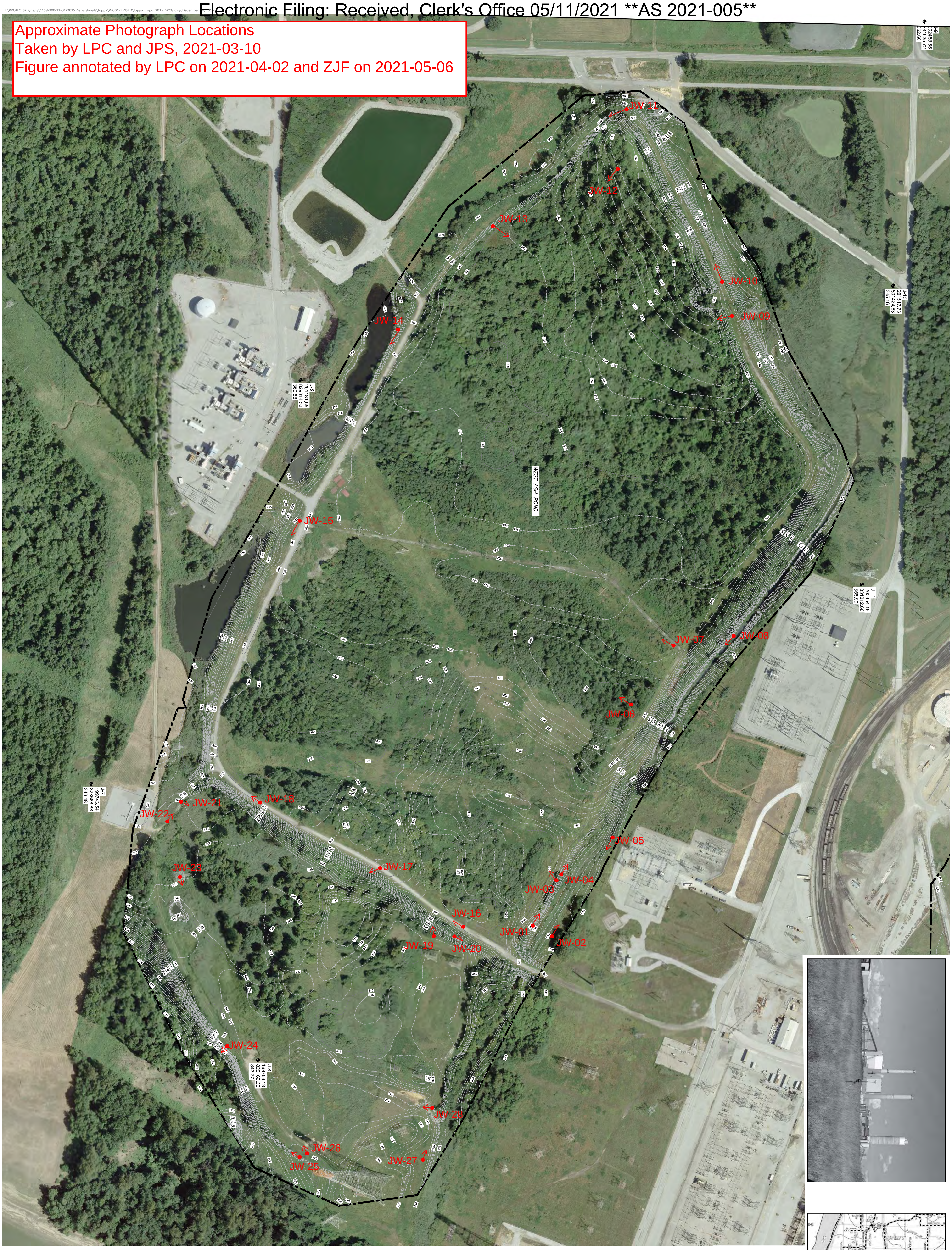
Monitoring results obtained during the previous one month shall be summarized and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 15 th day of the month following the completed reporting period. The first monthly report is due on September 15, 1974. The signed reports required herein, shall be submitted monthly to the State at the following address:

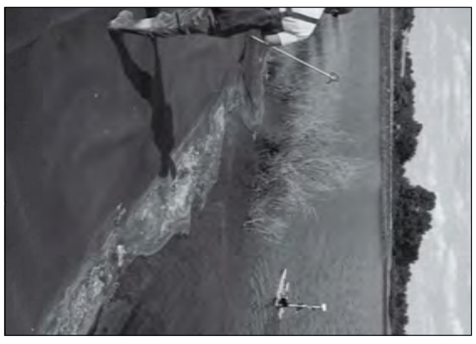
Environmental Protection Agency
State of Illinois
Division of Water Pollution Control
2200 Churchill Road
Springfield, Illinois 62706

APPENDIX C

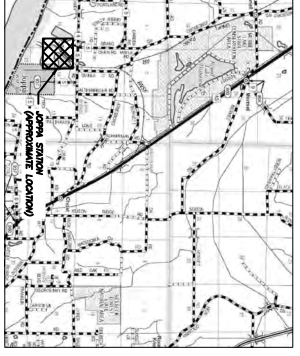
PHOTOGRAPHIC LOG OF MARCH 10, 2021 SITE VISIT

Approximate Photograph Locations
Taken by LPC and JPS, 2021-03-10
Figure annotated by LPC on 2021-04-02 and ZJF on 2021-05-06





NO SCALE



LEGEND

- - - - -	MAJOR CONTOUR LINE – 5 FOOT
- - - - -	MINOR CONTOUR LINE – 1 FOOT
▬ ▬	LIMITS OF AERIAL MAPPING
▬ · · ▬	LIMITS OF BATHYMETRIC/TOPOGRAPHIC SURVEY
⊕ 555614.37 2386187.58 446.36	CONTROL POINT
× 8007	SURVEYED PIPE LOCATION

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY
2. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 16, 2015 AND TOPOGRAPHIC/BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 17, 2015.
3. NO UNDERGROUND OR OVERHEAD UTILITIES WERE LOCATED DURING THIS SURVEY.

N

SCALE: 1" = 150'
0 75' 150' 300'

SHEET 4 OF 5
CAD: Joppa_Topo_2015_WCG.dwg
FILE: 4153-300-11-01
DATE: 12/1/2015
REVIEWED BY: CC
DRAWN BY: CC

REUSE OF DOCUMENTS
This document, and the designs incorporated herein, as an instrument of professional service, is the property of Weaver Consultants Group, and is not to be used in whole or in part, without the written authorization of Weaver Consultants Group.

www.wcgrp.com

WEAVER CONSULTANTS GROUP
1604 EASTPORT PLAZA DRIVE
SUITE 104
COLLINSVILLE, ILLINOIS 62234
(855) 457-1710

Weaver Consultants Group

No.	DATE	REVISION DESCRIPTION

JOPPA 2015 AERIAL TOPOGRAPHY
WEST ASH POND
2100 PORTLAND ROAD
JOPPA, IL

PREPARED FOR
DYNEGY

☐ DRAFT
☐ RELEASED FOR BID
☐ APPROVED FOR CONSTRUCTION
☐ CLIENT APPROVAL BY: ______________

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Electric Energy, Incorporated | **Project Number: GLP8024**

Site Name: Joppa West | **Site Location: Joppa, Illinois**

Photo: JW-01

Date: 3/10/2021

Direction: NE

Comments: East JW perimeter road showing typical crest road condition, vegetation on inside and outside of road, and power line.

Photo: JW-02

Date: 3/10/2021

Direction: NE

Comments: East perimeter slopes showing ground cover extent and type.

Client: Electric Energy, Incorporated **Project Number: GLP8024**

Site Name: Joppa West **Site Location: Joppa, Illinois**

Photo: JW-03

Date: 3/10/2021

Direction: W

Comments: East side JW interior vegetation showing shrub type and ground cover.

Photo: JW-04

Date: 3/10/2021

Direction: NE

Comments: East JW perimeter road with grass cover typical of a transmission corridor and the low area to convey surface water off the cover to the east (right).

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-05

Date: 3/10/2021

Direction: NE

Comments: East perimeter grassed slopes showing typical ground cover in grassed areas.

Photo: JW-06

Date: 3/10/2021

Direction: NW

Comments: East side interior JW showing typical interior ground cover.

Client: Electric Energy, Incorporated **Project Number: GLP8024**

Site Name: Joppa West **Site Location: Joppa, Illinois**

Photo: JW-07

Date: 3/10/2021

Direction: NW

Comments:
Eastern JW showing typical ground cover conditions in a transmission corridor

Photo: JW-08

Date: 3/10/2021

Direction: SW

Comments:
Eastern JW grassed slope after mowing.

Client: Electric Energy, Incorporated **Project Number: GLP8024**

Site Name: Joppa West **Site Location: Joppa, Illinois**

Photo: JW-09

Date: 3/10/2021

Direction: SW

Comments: Northern JW interior forest vegetation

Photo: JW-10

Date: 3/10/2021

Direction: N

Comments: Northern JW showing typical vegetated dike slope.

Client: Electric Energy, Incorporated **Project Number: GLP8024**

Site Name: Joppa West **Site Location: Joppa, Illinois**

Photo: JW-11

Date: 3/10/2021

Direction: SW

Comments: JW corner interior vegetation at low area near storm water outlet.

Photo: JW-12

Date: 3/10/2021

Direction: SW

Comments: JW northern corner low area berm vegetation near storm water outlet. Cover is ~1 inch of organics over black clay topsoil.

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-13

Date: 3/10/2021

Direction: SE

Comments: JW northern corner clear area-sediment fill. Grass cover is sparse with < 1 inch of organics over yellow brown silty clay. Bare spots intermixed. No ponding and no erosion were identified.

Photo: JW-14

Date: 3/10/2021

Direction: SW

Comments: JW western berm showing typical slope vegetation.

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-15

Date: 3/10/2021

Direction: SW

Comments: JW western crest road showing interior (left) vegetation and shallow, well-vegetated slope on the west (right) of the road.

Photo: JW-16

Date: 3/10/2021

Direction: W-NW

Comments: Overview of southern separator dike road with settling area to the south (left) and buried gas pipeline corridor to the north (right).

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-17

Date: 3/10/2021

Direction: SW

Comments: Typical brushy vegetation on the south slope of the separator dike looking down slope.

Photo: JW-18

Date: 3/10/2021

Direction: W-NW

Comments: Overview of utility corridor just north of the separator dike. Note transmission lines and buried gas pipeline to the right.

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-19

Date: 3/10/2021

Direction: N

Comments: Typical view of the south side of the separator dike from the downstream toe. Slope was approximately 1.5-2H:1V. No signs of geotechnical instability were noted.

Photo: JW-20

Date: 3/10/2021

Direction: SE

Comments: View of the south side of the separator dike from mid-slope. No signs of geotechnical instability were noted.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-21

Date: 3/10/2021

Direction: SE

Comments: Overview of dense vegetation in the settling area.

Photo: JW-22

Date: 3/10/2021

Direction: NE

Comments: Two culverts beneath the access road to the settling basin. Culverts appears to allow for stormwater run-on from the north into the settling pond.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Electric Energy, Incorporated	**Project Number: GLP8024**
Site Name: Joppa West	**Site Location: Joppa, Illinois**

Photo: JW-23

Date: 3/10/2021

Direction: S

Comments: Overview of the settling area along the power line corridor. Note recent mowing, standing water, and ruts.

Photo: JW-24

Date: 3/10/2021

Direction: SW

Comments: Stormwater erosion feature on the south Joppa West dike. No signs of geotechnical instability were noted.

Client: Electric Energy, Incorporated **Project Number: GLP8024**

Site Name: Joppa West **Site Location: Joppa, Illinois**

Photo: JW-25

Date: 3/10/2021

Direction: W-NW

Comments: Stormwater erosion features on the southern Joppa West dike of the settling area. No signs of geotechnical instability were noted.

Photo: JW-26

Date: 3/10/2021

Direction: W-NW

Comments: Overview of the settling area showing mowed grass in the transmission corridor.

Client: **Electric Energy, Incorporated** **Project Number:** **GLP8024**

Site Name: **Joppa West** **Site Location:** **Joppa, Illinois**

Photo: JW-27

Date: 3/10/2021

Direction: N-NE

Comments: Overview of exterior stormwater channel that flows on the east side of Joppa West along the settling area southward towards the Ohio River.

Photo: JW-28

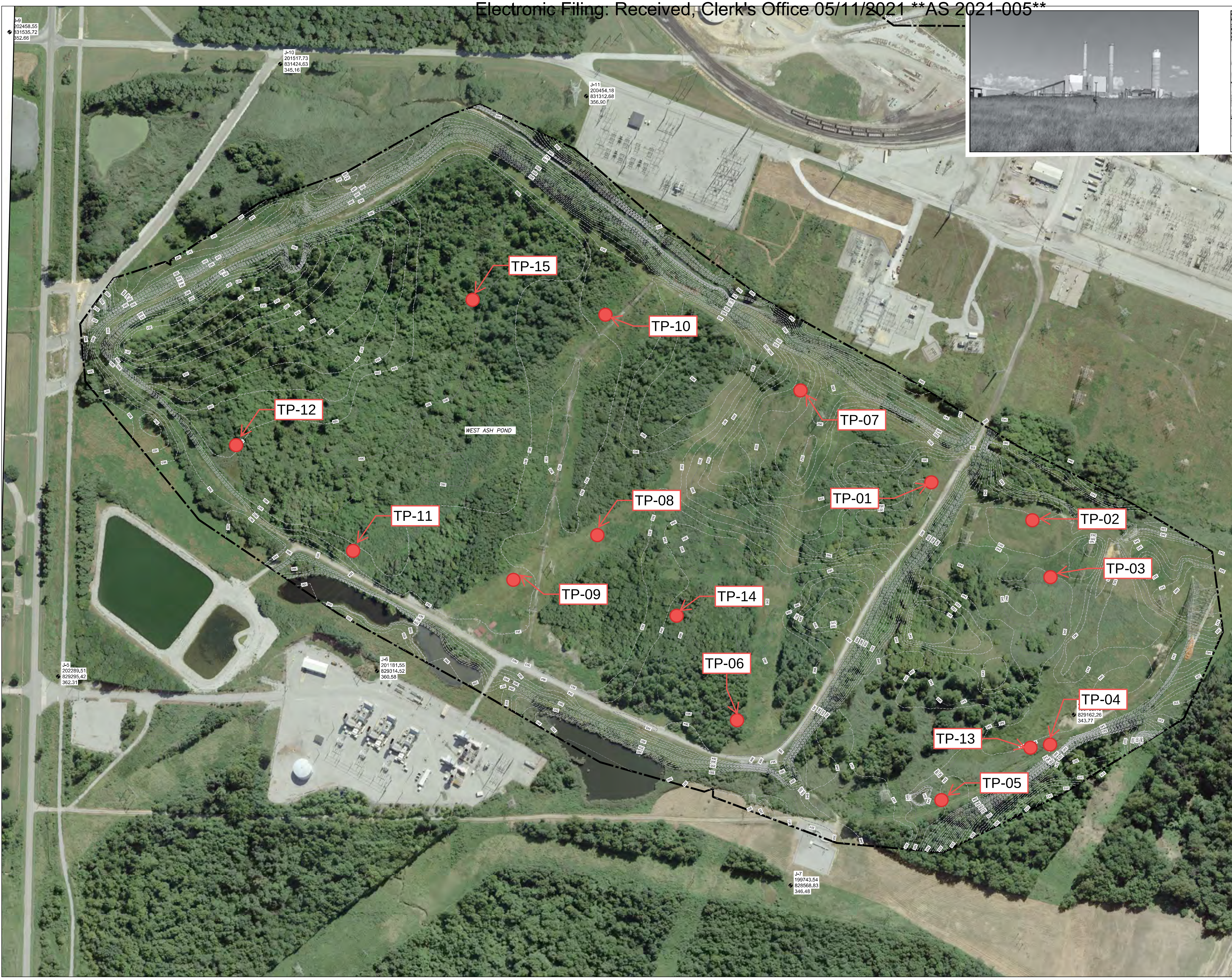
Date: 3/10/2021

Direction: W

Comments: View of approximately 30-inch corrugated metal pipe (CMP) culvert beneath an interior roadway. The culvert directs flow to the exterior stormwater channel.

APPENDIX D

TEST PIT LOGS



NO SCALE

Drawing Annotated by Geosyntec

ZJF
03/22/2021

● Test Pit Location

Locations are Approximate

LEGEND

- - - - - -	MAJOR CONTOUR LINE – 5 FOOT
- - - - - -	MINOR CONTOUR LINE – 1 FOOT
▬ ▬ ▬	LIMITS OF AERIAL MAPPING
▬ · · ▬ · · ▬	LIMITS OF BATHYMETRIC/TOPOGRAPHIC SURVEY
⊕ 555614.37 2386187.58 446.36	CONTROL POINT
× 8007	SURVEYED PIPE LOCATION

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY
2. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 16, 2015 AND TOPOGRAPHIC/BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 17, 2015.
3. NO UNDERGROUND OR OVERHEAD UTILITIES WERE LOCATED DURING THIS SURVEY.

N

SCALE: 1" = 150'
0 75' 150' 300'

☐ DRAFT
☐ RELEASED FOR BID
☐ APPROVED FOR CONSTRUCTION
☐ CLIENT APPROVAL BY: ______

PREPARED FOR
DYNEGY

JOPPA 2015 AERIAL TOPOGRAPHY
WEST ASH POND
2100 PORTLAND ROAD
JOPPA, IL

No.	DATE	REVISION DESCRIPTION

Weaver Consultants Group

WEAVER CONSULTANTS GROUP
1604 EASTPORT PLAZA DRIVE
SUITE 104
COLLINSVILLE, ILLINOIS 62234
(855) 457-1710
www.wcgrp.com

DRAWN BY:	CC
REVIEWED BY:	CC
DATE:	12/1/2015
FILE:	4153-300-11-01
CAD:	Joppa_Topo_2015_WCG.dwg

SHEET 4 OF 5

Geosyntec consultants

TEST PIT NUMBER 01

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 347.584 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 199335.925
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829987.698
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	1 1.25	Moist, brown, lean CLAY, with silt and organics [Cover Fill]	CL					
	2	Moist, brown, silty SAND, trace gravel and coal fragments [Ash]	SM					
	3 4 5 6 7 8 9 10	Test pit terminated at 3.0 ft below ground surface.						

Geosyntec consultants

TEST PIT NUMBER 02

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 330.800 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 198881.597
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829874.515
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	1 2 3	Moist, brown-tan, lean CLAY [Alluvium]	CL					
	4 5 6 7 8 9 10	Test pit terminated at 4.0 ft below ground surface.						

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TEST PIT NUMBER 03

PAGE 1 **OF** 1

CLIENT Vistra

PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation

PROJECT NUMBER

PROJECT LOCATION Joppa, Illinois

DATE STARTED 3/10/21 **COMPLETED** 3/10/21

SURVEY NOTE Surveyed using Trimble GEO 7X

DRILLING CONTRACTOR Ozinga

GROUND ELEVATION 327.668 **DATUM** NAVD88

DRILLING EQUIPMENT Komatsu PC360LC

NORTHING 198793.960

DRILLING METHOD Excavator - smooth edge bucket

EASTNG 829624.676

LOGGED BY Z. Fallert **CHECKED BY**

DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	1 2 3	Moist, tan with gray mottling, lean CLAY [Alluvium]	CL					
	4 5 6 7 8 9 10	Test pit terminated at 3.5 ft below ground surface.						

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TEST PIT NUMBER 04

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 330.605 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 198787.771
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829113.591
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.50	Moist, dark brown, lean CLAY, with silt, some gravel [Cover Fill]	CL					
	1 2	Moist, gray and brown, silty SAND [Ash]	SM					
	3 4 5 6 7 8 9 10	Test pit terminated at 2.5 ft below ground surface.						

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TEST PIT NUMBER 05

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 333.958 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 199192.093
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 828888.074
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0–4 1 2 3	Moist, tan with gray mottling, lean CLAY, trace gravel [Alluvium]	CL					
	4 5 6 7 8 9 10	Test pit terminated at 3.0 ft below ground surface.						

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TEST PIT NUMBER 06

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 355.216 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 199894.707
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829185.893
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.25	Moist, brown, ORGANICS [Natural Cover]	OL					
		Moist, gray, SILT [Ash]	ML					
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9	Increased moisture content, becomes sandy, trace coal fragments						
	10	Test pit terminated at 10.0 ft below ground surface.						

TEST PIT NUMBER 07

PAGE 1 OF 1

CLIENT Vistra

PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation

PROJECT NUMBER

PROJECT LOCATION Joppa, Illinois

DATE STARTED 3/10/21 **COMPLETED** 3/10/21

SURVEY NOTE Surveyed using Trimble GEO 7X

DRILLING CONTRACTOR Ozinga

GROUND ELEVATION 341.875 **DATUM** NAVD88

DRILLING EQUIPMENT Komatsu PC360LC

NORTHING 199668.071

DRILLING METHOD Excavator - smooth edge bucket

EASTNG 830271.551

LOGGED BY Z. Fallert **CHECKED BY**

DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.25	Moist, brown, lean CLAY, with organics [Cover Fill]	CL					
		Moist, gray, sandy SILT [Ash]	ML					
	1							
	2							
		Test pit terminated at 2.5 ft below ground surface.						
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							

Geosyntec consultants

TEST PIT NUMBER 08

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 354.102 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 200402.72
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829838.876
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.75	Moist, tan, lean CLAY, with organics [Cover Fill]	CL					
	1 2 3	Moist, gray, sandy SILT, sand seams and varves [Ash]	ML					
	4 5 6 7 8 9 10	Test pit terminated at 3.25 ft below ground surface.						

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TEST PIT NUMBER 09

PAGE 1 **OF** 1

CLIENT Vistra

PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation

PROJECT NUMBER

PROJECT LOCATION Joppa, Illinois

DATE STARTED 3/10/21 **COMPLETED** 3/10/21

SURVEY NOTE Surveyed using Trimble GEO 7X

DRILLING CONTRACTOR Ozinga

GROUND ELEVATION 353.153 **DATUM** NAVD88

DRILLING EQUIPMENT Komatsu PC360LC

NORTHING 200689.393

DRILLING METHOD Excavator - smooth edge bucket

EASTNG 829676.073

LOGGED BY Z. Fallert **CHECKED BY**

DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.17	Moist, brown, ORGANICS [Natural Cover]	OL					
		Moist, gray, SILT, with sand seams and varves	ML					
	1							
	2							
	3							
	4	Increased moisture content, becomes sandy						
	5							
		Test pit terminated at 5.5 ft below ground surface.						
	6							
	7							
	8							
	9							
	10							

Geosyntec consultants

TEST PIT NUMBER 10

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 349.590 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 200372.664
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 830599.113
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
		Moist, brown, lean CLAY, with organics	CL					
	0.50	Moist, gray, SILT, with sand seams and varves	ML					
	1							
	2	Becomes sandy						
	3	Test pit terminated at 3.0 ft below ground surface.						
	4							
	5							
	6							
	7							
	8							
	9							
	10							

TEST PIT NUMBER 11

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 354.264 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 201266.036
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 829758.409
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.50	Moist, brown, lean CLAY, with organics	CL					
	1	Moist, gray, SILT, with sand seams and varves	ML					
	2	Becomes wet, very soft						
	3							
	4							
	5	Test pit terminated at 5.0 ft below ground surface.						
	6							
	7							
	8							
	9							
	10							

Geosyntec consultants

TEST PIT NUMBER 12

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR Ozinga
GROUND ELEVATION 349.550 **DATUM** NAVD88
DRILLING EQUIPMENT Komatsu PC360LC
NORTHING 201624.027
DRILLING METHOD Excavator - smooth edge bucket
EASTNG 830185.154
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.17	Moist, brown, ORGANICS [Natural Cover]	OL					
	1 2 3	Wet, gray, SILT, with sand seams and varves [Ash]	ML					
	4 5	Moist, brown, lean Clay [Alluvium]	CL					
	6 7 8 9 10	Test pit terminated at 5.5 ft below ground surface.						

Geosyntec consultants

TEST PIT NUMBER 13

PAGE 1 OF 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR NA
GROUND ELEVATION 330.731 **DATUM** NAVD88
DRILLING EQUIPMENT NA
NORTHING 198865.556
DRILLING METHOD Hand dug using shovel and mattock
EASTNG 829096.332
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.08	Moist, brown, ORGANICS [Natural Cover]	OL					
		Wet, gray, sandy SILT, with organics [Ash]	ML					
		Test pit terminated at 2.5 ft below ground surface. Wet ash flowing into hole prevented the further advancement. The bottom of 2.5 ft bgs is a firm underlying layer based on probing through the wet ash in the bottom of the test pit.						

Depth scale: 1 2 3 4 5 6 7 8 9 10

Geosyntec consultants

TEST PIT NUMBER 14

PAGE 1 **OF** 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR NA
GROUND ELEVATION 352.856 **DATUM** NAVD88
DRILLING EQUIPMENT NA
NORTHING 200167.079
DRILLING METHOD Hand dug using shovel and mattock
EASTNG 829422.679
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
		Moist, brown, lean CLAY, with silt and organics	CL					
	1	Moist, gray, sandy SILT [Ash]	ML					
	2	Test pit terminated at 3 ft below ground surface.						
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							

TEST PIT NUMBER 15

PAGE 1 **OF** 1

CLIENT Vistra
PROJECT NAME Joppa West Ash Pond - Existing Cover Investigation
PROJECT NUMBER
PROJECT LOCATION Joppa, Illinois
DATE STARTED 3/10/21 **COMPLETED** 3/10/21
SURVEY NOTE Surveyed using Trimble GEO 7X
DRILLING CONTRACTOR NA
GROUND ELEVATION 353.242 **DATUM** NAVD88
DRILLING EQUIPMENT NA
NORTHING 200851.085
DRILLING METHOD Hand dug using shovel and mattock
EASTNG 830664.536
LOGGED BY Z. Fallert **CHECKED BY**
DATUM NAD83

ELEVATION (ft AMSL)	DEPTH (ft)	MATERIAL DESCRIPTION SOIL TYPE (USCS): Munsell color, odor, obvious materials, structure, consistency, gradation, dry strength, dilatancy, toughness, and plasticity	USCS SYMBOL	RECOVERY/ ATTEMPTED	ANALYTICAL SAMPLE	WELL CONST.	HOLE BACKFILL	PID (ppm)
	0.25	Moist, brown, ORGANICS [Natural Cover]	OL					
	1 2 3 4	Moist, gray, SILT, some sand [Ash]	ML					
	5	Moist, gray with white speckles, f. SAND, with silt [Ash]	SP					
	6 7 8 9 10	Test pit terminated at 5.0 ft below ground surface.						

APPENDIX E

U.S. Fish and Wildlife Service Threatened and Endangered Species Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
Phone: (618) 997-3344 Fax: (618) 997-8961
http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html

In Reply Refer To:
Consultation Code: 03E18100-2021-SLI-0213
Event Code: 03E18100-2021-E-00602
Project Name: Vistra-Joppa West Ash Pond

March 05, 2021

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies any federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the Service if they determine their project “may affect” listed species or critical habitat. Under the ESA, it is the responsibility of the Federal action agency or its designated respresentative to determine if a proposed action "may affect" endangered, threatened, or proposed species, or designated critical habitat, and if so, to consult with the Service further. Similarly, it is the responsibility of the Federal action agency or project proponent, not the Service to make "no effect" determinations. If you determine that your proposed action will have "no effect" on threatened or endangered species or their respective critical habitat, you do not need to seek concurrence with the Service. Nevertheless, it is a violation of Federal law to harm or harass any federally-listed threatened or endangered fish or wildlife species without the appropriate permit.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally. You may verify the list by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation and completing the same process you used to receive the attached list. As an alternative, you may contact this Ecological Services Field Office for updates.

Please use the species list provided and visit the U.S. Fish and Wildlife Service's Region 3 Section 7 Technical Assistance website http://www.fws.gov/midwest/endangered/section7/s7process/index.html. This website contains step-by-step instructions which will help you determine if your project will have an adverse effect on listed species and will help lead you through the Section 7 process.

For all wind energy projects and projects that include installing towers that use guy wires or are over 200 feet in height, please contact this field office directly for assistance, even if no federally listed plants, animals or critical habitat are present within your proposed project or may be affected by your proposed project.

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*) and Migratory Bird Treaty Act *(*16 U.S.C. 703 *et seq*), as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website http://www.fws.gov/midwest/midwestbird/EaglePermits/index.html to help you determine if you can avoid impacting eagles or if a permit may be necessary.

We appreciate your concern for threatened and endangered species. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
(618) 997-3344

Project Summary

Consultation Code:	03E18100-2021-SLI-0213
Event Code:	03E18100-2021-E-00602
Project Name:	Vistra-Joppa West Ash Pond
Project Type:	DREDGE / EXCAVATION
Project Description:	120 acre pond for ash retention

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.21515535,-88.86356279076156,14z

Counties: Massac County, Illinois

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Clams

NAME	STATUS
Fat Pocketbook *Potamilus capax* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2780	Endangered
Orangefoot Pimpleback (pearlymussel) *Plethobasus cooperianus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1132	Endangered
Pink Mucket (pearlymussel) *Lampsilis abrupta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7829	Endangered
Rabbitsfoot *Quadrula cylindrica cylindrica* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5165	Threatened
Sheepnose Mussel *Plethobasus cyphyus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6903	Endangered
Spectaclecase (mussel) *Cumberlandia monodonta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7867	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

APPENDIX F

Illinois Natural Heritage Database

Mason

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Emydoidea blandingii	Blanding's Turtle	LE	2	2017-06-29
Erimystax x-punctatus	Gravel Chub	LT	1	2000-06-19
Fundulus dispar	Starhead Topminnow	LT	5	2017-08-14
Gallinula galeata	Common Gallinule	LE	1	2011-08-21
Hesperia metea	Cobweb Skipper	LE	1	1985-07-23
Hesperia ottoe	Ottoe Skipper	LE	3	2007-06-16
Heterodon nasicus	Plains Hog-nosed Snake	LT	4	2017-06-10
Hymenopappus scabiosaeus	Old Plainsman	LE	3	2017-06-14
Kinosternon flavescens	Yellow Mud Turtle	LE	4	2015-05-29
Lanius ludovicianus	Loggerhead Shrike	LE	2	2004-07-01
Lepomis miniatus	Redspotted Sunfish	LT	3	2017-10-16
Mimulus glabratus	Yellow Monkey Flower	LE	1	1977-09-08
Moxostoma carinatum	River Redhorse	LT	3	2017-09-27
Myotis septentrionalis	Northern Long-eared Myotis	LT	2	2016-06-22
Nothocalais cuspidata	Prairie Dandelion	LE	1	2017-04-22
Notropis chalybaeus	Ironcolor Shiner	LT	9	2013-08-06
Nycticorax nycticorax	Black-crowned Night-Heron	LE	2	2008-07-22
Orobanche fasciculata	Clustered Broomrape	LE	1	2000
Orobanche ludoviciana	Broomrape	LT	5	2018-01-21
Pandion haliaetus	Osprey	LT	1	2017
Physaria ludoviciana	Silvery Bladderpod	LE	1	2020-01-02
Pinus banksiana	Jack Pine	LE	1	1988-06-13
Pinus resinosa	Red Pine	LE	1	2004-08-16
Platanthera flava	Tubercled Orchid	LT	1	2017-06-14
Pseudacris illinoensis	Illinois Chorus Frog	LT	13	2020-03-19
Quadrula metanevra	Monkeyface	LT	1	2010-09-29
Rallus elegans	King Rail	LE	1	1994-07-02
Salvia azurea	Blue Sage	LT	2	2019-10-02
Schoenoplectus hallii	Hall's Bulrush	LT	10	2019-10-22
Schoenoplectus purshianus	Pursh's Bulrush	LE	1	1995-09-13
Speyeria idalia	Regal Fritillary	LT	3	2020-07-10
Stylisma pickeringii	Patterson's Bindweed	LE	2	2016-08-10
Terrapene ornata	Ornate Box Turtle	LT	5	2018-11-13
Tracaulon arifolium	Halberd-leaved Tearthumb	LE	1	1990-08-03
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	LE	1	1994-06

Total # of Species **46**

Massac

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Actaea rubifolia	Black Cohosh	LE	1	2013-08-27
Amorpha nitens	Smooth False Indigo	LE	1	2004-06-28

Massac

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Asio flammeus	Short-eared Owl	LE	1	2005-12-19
Carex gigantea	Large Sedge	LE	2	2018-06-06
Carex intumescens	Swollen Sedge	LE	1	2018-07-11
Carex reniformis	Sedge	LE	3	2010-06-09
Carya aquatica	Water Hickory	LT	4	2015
Chamaelirium luteum	Fairy Wand	LE	2	2015-06-24
Cryptobranchus alleganiensis	Hellbender	LE	1	1956-04-15
Cyclonaias tuberculata	Purple Wartyback	LT	2	2016-10-17
Cyperus lancastriensis	Galingale	LT	1	2005-10-02
Ellipsaria lineolata	Butterfly	LT	4	2018-11-02
Elliptio crassidens	Elephant-ear	LE	3	2018-11-02
Eryngium prostratum	Eryngo	LE	1	2002-08-08
Euonymus americanus	American Strawberry Bush	LT	2	2013-08-27
Eurynia dilatata	Spike	LE	1	2014-09-22
Faxonius placidus	Bigclaw Crayfish	LE	3	2001-07-25
Galactia mohlenbrockii	Boykin's Dioclea	LE	2	2013
Gallinula galeata	Common Gallinule	LE	1	2013-07-14
Halesia carolina	Silverbell Tree	LE	2	2016-04-15
Helianthus angustifolius	Narrow-leaved Sunflower	LE	4	2015-10-06
Hyla avivoca	Bird-voiced Treefrog	LT	1	2019-09-26
Iresine rhizomatosa	Bloodleaf	LE	1	1997
Ixobrychus exilis	Least Bittern	LT	1	2005-06-18
Lanius ludovicianus	Loggerhead Shrike	LE	1	1986-06-03
Lepomis miniatus	Redspotted Sunfish	LT	2	1987-07-15
Malus angustifolia	Narrow-leaved Crabapple	LE	1	2019-06-12
Margaritifera monodonta	Spectaclecase	LE	1	1994-08-18
Melanthera nivea	White Melanthera	LE	1	2005-10-03
Melica mutica	Two-flowered Melic Grass	LE	3	2016-04-15
Melothria pendula	Squirting Cucumber	LT	1	2004-05-26
Myotis austroriparius	Southeastern Myotis	LE	1	2005-06-26
Myotis septentrionalis	Northern Long-eared Myotis	LT	1	2005-07-08
Nemophila triloba	Baby blue-eyes	LE	1	2010-04-16
Nerodia fasciata	Southern Watersnake	LE	1	2004-03-28
Notropis maculatus	Taillight Shiner	LE	1	1988-07-19
Noturus stigmosus	Northern Madtom	LE	1	2009-07
Nyctanassa violacea	Yellow-crowned Night-Heron	LE	1	1998-07-26
Pandion haliaetus	Osprey	LT	5	2019
Phaeophyscia leana	Lea's Bog Lichen	LT	2	2002-02-23
Phemeranthus parviflorus	Small Flower-of-an-hour	LT	1	1952-05-30
Planera aquatica	Water Elm	LT	2	2005-10-02

Massac

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Platanthera flava	Tubercled Orchid	LT	1	1976-06-21
Plethobasus cooperianus	Orange-foot Pimpleback	LE	1	2015-10
Plethobasus cyphyus	Sheepnose	LE	3	2012
Pleurobema cordatum	Ohio Pigtoe	LE	2	2018-11-02
Potamilus capax	Fat Pocketbook	LE	3	2018-11-02
Pseudemys concinna	River Cooter	LE	3	2019-04-02
Quadrula metanevra	Monkeyface	LT	3	1998-08-29
Quercus phellos	Willow Oak	LT	7	2019-11-06
Rallus elegans	King Rail	LE	1	2006-06-25
Reginaia ebenus	Ebonyshell	LE	4	2018-11-02
Rhexia mariana	Dull Meadow Beauty	LE	1	2018-07-29
Scirpus polyphyllus	Leafy Bulrush	LE	1	2019-09-04
Scleria pauciflora	Carolina Whipgrass	LE	1	2004-06-30
Setophaga cerulea	Cerulean Warbler	LT	1	1993-07
Sternula antillarum	Least Tern	LE	1	1996-06-11
Styrax americana	Storax	LT	5	2010-09-28
Thamnophis saurita	Eastern Ribbon Snake	LT	2	2020-08-17
Theliderma cylindrica	Rabbitsfoot	LE	3	2012
Tilia heterophylla	White Basswood	LE	1	2005-10-02

Total # of Species 61

Mcdonough

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Bartramia longicauda	Upland Sandpiper	LE	1	2015-05-09
Caecidotea lesliei	Isopod	LE	1	2001-05-01
Filipendula rubra	Queen-of-the-prairie	LT	2	2020-06-29
Lanius ludovicianus	Loggerhead Shrike	LE	2	1988-06-25
Melanthium virginicum	Virginia Bunchflower	LE	9	2020-07-16
Myotis septentrionalis	Northern Long-eared Myotis	LT	3	2002-06-22
Myotis sodalis	Indiana Bat	LE	1	2002-06-21
Pinus banksiana	Jack Pine	LE	1	1968-04-27
Speyeria idalia	Regal Fritillary	LT	3	2003-07-09
Tradescantia bracteata	Prairie Spiderwort	LE	2	1987-05-12
Tropidoclonion lineatum	Lined Snake	LT	1	2001-10-09

Total # of Species 11

Mchenry

Scientific Name	Common Name	State Status	# of Occurrences	Last Observed
Actaea rubifolia	Black Cohosh	LE	1	2017-08-02
Aflexia rubranura	Redveined Prairie Leafhopper	LT	1	1999
Alnus incana ssp. rugosa	Speckled Alder	LE	2	2019-05-07
Amelanchier sanguinea	Shadbush	LE	1	2019-10-09

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 3

Intended for
Schiff Harden LLP
233 South Wacker Driver
Suite 7100
Chicago, Illinois 60606

Document type
EXPERT REPORT

Date
May 11, 2021

EXPERT REPORT

JOPPA WEST GROUNDWATER EVALUATION

Brian G. Hennings, PG
Ramboll Americas Engineering Solutions, Inc.
234 West Florida Street, Fifth Floor
Milwaukee, Wisconsin 53204
USA

RAMBOLL Bright ideas. Sustainable change.

CONTENTS

TABLES IN BODY OF REPORT

TABLES

FIGURES IN BODY OF REPORT

FIGURES

ATTACHMENTS

1. EXECUTIVE SUMMARY

This groundwater evaluation has been prepared for Electric Energy, Incorporated (EEI) for the Joppa West former surface impoundment at the Joppa Power Station (Joppa Plant) located west of the Village of Joppa and northeast of the Ohio River in Massac County, Illinois. The purpose of this groundwater evaluation is to provide information in support of an adjusted standard from 35 Ill Admin. Code Part 845.

This report has been prepared by Brian G. Hennings, PG. Mr. Hennings is a licensed professional geologist (IL PG number 196.001482), with 18 years of experience in groundwater investigation and remediation projects at Coal Combustion Residual (CCR) management sites. He has published and presented groundwater topics at local and international conferences including fate and transport of CCR constituents in groundwater. Mr. Hennings has also provided groundwater fate and transport models of CCR management facilities in support of Closure and Post Closure Care plans approved by the Illinois Environmental Protection Agency (IEPA). The Curriculum Vitae of Brian G. Hennings is provided in Attachment 1.

Joppa West is located west of the Joppa power plant and was in use by 1957 and was removed from service in the 1970s when the Joppa East impoundment was brought into service. Joppa West ceased receiving CCR prior to October 19, 2015 and is not subject to Title 40 of the Code of Federal Regulations (40 C.F.R.) Part 257 Subpart D in accordance with 40 C.F.R. § 257.50(d).

Currently, Joppa West is covered by varying thicknesses of topsoil and clay with dense vegetation including grasses, shrubs, and mature trees. The surface of Joppa West appears to have been graded to avoid low areas that would result in permanent ponding of water (Geosyntec, 2021).

In the subsurface of the site three hydrostratigraphic (water bearing) units are present:

1. The Upper Confining Unit (UCU), comprised of native low-permeability silts and clays of the Equality and Metropolis Formation deposits.
    a. The UCU is Class II groundwater as defined by Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 620, § 620.220
    b. The UCU is not a groundwater aquifer; and, is not utilized as a potable water resource.
2. The Uppermost aquifer (UA) which lies beneath the UCU and is composed of sand and gravel of the McNairy formation.
    a. The McNairy Formation has been identified as the Uppermost Aquifer for compliance with the Federal CCR Rule (40 C.F.R. Part 257) at Joppa East and as defined by § 845.120.
    b. The UA is Class I groundwater as defined by 35 I.A.C. Part 620, § 620.210
    c. The UA is not in contact with CCR materials and is separated from them by the UCU.
3. A limestone bedrock unit (BU) which lies beneath the UA and is composed of the Mississippian Aged Salem Limestone
    a. The BU is Class I groundwater as defined by 35 I.A.C. Part 620, § 620.210

No known wells in the area utilize the Equality and Metropolis Formations (UCU) for groundwater and most wells obtain groundwater from sands and gravels of the McNairy Formation or underlying Mississippian-age limestone bedrock.

Joppa West was formed by constructing clay containment dikes. Joppa West is 103.5 acres in area. An area of approximately 17 acres was designated for final clarification of water at the southern portion of Joppa West known as the “Settling Area” (SA). The SA and the northern portion of Joppa West are separated by a separator dike. An unnamed intermittent stream valley was present within the Joppa West footprint prior to its construction. Prior to construction of Joppa West, the land surface appears undisturbed in aerial photography; United States Geological Service (USGS) topographic contours of the area from 1932 represent the pre-construction land surface, which also represent the base of Joppa West. During operation of Joppa West, CCR materials, including fly ash and bottom ash, were sluiced into the northern portion of Joppa West from pipes coming from the Joppa Plant. CCR material was placed on top of the low permeability silts and clays of the UCU.

In March 2021 Ramboll completed six soil borings and installed five temporary monitoring wells at Joppa West, redeveloped existing wells surrounding Joppa West, and collected a round of groundwater samples from new and existing monitoring wells to supplement existing data for this groundwater evaluation.

Key conclusions from the groundwater evaluation include the following:

1. Approximately 50 years after closure of Joppa West, groundwater impacts attributable to CCR material are observed in a single well (112C) located immediately downgradient of the Settling Area, and monitors a water bearing unit (the UCU) that is not suitable for any groundwater use.
2. Groundwater exceedances attributable to Joppa West have not been observed in the uppermost aquifer (UA), indicating the UCU effectively limits impacts from the CCR materials to the UA.
3. Groundwater concentrations are stable.
4. Based upon the timeline for closure of Joppa West in the 1970s, and as described in Section 4, potentiometric heads and flow directions at Joppa West are stable (steady-state) at the current time.
5. No open water or persistent standing water was observed at land surface within Joppa West during March 2021 field activities. Ponded water has not been observed in aerial photographs within Joppa West since 2015 (Geosyntec, 2021).
6. The phreatic surface (measured depth to water) within Joppa West at XTPW01 is approximately 11 feet below ground surface. Based on observations collected in March 2021, the elevation of the phreatic surface measured at XTPW01 (350.75) is approximately 4 feet lower than the groundwater elevation observed in the UCU upgradient of Joppa West at G111 (354.6), indicating upgradient groundwater in the UCU has the potential to flow into Joppa West.
7. Based on the geologic profiles and the March 2021 water level measurements, the projected elevation of the phreatic surface within the CCR material is consistent with the potentiometric surface of the UCU, indicating that water levels within Joppa West are at or near equilibrium in the subsurface with the groundwater elevations in the underlying silts and clays of the UCU.

Based on the Conceptual Site Model (CSM) for groundwater flow at the site, the following conclusions are relevant for closure selection at the site:

1. The pre-development ground surface topography indicates that ash may be present at the base of the former impoundment to an approximate elevation of 305 feet NAVD88. This elevation is lower than the groundwater elevations measured in wells adjacent to the impoundment. Comparison of the elevation of the phreatic surface at XTPW01 to groundwater elevations in nearby wells indicates continuation of the potentiometric surface across the former West Ash Pond. Therefore, based upon these elevations, it is unlikely that the phreatic surface will drop below the level of the CCR material without management of groundwater levels in the native material which surrounds Joppa West.
2. Removal of the established and mature vegetation that is currently in place at the former impoundments will result in reduced transpiration (uptake of water) and could result in an increase in percolation through the cover, which could increase the concentration of constituents of concern in groundwater.
3. Groundwater flow conditions and concentrations are currently stable. Mitigation or elimination of vertical infiltration by modifications to the existing cover will not eliminate lateral influx of groundwater into Joppa West. Approximately 50 years of dewatering has occurred. Therefore, groundwater exceedances should be addressed in connection with either an approved groundwater management zone pursuant to Part 620 or Subpart F of Part 845.
4. Further groundwater investigations will be completed as necessary to refine the conceptual site model, monitor trends in groundwater flow and concentrations, and evaluate potential remedial options as required by Part 620 or Subpart F of Part 845.

2. SETTING

2.1 Power Plant and Coal Combustion Residuals (CCR) Management

The Joppa Steam Generating Plant (Joppa Plant) is located west of the Village of Joppa and northeast of the Ohio River in Massac County, Illinois. The Joppa Plant lies in Section 14, Township 15 North, Range 3 East of the 3rd Principal Meridian. The Site is bounded by industries to the west and north, the village of Joppa to the east, and the Ohio River to the south. The Site has a CCR landfill located in the southwest quarter of Section 10, the former west ash pond (Joppa West) located in the east half of Section 15, and the East Ash Pond (Joppa East) located in the west half of Section 14 directly north of the power plant (Figure 1).

The former Joppa West impoundment was in use by 1957 and was removed from service in the 1970s when the Joppa East impoundment was brought into service. Joppa West was formed by constructing clay containment dikes. Joppa West is 103.5 acres in area. An area of approximately 17 acres was designated for final clarification of water at the southern portion of Joppa West known as the “Settling Area” (SA). The SA and the northern portion of Joppa West are separated by a separator dike (Figure 2). An unnamed intermittent stream valley was present within the Joppa West footprint prior to its construction. As the dikes for Joppa West were constructed, the intermittent stream was routed into a drainage swale outside of the impoundment and settling pond along the base of the eastern dike. Prior to construction of Joppa West, the land surface appears undisturbed in aerial photography; United States Geological Service (USGS) topographic contours of the area from 1932 represent the pre-construction land surface, which also approximates the base of Joppa West. The base of CCR within Joppa West varies from approximately 350 feet elevation on the flanks of the former stream valley, to approximately 305 feet elevation at the lower end of the former stream valley beneath the Joppa West settling area.

Joppa West was closed in place in the 1970s when Joppa East was brought into service. Currently, Joppa West is capped by a layer of topsoil and clay ranging from 1-2 inches (in the forested areas) to several feet along the utility corridors. Natural vegetation was allowed to grow on the surface of Joppa West, which is now covered dense vegetation, shrubs, and mature trees. While most of Joppa West lies at an elevation of approximately 362 feet, the top surface appears to have been graded to avoid low areas that would result in permanent ponding of water (Geosyntec, 2021). No open water or persistent standing water is currently present within Joppa West.

Joppa West ceased receiving CCR and was capped or otherwise maintained prior to October 19, 2015 and is not subject to Title 40 of the Code of Federal Regulations (40 C.F.R.) Part 257 Subpart D in accordance with 40 C.F.R. § 257.50(d).

2.2 Regional Geology

Discussion of geology provided in the *Phase I Hydrogeological Assessment Report* (NRT, 2013) and subsequent site characterization activities performed in the vicinity of Joppa West have been summarized in this section and supplemented with the collection of additional site-specific data in March of 2021.

The Joppa Plant lies at the southern boundary of the Illinois Basin and the northern edge of the Mississippi Embayment, a relatively low-lying area that is part of the Coast Plain Physiographic Province. The vicinity of the Joppa Plant generally has less than 6 meters (<19.7 feet) of silty and clayey diamictons overlying Cretaceous sediments, silts, sands, etc. between depths of 6 to 15 meters (19 to 50 feet). The unlithified materials rest on Mississippian age bedrock (NRT, 2013).

Geologic units present in the vicinity of Joppa West include the following (starting at ground surface):

- Fill (clay, silt, sand, gravel and crushed rock) and CCR (coal ash generated at the Joppa Plant): primarily occurs within Joppa West and dikes.
- Unlithified materials of the Equality Formation: silt, clay, and minor amounts of sand and gravel.
- Unlithified Peoria, Roxana and Loveland Silt: consists of Wisconsinan-age wind-blown (eolian) silt deposits (not mapped at the site).
- Unlithified materials of the Metropolis Formation: consists of silt, sand, clay, and gravel. Much of the unit may be classified as diamicton. Gravel occurs as common scattered pebbles and as lenses up to 4 feet thick.
- Unlithified materials of the McNairy Formation: consists of Upper Cretaceous-age sands, silts and clays. Increased sand and gravel content compared to overlying unlithified units.
- Salem Limestone bedrock: Mississippian-age uppermost bedrock. The bedrock dips gently northward toward the center of the Illinois Basin.

Previous investigations indicate more than 50 feet of clay-rich deposits of the Equality and Metropolis Formations are present in the area. Site characterization activities completed between 2013 and 2021 provide additional details of subsurface conditions at the site. Cross-sections of the subsurface are provided in Figures 3, 4, and 5.

Hanson (2015) completed the CCR groundwater monitoring network well installations and borehole logging at six locations at Joppa East to support compliance with the United States Protection Agency (USEPA) Final Rule to regulate CCR - 40 C.F.R. Part 257 Subpart D. Boring depths ranged from 58 to 80 feet below ground surface (ft bgs) and had an average depth of approximately 69 ft bgs. The wells were screened within sandy strata of the McNairy Formation. Materials encountered in the Hanson (2015) borings included 0 to 4 feet of silt or gravel fill overlying 38 to 70 feet of clay-rich Equality and Metropolis Formation deposits with discontinuous lenses of silt or sand. Underlying the Metropolis Formation deposits were sand deposits of the McNairy Formation that contained variable amounts of silt and gravel. Occasional discontinuous lenses of primarily fine-grained materials (silt and clay) were also observed within the sandy McNairy Formation deposits. The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required by 40 C.F.R. § 257.91 for each monitored CCR Unit. Pertinent information from these investigations has been included in geologic cross-sections provided in Figures 3, 4, and 5.

Ramboll completed six soil borings in March 2021 and converted five of the borings into temporary monitoring wells, as discussed in Section 3 below. Soil boring TPZ117D was completed to a depth of 70 ft bgs in the McNairy Formation deposits and fine-grained Equality and Metropolis Formation deposits were observed to a depth of 57 ft bgs. The other five borings were all terminated in the Equality and Metropolis deposits above the McNairy Formation.

2.3 Regional Hydrogeology

Discussion of hydrogeology provided in the *Phase I Hydrogeological Assessment Report* (NRT, 2013) and subsequent site characterization activities performed in the vicinity of Joppa West have been summarized in this section and supplemented with the collection of additional site-specific data in March of 2021.

Three hydrostratigraphic (water bearing) units have been identified at Joppa West and vicinity:

- The uppermost hydrostratigraphic unit (Upper Confining Unit, or UCU) is approximately 50 feet thick and is composed of the Equality and Metropolis Formation deposits. These deposits are predominantly fine-grained, comprised of clay and silty clay with minor intervals of sandy material. This hydrostratigraphic unit extends down to the McNairy Formation which was encountered at 57 ft bgs at location TPZ117D. The geometric mean hydraulic conductivity of this unit is 5.9×10^{-6} centimeters per second (cm/s) (NRT, 2013). This unit is not an aquifer. As discussed in Section 4 below, this unit has been classified as Class II groundwater as defined by Part 620, § 620.220 and is not suitable as a potable water resource.
- The McNairy Formation has been identified as the Uppermost Aquifer (UA) for compliance with the Federal CCR Rule (40 C.F.R. Part 257) at Joppa East and as defined by § 845.120. This hydrostratigraphic unit is approximately 85 feet thick and extends down to the top of the Salem Limestone bedrock. The geometric mean of hydraulic conductivities in the McNairy Formation tested at Joppa East were 2.4×10^{-4} cm/s (NRT, 2017). The McNairy Formation is more permeable that the overlying Equality and Metropolis Formations due to the larger amount of sand and gravel in this unit. This unit is classified as Class I groundwater as defined by Part 620, § 620.110.
- The Salem Limestone bedrock is the third hydrostratigraphic unit identified. The limestone bedrock is the uppermost bedrock unit underlying Joppa West and has a reported thickness of 200 to 500 feet. This unit is classified as Class I groundwater as defined by Part 620, § 620.110.

No known wells in the area utilize the Equality and Metropolis Formations for groundwater. Most local wells obtain groundwater from sands and gravels of the McNairy Formation or underlying Mississippian-age limestone bedrock. Groundwater flow beneath Joppa West and Joppa East is south toward the Ohio River, the regional groundwater sink.

During operation of Joppa West, ponded water is apparent in historic aerial photographs within the footprint of Joppa West, including the northern area and settling area. Ponded water has not been observed within either portion of Joppa West since 2015 (Geosyntec, 2021). The phreatic surface (measured depth to water) within Joppa West at XTPW01 is approximately 11 feet below ground surface which is consistent with the observed absence of ponded water within Joppa West.

3. 2021 FIELD ACTIVITIES

In March 2021 Ramboll completed six soil borings and installed five temporary monitoring wells at Joppa West (Figure 2). A round of groundwater levels were collected from existing monitoring wells prior to boring advancement and temporary monitoring well installation. Groundwater levels and corresponding elevations are presented in Table 1. Existing monitoring wells surrounding Joppa West were redeveloped, and newly installed temporary wells were developed. A complete description of field activities is provided in Attachment 2. Boring logs, well construction forms, well (re)development forms, and a borehole abandonment form are provided in Attachment 3. A summary of well construction details for existing monitoring wells and temporary wells is provided in Table 2. Boring and well locations monitoring Joppa West were surveyed by a licensed surveyor (Attachment 4). A round of groundwater levels and analytical samples were collected from wells monitoring Joppa West. Field notes and the laboratory analytical report are included in Attachment 5. Field and laboratory parameters are summarized in Table 3 and laboratory analytical data compared to 35 I.A.C. § 620.410 and § 845.600 are presented on Table 4.

4. SITE HYDROGEOLOGY

This section presents a discussion of the hydrostratigraphic units present at the Site and their characteristics, including groundwater elevations and flow directions, physical properties of hydrogeologic units, and information regarding the phreatic surface within the CCR material within Joppa West

4.1 Groundwater Classification

As presented in the 2013 hydrogeologic report (NRT, 2013) and set forth in Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 620, any geologic material with a hydraulic conductivity of less than 1 x 10^{-4} cm/s, and which does not meet the provisions of § 620.210 (Class I), § 620.230 (Class III), or § 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater. Based on evaluation of the site data, groundwater in the unlithified deposits of the UCU can be classified as Class II groundwater.

Groundwater monitored at the Joppa Plant in the upper 50 feet of unlithified materials, which is inclusive of the clay, silt, and silty clay of the Equality Formation, and the Metropolis Formation, does not qualify as Class I groundwater because:

- Joppa West and Joppa East are not within the minimum setback zone of a well which serves as a potable water supply;
- The monitoring wells are screened in clay and silty clay rather than unconsolidated sand, gravel, or sand and gravel which is 5 feet or more in thickness and that contains 12% or less of fines;
- The monitoring wells are not screened in a sandstone which is 10 feet or more in thickness, nor are they screened in fractured carbonate which is 15 feet or more in thickness; and,
- The geometric mean hydraulic conductivity values for the clay units penetrated by seven individual monitoring wells, based on slug test data, is less than 1 x 10^{-4} cm/s.

4.2 Groundwater Elevations and Flow Directions

Groundwater elevation measurements are summarized in Table 1 and include elevation measurements for recently installed wells (Table 2). Groundwater elevations collected on March 22, 2021 from wells in the UCU are presented on Figure 6. As shown, groundwater in the UCU generally flows from higher topographic areas north of Joppa West (G111) toward the former stream valley beneath the former impoundment, and toward the Ohio River.

Elevations from well G101 are not included in groundwater elevation contours on Figure 6. G101 is screened in the UCU located topographically upgradient from both Joppa West and Joppa East, however, groundwater elevations observed at G101 continue to be lower than those of its nearest neighbors (G111 and G113) which is inconsistent with the higher ground surface elevation at G101 and its location upgradient of both former impoundments. Inconsistent groundwater elevation data at this well were first reported in 2013 and its elevation measurements have not been used to evaluate groundwater elevation at the Site or flow directions since that time.

Well G111 is screened in the UCU and is upgradient of Joppa West based on groundwater elevation and water chemistry, as discussed in Section 5. Wells G112C, G113, TPZ114, TPZ116, and TPZ117 are all screened in the UCU side-gradient or downgradient of Joppa West (which includes the northern area and the Settling Area). Groundwater elevations at these wells are consistent with the regional model of topographic-controlled groundwater flow and are reflective of flow patterns in the UCU. TPZ117D is screened in the UA south of Joppa West.

4.2.1 Relationship between Water in the CCR Materials and Groundwater

Joppa West has been closed since the early 1970s (approximately 48 years ago). At the current time, there is no impounded (ponded) surface water within the footprint of Joppa West. Two soil borings (one of which was converted to a monitoring well) were completed within Joppa West in March 2021. Well XTPW01 was screened near the base of CCR materials from 20 to 30 ft bgs to characterize water quality and levels within the CCR materials at Joppa West. The elevation of the phreatic surface measured at XTPW01 was 350.75 feet North American Vertical Datum of 1988 (NAVD88), which indicates that the phreatic surface in the former impoundment is approximately 11.5 feet below ground surface at this location. This is lower than the groundwater elevation observed at UCU well G111, located hydraulically upgradient of XTPW01 and just outside the western dike. The elevation of the phreatic surface within the northern area of Joppa West (350.75) is also consistent with groundwater elevations in the other UCU wells surrounding Joppa West (Figure 6).

When viewed in cross-section (Figure 3) the projected phreatic surface elevation at XTPW01 is consistent with the potentiometric surface drawn between UCU wells G111 and G113. The potentiometric surface is also consistent with the elevation of offsite water pondage areas just south of G111 and the drainage swale east of G113, where the intermittent stream was routed around the impoundment (Figure 4). The alignment of surface water and potentiometric heads in the subsurface indicates that the groundwater flow system and the elevation of the phreatic surface within Joppa West is at or near a state of equilibrium (steady state). The current flow system also follows the expected natural flow pattern of groundwater in the UCU from higher topographic areas north of Joppa West (G111) toward the former stream valley beneath Joppa West, and down the axis of the former stream valley toward the Ohio River.

4.3 Hydraulic Conductivity

Seven UCU wells were tested in 2010 to estimate hydraulic conductivity (Table A below) (NRT, 2013).

Table A. 2010 Hydraulic Conductivity Values

Monitoring Well	Hydraulic Conductivity (cm/s)
G101	5.6E-06
G111	1.5E-05
G112B	1.1E-06
G113	6.1E-06
G151	3.1E-06
G152	7.6E-05
G153	1.9E-06
Geometric Mean	**5.9E-06**

Additional site-specific hydraulic conductivities were estimated using drawdown and pumping information obtained during well development activities conducted in March 2021, summarized in Table B below. Development data at wells G101 and G112C were suitable for estimating hydraulic conductivity with the modified Jacob approximation for transient, unconfined conditions as presented in Walton (Walton, 1962). Data from TPZ117D indicated sustained drawdown during pumping and were evaluated using the Robbins modified slug-test method (Robbins et al., 2008). Results from the two wells completed in the UCU were generally consistent with the previous results, although the result for well G101 was a little higher than previous results. The estimated conductivity of 3.5 x 10^{-3} cm/s for TPZ117D provides information regarding the hydraulic conductivity of the UA.

Table B. 2021 Hydraulic Conductivity Values

Well ID	Date Sampled	Flow Rate (mL/min)	Draw-down (feet)	Hydrostrat-igraphic Unit	Interpreted Flow Pattern	K Estimate (cm/s)	Method
G101	3/17/21	5677.5	12.32	UCU (silt/clay)	Transient	4.1E-04	Walton (Jacob approximation)
G112C	3/15/21	1488.5	24.9	UCU (silt/clay)	Transient	4.9E-05	Walton (Jacob approximation)
TPZ-117D	3/17/21	7792	1.64	UA (sand/gravel)	Stable	3.5E-03	Radial Flow Model (Robbins/Muskat)

Notes:
mL/min = milliliters per minute
K = hydraulic conductivity

Development data for well XTPW01, which is screened within the CCR material, showed insufficient drawdown during pumping for application of the Robbins steady-state method. This indicates moderate to high hydraulic conductivity for the CCR material at the location of XTPW01.

4.4 Groundwater Gradients

Vertical groundwater gradients measured at nested wells screened in the UCU and UA at Joppa West and Joppa East are presented in Table 5. Limited vertical gradient data from Joppa West indicate an upward vertical gradient. However, both upward and downward vertical gradients have been identified from observed groundwater elevations. Conceptually, groundwater is expected to travel downward through the UCU in high topographic areas and may travel upward through the UCU in lower topographic areas (e.g., along the Ohio River).

Horizontal groundwater gradients and flow velocities between the UCU wells are calculated in Table 6. The average gradients range from 0.0097 to 0.0276, which is consistent with the previously reported gradient of 0.014 (NRT, 2013). Using the geometric mean hydraulic conductivity of 5.9 x 10^{-6} cm/s and an estimated effective porosity of 13.5% for silt and clay material, calculated groundwater velocities range from 0.44 to 1.25 feet per year. These flow velocities are approximately 3 times lower than calculated groundwater velocities for the Upper Aquifer at Joppa East (NRT, 2017) which ranged from 0.003 to 0.01 feet per day (1.09 to 3.65 feet per year).

5. GROUNDWATER CHEMISTRY

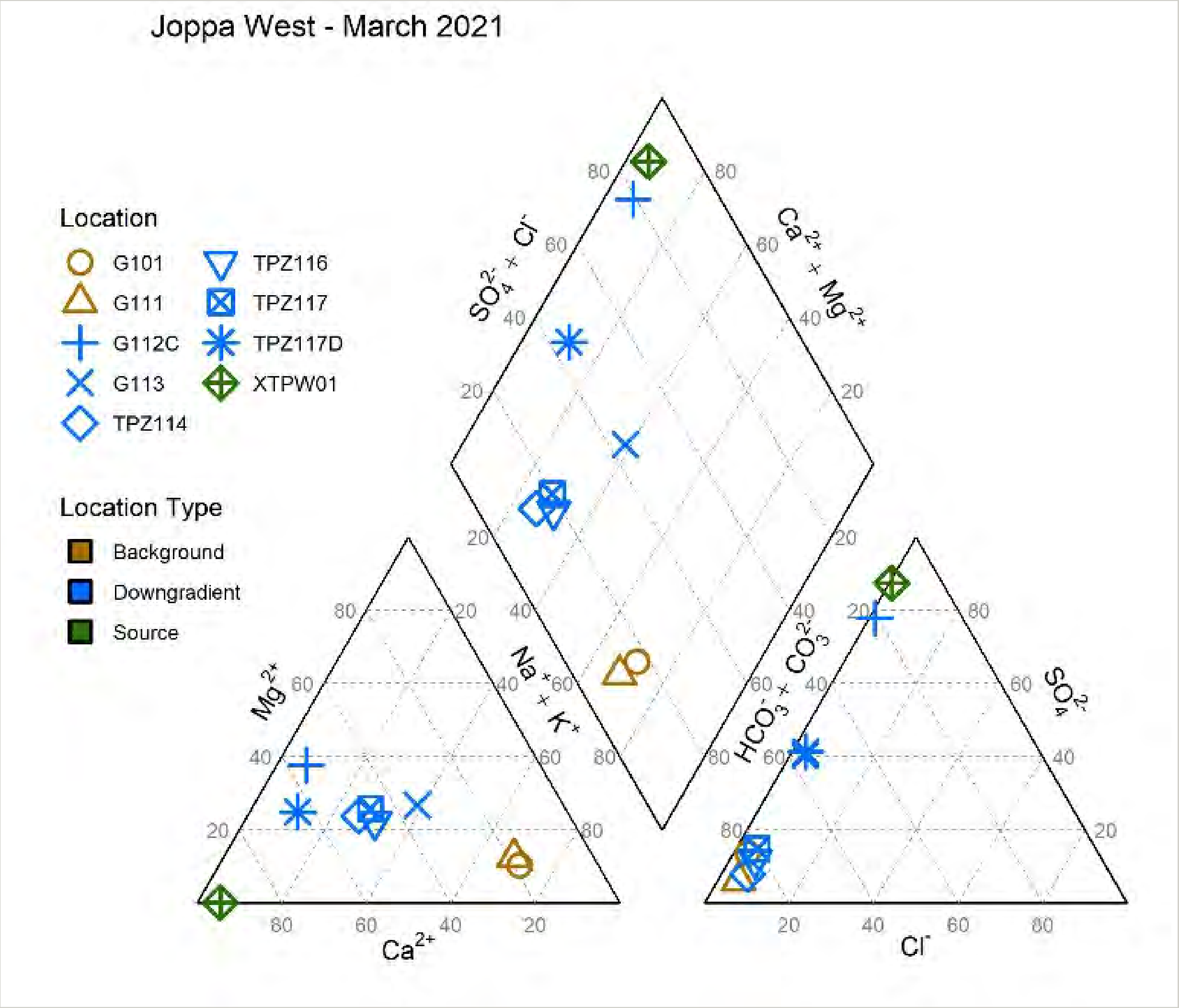
Available groundwater quality data for existing wells was reviewed with the groundwater and source water CCR data collected in March 2021 to evaluate groundwater chemistry. Well G101 is screened in the UCU located topographically upgradient from both Joppa West and Joppa East and is representative of background water quality for both Joppa West and Joppa East in the UCU.

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identifies the compositional categories or groupings (hydrochemical facies). Figure A, below, is a Piper diagram that displays the ionic composition of groundwater samples from background and downgradient monitoring wells associated with Joppa West and the pore water sample collected from the well screened in CCR (XTPW01). It is evident from the Piper diagram that:

- The CCR source sample (XTPW01) in green and downgradient monitoring well G112C plot in the calcium-sulfate hydrochemical facies;
- The background well G101 and upgradient well G111 plot in the sodium-bicarbonate hydrochemical facies; and
- The remaining wells plot in the calcium-bicarbonate hydrochemical facies.

The similar ionic compositions of the source water CCR sample and downgradient groundwater at G112C suggest that CCR constituents detected in G112C are attributed to the impacts from Joppa West. Conversely, the dissimilar ionic compositions of the other wells indicate Joppa West is not the source of CCR constituents detected in those locations. Further, the similar ionic composition between G101 and G111 along with the observation that G111 is hydraulically upgradient of Joppa West indicates that G111 is representative of background water quality.

Figure A. Piper Plot



6. GROUNDWATER QUALITY

Available groundwater data for existing wells was combined with the groundwater data collected in March 2021 and compared to 35 I.A.C. § 620.410 and § 845.600 as presented on Table 4. The following CCR constituents were detected above groundwater standards in pore water collected from XTPW01 (source):

- pH, arsenic, boron, and selenium

The following constituents were detected above groundwater standards in UCU wells near Joppa West:

- Boron, sulfate, and cobalt at G112C;
- pH at G113;
- Arsenic, cobalt, and lead at TPZ114; and
- Arsenic, beryllium, cobalt, and lead at TPZ117.

6.1 Exceedances of Groundwater Quality Standards Attributable to Joppa West

Concentrations of boron and sulfate detected at G112C are attributed to CCR in Joppa West as they are located downgradient of the former impoundment and the ionic composition of groundwater observed at G112C is similar to that observed in CCR source water at XTPW01, which was installed within the footprint of Joppa West. Boron and sulfate are also common indicator parameters of CCR impacts in groundwater suggesting that the former impoundment is a source for the observed concentrations.

The other exceedances observed are not attributed to Joppa West for the following reasons:

1. Beryllium, cobalt, and lead were not detected in the source sample collected from XTPW01. The detection limits of the samples collected from XTPW01 were also below the water quality standards indicating the CCR cannot be the source of exceedances observed at G112C, TPZ114 and TPZ117. Further, samples were collected with bailers from wells TPZ114 and TPZ117 due to the depths to groundwater, which resulted in more turbid water than what was sampled at other wells. The particulates in the groundwater samples are a likely alternative source for the elevated concentrations detected at these wells.
2. The pH exceedance observed at G113 was a low pH value of 6.4 which is just below the minimum permissible range of 6.5 to 9.0. The pH exceedance observed in the source sample XTPW01 was a high pH value of 11.1; therefore, Joppa West cannot be the source of low pH in the sample from the UCU well.
3. The initial and only samples collected from TPZ114 and TPZ117 contained arsenic exceedances (0.0169 and 0.0198 milligrams per liter [mg/L] respectively) which were just above the standard of 0.01 mg/L. It is unlikely that Joppa West is the source of these exceedances for the following reasons:
    a. Neither boron nor sulfate (common CCR indicator parameters) were detected above their respective water quality standards in the samples collected from TPZ114 and TPZ117.

b. As discussed in Section 5, the ionic composition of source water collected from XTPW01 is different from the water collected from TPZ114 and TPZ117, indicating Joppa West is not the source of CCR impacts in these wells.

c. Arsenic has not been detected at well G112C, which has similar ionic composition to source water collected from XTPW01 and has exceedances of boron and sulfate.

d. These samples were more turbid than other samples and the particulates in the groundwater are a likely alternative source for the elevated concentrations detected.

Exceedances of boron and sulfate attributable to Joppa West (illustrated on Figure 6) are defined laterally by the monitoring wells placed in the UCU adjacent to Joppa West: G111, G113, TPZ114, TPZ116, and TPZ117. Groundwater collected from the underlying UA at TPZ117D did not contain any exceedances of groundwater standards. Monitoring well G112C, screened in the UCU downgradient of Joppa West near the mouth of the former intermittent stream valley is the only well that has CCR impacts attributable to Joppa West.

6.2 Stability of Groundwater Concentrations

Previous sections have discussed how groundwater elevations and the phreatic surface within Joppa West have reached a state of equilibrium since Joppa West was taken out of service. Mann-Kendall trend analysis tests were performed on all available groundwater data to determine if groundwater concentrations were increasing, decreasing, or stable (i.e., no statistically significant upward or downward trend) with 95% confidence. Complete results of the Mann-Kendall tests are presented in Attachment 6 and trends identified are summarized below in Table C. Constituents with no detected results are not discussed because the trends merely reflect changes in laboratory reporting limits over time.

The Mann-Kendall tests identified upward trends for barium in wells G111 and G113; and, total dissolved solids (TDS) in well G113 (Table C below). As discussed above, G111 is representative of upgradient water quality, therefore increases in concentration in G111 and G113 are likely associated with changes in upgradient groundwater conditions. TDS concentrations at well G113 remain below the groundwater protection standard and groundwater at this location does not exhibit corresponding increases in sulfate or boron, indicating that Joppa West is not the likely source of the increasing trend for TDS.

Table C. Concentration Trends

Location	Parameter	Sample Count	Minimum	Maximum	Mean	SD	CV	Trend (p value)
G111	Barium	12	0.149	0.207	0.167	0.0162	0.097	Upward (0.023)
G113	Barium	12	0.108	0.547	0.446	0.121	0.271	Upward (0.017)
G113	TDS	12	524	870	618	96	0.155	Upward (0.00078)

SD=standard deviation
CV=coefficient of variation
The p value is the result of the Mann-Kendall trend test. A trend is considered significant when the p value was less than 0.05.

No downward trends were identified, which means the remaining constituents had no trend. Based on the results of trend analysis, CCR constituents in groundwater are stable, which is consistent with the groundwater flow reaching a state of equilibrium.

7. CONCEPTUAL MODEL FOR GROUNDWATER FLOW

The information presented in this report was used to develop a conceptual model for groundwater flow at the Site. This section presents the conceptual model for groundwater flow for conditions at Joppa West prior to construction (predevelopment); and, under current conditions. This section also presents considerations for evaluation of potential remedial options to address groundwater impacts under Subpart F of Part 845 or in accordance with an approved groundwater management zone under Part 620.

7.1 Pre-Development Conditions

The site setting, topography, and hydrogeology for pre-development conditions are presented in Section 2. As described, Joppa West was built by constructing dikes and placing fill and ash within an existing surface water drainage/intermittent stream valley. Both the stream valley and the upland hills are comprised of unconsolidated silts and clays of the Equality and Metropolis Formations, of relatively low hydraulic conductivity (the UCU). The change from the silt and clay material of the UCU to the sand and gravel which comprises the UA is encountered below 300 feet NAVD88, which indicates the footprint of the CCR materials is fully within the fine-grained UCU (no outcropping of the permeable UA at the pre-development ground surface).

Pre-development groundwater elevations within the shallow UCU would have been consistent with a topographic-controlled groundwater flow pattern, in which areal recharge and flow from upgradient/upland areas would result in groundwater flowing towards the incised intermittent or perennial creeks and towards the Ohio River. Groundwater elevations at the base of the drainage would have been close to ground surface; during periods of high rainfall, shallow groundwater would have discharged to the stream, and during periods of drought the stream may have been dry. Figure 7 presents a conceptual diagram of the potentiometric surface under pre-development conditions; and, indicates how shallow groundwater would have flowed from upland areas towards the creeks as well as toward the Ohio River.

7.2 Current Conditions

Current conditions of groundwater flow at the Site are described in Section 4. Joppa West is currently covered by dense vegetation, which includes mature trees, and there is no indication of persistent standing surface water at Joppa West. As presented on Figure 6, the phreatic surface measurements within the CCR materials (XTPW01) and groundwater elevations from wells in the UCU are consistent with groundwater flow directions generally south towards the Ohio River.

Well G111 is located nearest the pre-development topographic ridge to the west of Joppa West. Groundwater elevations at this well are a few feet below ground surface, which is consistent with the topographic-controlled pattern of groundwater flow, with recharge in upland areas. Comparison of the elevation of the phreatic surface at XTPW01 to groundwater elevations measured at wells G111 and G113, which are located near XTPW01 but screened within the native fine-grained material of the UCU, indicate that flow directions are generally south towards the Ohio River, with an eastward component across the former impoundment from G111 towards G113. Based on observations collected in March 2021, the elevation of the phreatic surface measured at XTPW01 (350.75) is approximately 4 feet lower than the groundwater elevation observed in the UCU upgradient of Joppa West at G111 (354.6), indicating upgradient groundwater has the potential to flow into Joppa West.

Based upon the timeline for discontinued use at Joppa West in the 1970s, and as described in Section 4, potentiometric heads and flow directions at Joppa West are stable (steady-state) at the current time.

7.3 Considerations for Closure

Comparison of the current flow system and phreatic surface within Joppa West to the conceptual pre-development groundwater flow directions illustrates how placement of CCR material in the former stream valley influences the current groundwater flow patterns. Shallow groundwater flow which would have previously discharged to the intermittent stream, or to seeps along the slopes, is now directed into the CCR material as lateral influx. Comparison of pre-development and current topographic data indicates that some filling of the intermittent stream valley occurred after 1932 to the north of Joppa West. This may have been completed during construction of the northern dike along with activities to re-route the intermittent stream to a constructed swale along the eastern dike of Joppa West. Conceptually, the lateral flux into Joppa West includes both groundwater flux from the UCU that was headed toward the former stream, and flux from the headwaters of the former stream uphill of Joppa West.

Rerouting of the former streambed to the drainage swale would have ideally eliminated the uphill inflow of surface water from the stream into the CCR materials; however, increasing the elevation of this feature would not divert groundwater flow away the former stream channel, and, in fact, may create a source of groundwater recharge adjacent to the former impoundment from the constructed streambed.

Based on the CSM for groundwater flow at the site, the following conclusions are relevant for closure selection:

- The pre-development ground surface topography indicates that ash may be present at the base of the former impoundment to an approximate elevation of 305 feet NAVD88. This elevation is lower than the groundwater elevations measured in wells adjacent to the impoundment. Comparison of the elevation of the phreatic surface at XTPW01 to groundwater elevations in nearby wells indicates continuation of the potentiometric surface across the former West Ash Pond. Therefore, based upon these elevations, it is unlikely that the phreatic surface will drop below the level of the CCR material without management of groundwater levels in the native material which surrounds Joppa West.
- Removal of the established and mature vegetation that is currently in place at the former impoundments will result in reduced transpiration (uptake of water) and could result in an increase in percolation through the cover, which could increase the concentration of constituents of concern in groundwater.
- Groundwater flow conditions and concentrations are currently stable. Mitigation or elimination of vertical infiltration by modifications to the existing cover will not eliminate lateral influx of groundwater into Joppa West. Approximately 50 years of dewatering has occurred. Therefore, groundwater exceedances should be addressed in connection with either an approved groundwater management zone pursuant to Part 620 or Subpart F of Part 845.
- Further groundwater investigations will be completed as necessary to refine the conceptual site model, monitor trends in groundwater flow and concentrations, and evaluate potential remedial options as required by Part 620 or Subpart F of Part 845.

8. SUMMARY AND CONCLUSIONS

Key information presented in this report is summarized below:

- Approximately 50 years after closure of Joppa West, groundwater impacts attributable to CCR material are observed in a single well (112C) located immediately downgradient of the Settling Area, and monitors a water bearing unit (the UCU) that is not suitable for use.
- Groundwater exceedances attributable to Joppa West have not been observed in the uppermost aquifer (UA), indicating the UCU effectively limits impacts from the CCR materials to the UA.
- No open water or persistent standing water was observed at land surface within Joppa West during March 2021 field activities. Ponded water has not been observed in aerial photographs within Joppa West since 2015 (Geosyntec, 2021).
- Groundwater flow conditions and concentrations are currently stable. Mitigation or elimination of vertical infiltration by modifications to the existing cover will not eliminate lateral influx of groundwater into Joppa West. Approximately 50 years of dewatering has occurred. Therefore, groundwater exceedances should be addressed in connection with either an approved groundwater management zone pursuant to Part 620 or Subpart F of Part 845.

9. REFERENCES

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TABLES

TABLE 1.

GROUNDWATER ELEVATIONS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Station ID	Date [1]	Northing [2] (ft)	Easting [2] (ft)	Top of Casing (ft NAVD88)	Ground Surface Elevation (ft NAVD88)	Total Well Depth (ft BTOC)	Depth to Water (ft BTOC)	Groundwater Elevation (ft NAVD88)
G101	08/16/10	202,050.25	831,716.43	363.69	361.12	54.57	45.25	318.44
	11/05/10						Dry	--
	03/15/11						44.88	318.81
	06/16/11						39.64	324.05
	09/13/11						46.24	317.45
	11/29/11						46.32	317.37
	02/14/12						48.12	315.57
	05/15/12						45.59	318.10
	08/07/12						Dry	--
	03/06/13						47.40	316.29
	04/17/13						NM	--
	05/13/13						49.68	314.01
	12/22/15						50.10	313.59
	03/15/16						47.21	316.48
	06/14/16						46.91	316.78
	09/13/16						48.53	315.16
	12/14/16						49.95	313.74
	03/07/17						49.60	314.09
	06/14/17						47.84	315.85
	07/19/17						48.67	315.02
	11/30/17						50.44	313.25
	06/09/18						48.30	315.39
	12/06/18						48.51	315.18
	03/27/19						44.36	319.33
	09/09/19						44.88	318.81
	03/30/20						42.40	321.29
	09/23/20						45.03	318.66
	03/15/21	202,049.46	831,717.01	363.47	361.03	54.24	37.50	325.97
	03/22/21						36.28	327.19
G01D	12/02/15	202,039.30	831,716.11	364.19	361.50	67.07	48.58	315.61
	03/15/16						40.21	323.98
	06/15/16						43.95	320.24
	09/14/16						47.05	317.14
	12/14/16						49.81	314.38
	03/07/17						46.91	317.28
	06/14/17						39.83	324.36
	07/19/17						45.65	318.54
	11/30/17						49.32	314.87
	06/09/18						44.50	319.69
	09/05/18						48.00	316.19
	03/27/19						34.50	329.69
	09/09/19						42.75	321.44
	03/30/20						33.73	330.46
	09/23/20						43.87	320.32
	03/15/21						38.94	325.25
	03/22/21							--

TABLE 1.
GROUNDWATER ELEVATIONS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Station ID	Date [1]	Northing [2] (ft)	Easting [2] (ft)	Top of Casing (ft NAVD88)	Ground Surface Elevation (ft NAVD88)	Total Well Depth (ft BTOC)	Depth to Water (ft BTOC)	Groundwater Elevation (ft NAVD88)
G111	08/16/10	200,806.110	829,139.790	359.17	356.63	47.54	8.00	351.17
	11/05/10						9.77	349.40
	03/15/11						4.90	354.27
	06/16/11						6.42	352.75
	09/13/11						8.45	350.72
	11/29/11						4.68	354.49
	02/14/12						4.55	354.62
	05/15/12						6.68	352.49
	08/07/12						9.22	349.95
	03/06/13						5.20	353.97
	04/17/13						NM	--
	05/13/13						4.68	354.49
	03/15/21	200,806.933	829,139.371	358.97	356.52		4.05	354.92
	03/22/21						4.37	354.60
G112B	08/16/10	198,913.55	828,988.60	347.62	345.16	47.66	26.42	321.20
	11/05/10						26.18	321.44
	03/15/11						15.50	332.12
	06/16/11						22.03	325.59
	09/13/11						26.05	321.57
	11/29/11						20.80	326.82
	02/14/12						9.72	337.90
(Abandoned	05/15/12						24.01	323.61
January 2013)	08/07/12						28.45	319.17
G112C	03/06/13	198,552.26	829,088.33	325.82	323.60	27.22	5.25	320.57
	04/17/13						5.31	320.51
	05/13/13						2.64	323.18
	03/15/21	198,552.23	829,088.34	325.89	323.46	27.52	2.85	323.04
	03/22/21						4.40	321.49
G113	08/16/10	199,599.53	830,364.44	353.04	350.46	46.18	15.40	337.64
	11/05/10						15.80	337.24
	03/15/11						11.80	341.24
	06/16/11						13.66	339.38
	09/13/11						14.90	338.14
	11/29/11						11.50	341.54
	02/14/12						12.05	340.99
	05/15/12						14.25	338.79
	08/07/12						16.65	336.39
	03/06/13						12.65	340.39
	04/17/13						NM	--
	05/13/13						12.12	340.92
	03/15/21	199,599.89	830,365.65	352.91	350.59		10.56	342.35
	03/22/21						10.55	342.36

TABLE 1.
GROUNDWATER ELEVATIONS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Station ID	Date[1]	Northing[2] (ft)	Easting[2] (ft)	Top of Casing (ft NAVD88)	Ground Surface Elevation (ft NAVD88)	Total Well Depth (ft BTOC)	Depth to Water (ft BTOC)	Groundwater Elevation (ft NAVD88)
G151	08/16/10	200,437.41	832,154.25	363.60	360.90	47.70	42.70	320.90
	11/05/10						Dry	--
	03/15/11						38.10	325.50
	06/16/11						36.83	326.77
	09/13/11						41.45	322.15
	11/29/11						42.20	321.40
	02/14/12						37.80	325.80
	05/15/12						41.82	321.78
	08/07/12						Dry	--
	03/06/13						39.49	324.11
	04/17/13						NM	--
	05/13/13						37.13	326.47
	03/15/21	200,438.57	832,154.49	363.38	360.79		35.13	328.25
	03/22/21						33.12	330.26
G152	08/16/10	198,547.23	832,358.44	351.18	348.55	29.53	9.21	341.97
	11/05/10						5.42	345.76
	03/15/11						2.20	348.98
	06/16/11						3.92	347.26
	09/13/11						5.34	345.84
	11/29/11						22.50	328.68
	02/14/12						18.20	332.98
(Abandoned January 2013)	05/15/12						5.07	346.11
	08/07/12						8.03	343.15
G152B	03/06/13	198,547.23	832,358.44	347.48	345.20	46.78	33.80	313.68
	04/17/13						NM	--
	05/13/13						17.08	330.40
	03/15/21	198,094.51	832,931.70	347.56	345.84		NM	--
	03/22/21						8.45	339.11
G153	08/16/10	200,067.47	833,979.90	354.65	351.73	46.52	38.13	316.52
	11/05/10						Dry	--
	03/15/11						37.82	316.83
	06/16/11						32.62	322.03
	09/13/11						39.55	315.10
	11/29/11						40.17	314.48
	02/14/12						32.90	321.75
	05/15/12						38.92	315.73
	08/07/12						Dry	--
	03/06/13						39.95	314.70
	04/17/13						NM	--
	05/13/13						33.37	321.28
	03/15/21	200,068.27	833,978.65	354.11	351.56		NM	--
	03/22/21						31.26	322.85

TABLE 1.
GROUNDWATER ELEVATIONS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Station ID	Date[1]	Northing[2] (ft)	Easting[2] (ft)	Top of Casing (ft NAVD88)	Ground Surface Elevation (ft NAVD88)	Total Well Depth (ft BTOC)	Depth to Water (ft BTOC)	Groundwater Elevation (ft NAVD88)
G51D	12/02/15	200,430.10	832,151.51	363.85	361.10	59.90	49.40	314.45
	03/15/16						36.81	327.04
	06/15/16						44.98	318.87
	09/14/16						48.13	315.72
	12/14/16						50.83	313.02
	03/07/17						47.50	316.35
	06/14/17						43.18	320.67
	07/19/17						46.29	317.56
	11/30/17						50.10	313.75
	06/09/18						45.43	318.42
	09/05/18						49.40	314.45
	03/27/19						34.57	329.28
	09/09/19						43.83	320.02
	03/30/20						33.67	330.18
	09/23/20						44.94	318.91
	03/15/21						38.86	324.99
	03/22/21						38.27	325.58
G52D	12/02/15	198,098.93	832,927.89	348.41	345.88	80.01	32.73	315.68
	03/15/16						26.18	322.23
	06/15/16						25.37	323.04
	09/14/16						28.04	320.37
	12/14/16						31.56	316.85
	03/07/17						30.03	318.38
	06/14/17						26.36	322.05
	07/19/17						27.24	321.17
	11/30/17						32.10	316.31
	06/09/18						24.55	323.86
	09/05/18						28.03	320.38
	03/27/19						19.68	328.73
	09/09/19						22.92	325.49
	03/30/20						20.59	327.82
	09/23/20						25.70	322.71
	03/15/21						NM	--
	03/22/21						25.30	323.11
G54S	03/15/21	199,073.93	831,608.79	356.57	353.58	47.84	Dry	--
	03/22/21						45.37	311.20
G54D	12/02/15	199,066.83	831,610.42	357.03	353.71	80.14	46.59	310.44
	03/15/16						40.23	316.80
	06/15/16						44.79	312.24
	09/14/16						47.56	309.47
	12/14/16						49.90	307.13
	03/07/17						43.69	313.34
	06/14/17						41.68	315.35
	07/19/17						44.51	312.52
	11/30/17						47.75	309.28
	06/09/18						43.23	313.80
	09/05/18						48.66	308.37
	03/27/19						30.73	326.30
	09/09/19						42.95	314.08
	03/30/20						27.90	329.13
	09/23/20						43.85	313.18
	03/15/21						32.87	324.16
	03/22/21						33.39	323.64

TABLE 1.
GROUNDWATER ELEVATIONS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Station ID	Date [1]	Northing [2] (ft)	Easting [2] (ft)	Top of Casing (ft NAVD88)	Ground Surface Elevation (ft NAVD88)	Total Well Depth (ft BTOC)	Depth to Water (ft BTOC)	Groundwater Elevation (ft NAVD88)
TPZ114	03/15/21	199,376.79	828,684.49	349.95	346.96	42.64	NI	--
	03/22/21						37.23	312.72
TPZ116	03/15/21	198,505.91	830,005.03	345.77	343.26	32.65	NI	--
	03/22/21						25.84	319.93
TPZ117	03/15/21	197,895.96	829,988.66	349.55	347.48	39.96	NI	--
	03/22/21						31.92	317.63
TPZ117D	03/15/21	197,891.54	829,987.18	349.27	347.26	70.42	NI	--
	03/22/21						29.73	319.54
XTPW01	03/15/21	200,570.41	830,167.15	363.52	361.43	32.00	NI	--
	03/22/21						12.77	350.75
Ohio River at Olmsted, IL [4] (Headwater)	03/06/13	187,402.55	773,029.00	NA	278.62	NA	23.48	302.10
	04/17/13						32.74	311.36
	05/13/13						43.42	322.04
	12/22/15						28.82	307.44
	03/15/16						32.49	311.11
	06/14/16						14.92	293.54
	09/13/16						17.33	295.95
	12/14/16						14.39	293.01
	03/07/17						31.31	309.93
	06/14/17						21.36	299.98
	07/19/17						20.44	299.06
	11/30/17						15.98	294.60
	06/09/18						20.30	298.92
	12/06/18						36.28	314.90
	03/27/19						37.89	316.51
	09/09/19						22.50	301.12
	03/30/20						46.80	325.42
	09/23/20						22.48	301.10
	03/15/21						40.86	319.48
	03/22/21						38.24	316.86
Ohio River at Olmsted, IL [4] (Tailwater)	06/09/18	187,402.55	773,029.00	NA	278.62	NA	28.01	306.63
	12/06/18						43.72	322.34
	03/27/19						45.85	324.47
	09/09/19						22.43	301.05
	03/30/20						54.77	333.39
	09/23/20						16.88	295.50
	03/15/21						48.85	327.47
	03/22/21						47.97	326.59

[O: KLT 4/5/21, C: MJM 4/6/21][U: KLT 4/6/21, U: KLT 4/22/21, C:YMD 4/22/2021]

Notes:

1. Historic elevations and survey data (2010 through 2013) were taken from the Phase I Hydrogeologic Assessment (NRT, 2013).
2. Northing and Easting values referenced to IL State Plane Coordinate System, East Zone (NAD 83).
3. Screen lengths, Top of Screen, and Bottom of Screen depths are based upon initial field measurements during well installation.
4. Data presented for the Ohio River at Olmsted, IL is taken from USGS gauging station USGS 03612600. Data include gage elevation and gage height at the tailwaters.

BTOC = below top of casing
-- = Groundwater Elevation Not Calculated
ft = foot/feet
NA = Not Applicable
NAVD88 = North American Vertical Datum of 1988
NI = Not Installed
NM = Not Measured

TABLE 2.
MONITORING WELL CONSTRUCTION DETAILS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Well Number	Date Constructed	Top of PVC Elevation (ft NAVD88/ GEOID 12A)	Measuring Point Elevation (ft NAVD88/ GEOID 12A)	Measuring Point Description	Ground Elevation (ft NAVD88/ GEOID 12A)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Screen Top Elevation (ft NAVD88/ GEOID 12A)	Screen Bottom Elevation (ft NAVD88/ GEOID 12A)	Bottom of Boring Elevation (ft NAVD88/ GEOID 12A)	Screen Length (ft)	Screen Diameter (inches)
G01D	8/14/2015	364.19	364.19	Top of Disk	361.50	54.2	63.9	307.3	297.7	297.1	9.7	2
G101	6/1/2010	363.47	363.47	Top of PVC	361.03	41.7	51.7	319.3	309.3	309.0	10.0	2
G111	6/24/2010	358.97	358.97	Top of PVC	356.52	31.7	41.7	324.8	314.8	314.5	10.0	2
G112B	6/20/2010	347.65	347.65	Top of PVC	345.16	31.7	41.7	313.5	303.5	303.2	10.0	2
G112C	1/29/2013	325.89	325.89	Top of PVC	323.46	15.0	25.0	308.5	298.5	298.5	10.0	2
G113	6/25/2010	352.91	352.91	Top of PVC	350.59	29.7	39.7	320.9	310.9	310.6	10.0	2
G151	6/19/2010	363.38	363.38	Top of PVC	360.79	31.7	41.7	329.1	319.1	318.8	10.0	2
G152	6/21/2010	351.07	351.07	Top of PVC	348.55	14.7	24.7	333.9	323.9	323.6	10.0	2
G152B	1/30/2013	347.56	347.56	Top of PVC	345.84	34.4	44.4	311.4	301.4	301.3	10.0	2
G153	6/18/2010	354.11	354.11	Top of PVC	351.56	29.7	39.7	321.9	311.9	311.6	10.0	2
G51D	8/18/2015	363.85	363.85	Top of PVC	361.10	49.6	59.3	311.5	301.8	301.2	10.0	2
G52D	8/19/2015	348.41	348.41	Top of PVC	345.88	69.9	79.6	276.0	266.3	265.9	10.0	2
G54S	1/22/2021	356.57	356.57	Top of PVC	353.58	34.7	44.7	318.9	308.9	308.6	10.0	2
G54D	8/11/2015	357.03	357.03	Top of PVC	353.71	70.0	79.7	283.8	274.1	273.6	10.0	2
TPZ114	3/17/2021	349.95	349.95	Top of PVC	346.96	30.0	40.0	317.0	307.0	307.0	10.0	2
TPZ116	3/17/2021	345.77	345.77	Top of PVC	343.26	20.0	30.0	323.3	313.3	313.3	10.0	2
TPZ117	3/16/2021	349.55	349.55	Top of PVC	347.48	30.0	40.0	317.5	307.5	307.5	10.0	2
TPZ117D	3/15/2021	349.27	349.27	Top of PVC	347.26	58.0	68.0	289.3	279.3	277.3	10.0	2
XTPW01	3/16/2021	363.52	363.52	Top of PVC	361.43	20.0	30.0	341.4	331.4	314.4	10.0	2

Notes:

bgs = below ground surface
BTOC = below toc of casing
DD = decimal degrees
ft = foot or feet
NAVD88 = North American Datum of 1988
UA = uppermost aquifer
UCU = upper confining unit

Descriptions for Hydraulic Position

B = background
D = downgradient
P = porewater
S = side gradient

TABLE 2.
MONITORING WELL CONSTRUCTION DETAILS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Well Number	Well Depth from Ground Surface (ft bgs)	Well Depth from Measuring Point (ft BTOC)	Total Boring Depth (ft bgs)	Screen Interval Lithology	Stickup of Measuring Point Above Ground Surface (ft)	State Planar Northing - Y (NAD83/ East Zone)	State Planar Easting - X (NAD 83/ East Zone)	Latitude (DD)	Longitude (DD)	CCR Unit Name	Hydraulic Position Relative to Unit
G01D	64.4	67.07	64.4	UA	2.69	202,039.300	831,716.108	37.22043	-88.85718	Joppa East/West Ash Pond	B
G101	51.7	49.32	52.0	UCU	2.45	202,049.460	831,717.012	37.22046	-88.85718	Joppa East/West Ash Pond	B
G111	41.7	44.69	42.0	UCU	2.45	200,806.933	829,139.371	37.21701	-88.86600	Joppa West Ash Pond	B
G112B	41.7	44.19	42.0	UA	2.49	198,913.550	828,988.600	37.21180	-88.86649	Joppa West Ash Pond	D
G112C	25.3	27.30	25.0	UCU	2.43	198,552.232	829,088.342	37.21081	-88.86614	Joppa West Ash Pond	D
G113	39.7	42.37	40.0	UCU	2.31	199,599.891	830,365.654	37.21371	-88.86177	Joppa West Ash Pond	S/D
G151	41.7	44.27	42.0	UCU	2.59	200,438.568	832,154.491	37.21604	-88.85564	Joppa East Ash Pond	D
G152	24.7	27.22	25.0	UA	2.52	198,547.230	832,358.440	37.21085	-88.85491	Joppa East Ash Pond	D
G152B	44.6	46.40	44.5	UCU	1.72	198,094.511	832,931.703	37.20961	-88.85293	Joppa East Ash Pond	D
G153	39.7	42.17	40.0	UCU	2.55	200,068.265	833,978.654	37.21505	-88.84937	Joppa East Ash Pond	D
G51D	59.9	62.65	59.9	UA	2.75	200,430.097	832,151.513	37.21602	-88.85565	Joppa East Ash Pond	D
G52D	80.0	82.54	80.0	UA	2.53	198,098.934	832,927.891	37.20963	-88.85294	Joppa East Ash Pond	D
G54S	44.7	47.84	45.0	UCU	2.99	199,073.930	831,608.787	37.21228	-88.85749	Joppa East Ash Pond	D
G54D	80.1	83.46	80.1	UA	3.32	199,066.829	831,610.418	37.21226	-88.85749	Joppa East Ash Pond	D
TPZ114	40.0	42.64	40.0	UCU	2.99	199,376.792	828,684.489	37.21307	-88.86754	Joppa West Ash Pond	D
TPZ116	30.0	32.65	30.0	UCU	2.52	198,505.914	830,005.025	37.21070	-88.86299	Joppa West Ash Pond	D
TPZ117	40.0	39.96	40.0	UCU	2.07	197,895.963	829,988.656	37.20902	-88.86303	Joppa West Ash Pond	D
TPZ117D	68.0	70.42	70.0	UA	2.01	197,891.542	829,987.176	37.20901	-88.86304	Joppa West Ash Pond	D
XTPW01	30.0	32.69	47.0	Ash	2.09	200,570.413	830,167.154	37.21637	-88.86247	Joppa West Ash Pond	P

[U: KLT 4/26/21, C: SSW 4/26/21]

Notes:

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BTOC = below toc of casing
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Descriptions for Hydraulic Position

B = background
D = downgradient
P = porewater
S = side gradient

TABLE 3.
FIELD AND LABORATORY PARAMETER RESULTS
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Sample Location	Sample Date [1]	pH	DO	ORP	SpC	Temperature	Turbidity	Cyanide	Nitrate as Nitrogen	Copper	Iron	Manganese	Nickel	Silver	Zinc
	Reporting Units:	STD	mg/L	mV	micromhos/cm	degrees C	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
G101	8/17/2010	7.1	--	--	--	--	--	<0.007	2.12	<0.01	1.34	0.0556	<0.01	<0.01	<0.01
G101	3/15/2011	6.6	--	--	--	--	--	<0.007	1.72	<0.01	0.172	<0.005	<0.01	<0.01	<0.01
G101	6/16/2011	7.2	--	--	--	--	--	<0.007	1.56	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	9/13/2011	6.9	--	--	--	--	--	<0.007	1.6	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	11/29/2011	7.2	--	--	--	--	--	<0.007	1.14	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	2/14/2012	6.9	--	--	--	--	--	<0.007	0.282	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	5/15/2012	7.3	--	--	--	--	--	<0.007	0.818	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	3/6/2013	7.1	--	--	--	--	--	<0.007	1.7	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	5/13/2013	6.8	--	--	--	--	--	<0.007	1.42	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G101	3/22/2021	7.0	3.14	135.6	552	18.43	0.00	--	--	--	0.468	0.0249	--	--	--
G111	8/17/2010	7.3	--	--	--	--	--	<0.007	0.092	<0.01	0.453	<0.005	<0.01	<0.01	<0.01
G111	11/5/2010	6.7	--	--	--	--	--	<0.007	0.719	<0.01	<0.02	<0.005	<0.01	<0.01	0.0132
G111	3/15/2011	7.1	--	--	--	--	--	<0.007	0.104	<0.01	<0.02	<0.005	<0.01	<0.01	0.0181
G111	6/16/2011	7.1	--	--	--	--	--	<0.007	0.166	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	9/13/2011	7.1	--	--	--	--	--	<0.007	0.127	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	11/29/2011	7.0	--	--	--	--	--	<0.007	0.147	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	2/14/2012	7.2	--	--	--	--	--	<0.007	0.093	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	5/15/2012	7.1	--	--	--	--	--	<0.007	0.116	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	8/7/2012	7.0	--	--	--	--	--	<0.007	0.052	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	3/7/2013	7.3	--	--	--	--	--	<0.007	0.367	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	5/14/2013	7.0	--	--	--	--	--	<0.007	<0.05	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G111	3/22/2021	7.3	7.79	162.1	573	17.13	75.56	--	--	--	0.628	<0.007	--	--	--
G112C	3/7/2013	6.8	--	--	--	--	--	<0.007	0.344	<0.01	0.0484	0.176	<0.01	<0.01	<0.01
G112C	4/17/2013	6.9	--	--	--	--	--	<0.007	<0.05	<0.01	0.0393	0.171	<0.01	<0.01	<0.01
G112C	5/14/2013	6.7	--	--	--	--	--	<0.007	<0.05	<0.01	<0.02	0.151	<0.01	<0.01	<0.01
G112C	3/22/2021	6.8	0.74	157.6	1,294	14.57	22.12	--	--	--	0.939	0.398	--	--	--
G113	8/17/2010	6.9	--	--	--	--	--	<0.007	0.838	<0.01	0.04	0.0919	<0.01	<0.01	<0.01
G113	11/5/2010	6.6	--	--	--	--	--	<0.007	0.139	<0.01	<0.02	0.0253	<0.01	<0.01	<0.01
G113	3/15/2011	6.6	--	--	--	--	--	<0.007	0.33	<0.01	<0.02	0.0064	<0.01	<0.01	<0.01
G113	6/16/2011	6.6	--	--	--	--	--	<0.007	0.348	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	9/13/2011	6.5	--	--	--	--	--	<0.007	0.395	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	11/29/2011	6.4	--	--	--	--	--	<0.007	0.68	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	2/14/2012	6.6	--	--	--	--	--	<0.007	0.481	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	5/15/2012	6.7	--	--	--	--	--	<0.007	0.572	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	8/7/2012	6.5	--	--	--	--	--	<0.007	0.482	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	3/7/2013	6.8	--	--	--	--	--	<0.007	0.525	<0.01	<0.02	0.0076	<0.01	<0.01	<0.01
G113	5/14/2013	6.7	--	--	--	--	--	<0.007	0.38	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01
G113	3/22/2021	6.9	7.29	152.5	1,398	15.92	0.00	--	--	--	0.484	0.0095	--	--	--

TABLE 3.
FIELD AND LABORATORY PARAMETER RESULTS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Sample Location	Sample Date [1]	pH	DO	ORP	SpC	Temperature	Turbidity	Cyanide	Nitrate as Nitrogen	Copper	Iron	Manganese	Nickel	Silver	Zinc
	Reporting Units:	STD	mg/L	mV	micromhos/cm	degrees C	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TPZ114	3/22/2021	7.4	7.29	124.9	460	19.34	318.08	--	--	--	19.6	0.476	--	--	--
TPZ116	3/22/2021	7.0	8.07	125.0	341	17.69	18.04	--	--	--	4.44	0.0806	--	--	--
TPZ117	3/22/2021	6.7	8.04	11.0	452	17.65	260.29	--	--	--	71.6	0.761	--	--	--
TPZ117D	3/22/2021	7.1	3.09	36.2	271	16.90	0.00	--	--	--	0.277	0.922	--	--	--
XTPW01	3/22/2021	11.1	1.48	12.1	1,153	17.38	0.00	--	--	--	0.0998	<0.007	--	--	--

[O: KLT 4/27/21, C: AOC 4/27/21]

Notes:

1. Data prior to 2021 were initially presented in the Phase I Hydrogeological Assessment Report (Natural Resource Technology, Inc., 2013)

-- = parameter not analyzed
< = concentration below method reporting limit
degrees C = degrees Celsius
DO = dissolved oxygen
mg/L = milligrams per liter
micromhos/cm = micromhos per centimeter
mV = millivolts
NTU = nephelometric turbidity units
ORP = oxidation-reduction potential
SpC = specific conductance
STD = standard pH units

TABLE 4.

FIELD AND LABORATORY RESULTS COMPARED TO GROUNDWATER STANDARDS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Sample Location	Sample Date [1]	pH [2]	TDS	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chloride	Chromium	Cobalt	Fluoride	Lead	Mercury	Selenium	Sulfate	Thallium
	Reporting Units:	STD	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
IL 845.600 Standard:		**6.5/9.0**	**1,200**	**0.006**	**0.010**	**2.0**	**0.004**	**2.0**	**0.005**	**200**	**0.1**	**0.006**	**4.0**	**0.0075**	**0.002**	**0.05**	**400**	**0.002**
IL Class II Standard [3]:		6.5/9.0	1,200	0.024	0.2	2.0	0.5	2.0	0.05	200.0	1.0	1.0	4.0	0.1	0.01	0.05	400.0	0.02
IL Class I Standard [4,5]:		6.5/9.0	1,200	0.006	0.010	2.0	0.004	2.0	0.005	200.0	0.1	1.0	4.0	0.0075	0.002	0.05	400.0	0.002
G101	8/17/2010	7.1	344	<0.005	<0.025	0.103	<0.001	<0.02	<0.002	7	<0.01	<0.01	0.26	0.0026	<0.0002	<0.05	32	<0.002
G101	3/15/2011	6.6	294	<0.005	<0.025	0.090	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.27	<0.002	<0.0002	<0.05	32	<0.002
G101	6/16/2011	7.2	276	<0.005	<0.025	0.635	<0.001	<0.02	<0.002	5	<0.01	<0.01	0.26	<0.002	<0.0002	<0.05	34	<0.002
G101	9/13/2011	6.9	222	<0.005	<0.025	0.0614	<0.001	<0.02	<0.002	3	<0.01	<0.01	0.32	<0.002	<0.0002	<0.05	28	<0.002
G101	11/29/2011	7.2	268	<0.005	<0.025	0.0719	<0.001	<0.02	<0.002	4	<0.01	<0.01	0.28	<0.002	<0.0002	<0.05	35	<0.002
G101	2/14/2012	6.9	216	<0.005	<0.025	0.582	<0.001	<0.02	<0.002	4	<0.01	<0.01	0.30	<0.002	<0.0002	<0.05	35	<0.002
G101	5/15/2012	7.3	208	<0.005	<0.025	0.0443	<0.001	<0.02	<0.002	4	<0.01	<0.01	0.31	<0.002	<0.0002	<0.05	22	<0.002
G101	3/6/2013	7.1	214	<0.005	<0.01	0.0694	<0.001	<0.02	<0.002	<5	<0.01	<0.01	0.33	<0.007	<0.0002	<0.05	33	<0.002
G101	5/13/2013	6.8	272	<0.006	<0.01	0.0759	<0.001	<0.02	<0.002	5	<0.01	<0.01	0.28	<0.007	<0.0002	<0.05	33	<0.002
G101	3/22/2021	7.0	358	<0.001	<0.01	0.114	<0.0005	<0.02	<0.002	7	<0.005	<0.005	0.23	<0.0075	<0.0002	<0.04	39	<0.002
G111	8/17/2010	7.3	342	<0.005	<0.025	0.153	<0.001	<0.02	<0.002	8	<0.01	<0.01	0.62	<0.002	<0.0002	<0.05	25	<0.002
G111	11/5/2010	6.7	330	<0.005	<0.025	0.149	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.70	<0.002	<0.0002	<0.05	22	<0.002
G111	3/15/2011	7.1	322	<0.005	<0.025	0.157	<0.001	<0.02	<0.002	7	<0.01	<0.01	0.67	<0.002	<0.0002	<0.05	23	<0.002
G111	6/16/2011	7.1	372	<0.005	<0.025	0.159	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.63	<0.002	<0.0002	<0.05	27	<0.002
G111	9/13/2011	7.1	330	<0.005	<0.025	0.181	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.63	<0.002	<0.0002	<0.05	24	<0.002
G111	11/29/2011	7.0	376	<0.005	<0.025	0.176	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.62	<0.002	<0.0002	<0.05	19	<0.002
G111	2/14/2012	7.2	354	<0.005	<0.025	0.160	<0.001	<0.02	<0.002	7	<0.01	<0.01	0.67	<0.002	<0.0002	<0.05	27	<0.002
G111	5/15/2012	7.1	324	<0.005	<0.025	0.167	<0.001	<0.02	<0.002	7	<0.01	<0.01	0.67	<0.002	<0.0002	<0.05	30	<0.002
G111	8/7/2012	7.0	394	<0.005	<0.025	0.152	<0.001	<0.02	<0.002	5	<0.01	<0.01	0.69	<0.002	<0.0002	<0.05	26	<0.002
G111	3/7/2013	7.3	390	<0.005	<0.01	0.165	<0.001	<0.02	<0.002	6	<0.01	<0.01	0.63	<0.007	<0.0002	<0.05	20	<0.002
G111	5/14/2013	7.0	374	<0.006	<0.01	0.174	<0.001	<0.02	<0.002	7	<0.01	<0.01	0.71	<0.007	<0.0002	<0.05	19	<0.002
G111	3/22/2021	7.3	364	<0.001	<0.01	0.207	<0.0005	<0.02	<0.002	10	<0.005	<0.005	0.66	<0.0075	<0.0002	<0.04	17	<0.002
G112C	3/7/2013	6.8	412	<0.005	<0.01	0.0619	<0.001	**3.31**	<0.002	<5	<0.01	<0.01	0.74	<0.007	<0.0002	<0.05	63	<0.002
G112C	4/17/2013	6.9	476	<0.005	<0.01	0.0593	<0.001	**3.1**	<0.002	<5	<0.01	<0.01	0.80	<0.04	<0.0002	<0.05	66	<0.002
G112C	5/14/2013	6.7	432	<0.006	<0.01	0.0621	<0.001	**3.09**	<0.002	<5	<0.01	<0.01	0.81	<0.007	<0.0002	<0.05	60	<0.002
G112C	3/22/2021	6.8	1,010	<0.001	<0.01	0.0845	<0.0005	**4.25**	<0.002	7	<0.005	**0.0117**	0.60	<0.0075	<0.0002	<0.04	**532**	<0.002
G113	8/17/2010	6.9	542	<0.005	<0.025	0.354	<0.001	<0.02	<0.002	27	<0.01	<0.01	0.43	<0.002	<0.0002	<0.05	61	<0.002
G113	11/5/2010	6.6	524	<0.005	<0.025	0.395	<0.001	<0.02	<0.002	29	<0.01	<0.01	0.45	<0.002	<0.0002	<0.05	35	<0.002
G113	3/15/2011	6.6	540	<0.005	<0.025	0.461	<0.001	<0.02	<0.002	29	<0.01	<0.01	0.44	<0.002	<0.0002	<0.05	36	<0.002
G113	6/16/2011	6.6	590	<0.005	<0.025	0.454	<0.001	<0.02	<0.002	29	<0.01	<0.01	0.39	<0.002	<0.0002	<0.05	32	<0.002
G113	9/13/2011	6.5	554	<0.005	<0.025	0.49	<0.001	<0.02	<0.002	29	<0.01	<0.01	0.40	<0.002	<0.0002	<0.05	30	<0.002
G113	11/29/2011	**6.4**	636	<0.005	<0.025	0.507	<0.001	<0.02	<0.002	28	<0.01	<0.01	0.39	<0.002	<0.0002	<0.05	34	<0.002
G113	2/14/2012	6.6	590	<0.005	<0.025	0.504	<0.001	<0.02	<0.002	31	<0.01	<0.01	0.42	<0.002	<0.0002	<0.05	35	<0.002
G113	5/15/2012	6.7	586	<0.005	<0.025	0.527	<0.001	<0.02	<0.002	34	<0.01	<0.01	0.43	<0.002	<0.0002	<0.05	32	<0.002
G113	8/7/2012	6.5	666	<0.005	<0.025	0.469	<0.001	<0.02	<0.002	29	<0.01	<0.01	0.45	<0.002	<0.0002	<0.05	30	<0.002
G113	3/7/2013	6.8	606	<0.005	<0.01	0.536	<0.001	<0.02	<0.002	32	<0.01	<0.01	0.42	<0.007	<0.0002	<0.05	37	<0.002
G113	5/14/2013	6.7	706	<0.005	<0.01	0.547	<0.001	<0.02	<0.002	30	<0.01	<0.01	0.44	<0.007	<0.0002	<0.05	50	<0.002
G113	3/22/2021	6.9	870	<0.001	<0.01	0.108	<0.0005	<0.02	<0.002	19	<0.005	<0.005	0.36	<0.0075	<0.0002	<0.04	292	<0.002

TABLE 4.

FIELD AND LABORATORY RESULTS COMPARED TO GROUNDWATER STANDARDS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Sample Location	Sample Date [1]	pH [2]	TDS	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chloride	Chromium	Cobalt	Fluoride	Lead	Mercury	Selenium	Sulfate	Thallium
Reporting Units:		STD	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
IL 845.600 Standard:		**6.5/9.0**	**1,200**	**0.006**	**0.010**	**2.0**	**0.004**	**2.0**	**0.005**	**200**	**0.1**	**0.006**	**4.0**	**0.0075**	**0.002**	**0.05**	**400**	**0.002**
IL Class II Standard [3]:		6.5/9.0	1,200	0.024	0.2	2.0	0.5	2.0	0.05	200.0	1.0	1.0	4.0	0.1	0.01	0.05	400.0	0.02
IL Class I Standard [4,5]:		6.5/9.0	1,200	0.006	0.010	2.0	0.004	2.0	0.005	200.0	0.1	1.0	4.0	0.0075	0.002	0.05	400.0	0.002
TPZ114	3/22/2021	7.4	306	<0.001	**0.0169**	0.365	0.0013	0.177	<0.002	11	0.0315	**0.0074**	0.32	**0.0213**	<0.0002	<0.04	19	<0.002
TPZ116	3/22/2021	7.0	292	<0.001	<0.01	0.51	0.0006	<0.02	<0.002	9	0.0124	<0.005	0.36	<0.0075	<0.0002	<0.04	24	<0.002
TPZ117	3/22/2021	6.7	284	0.0051	**0.0198**	0.515	**0.0054**	<0.02	<0.002	8	0.0987	**0.0381**	0.30	**0.0386**	<0.0002	<0.04	32	<0.002
TPZ117D [4,5]	3/22/2021	7.1	318	0.0053	<0.01	0.271	<0.0005	0.0763	<0.002	11	<0.005	0.0052	0.27	<0.0075	<0.0002	<0.04	187	<0.002
XTPW01	3/22/2021	**11.1**	824	0.0036	**0.0298**	0.0776	<0.0005	**27**	<0.002	2	<0.005	<0.005	<0.1	<0.0075	<0.0002	**0.0937**	387	<0.002

[O: AOC 4/27/21, C: KLT 4/27/21]

Notes:

Underline	Exceeds IL Class I or II Standard
Bold	**Exceeds IL 845.600 Groundwater Protection Standard**
Pink Highlighting	Exceeds one or more screening criteria

1. Data prior to 2021 were initially presented in the Phase I Hydrogeological Assessment Report (Natural Resource Technology, Inc., 2013)
2. Standards for pH are presented as upper/lower limits
3. Illinois Administrative Code Part 620 Class II: General Resource Groundwater Standard
4. Illinois Administrative Code Part 620 Class I: Potable Resource Groundwater Standard
5. All wells are compared to the IL Class II Standard except TPZ117D. TPZ117D is compared to the IL Class I Standard.

< = concentration below method reporting limit
mg/L = milligrams per liter
STD = standard pH units
TDS = total dissolved solids

TABLE 5.
VERTICAL GRADIENTS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Date	G101 Groundwater Elevation (ft NAVD88)	G01D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change ^{1} (ft)	Vertical Hydraulic Gradient ^{2} (dh/dl)	
12/2/2015	313.59	315.61	--	--	--	--
3/15/2016	316.48	323.98	-7.50	14.17	-0.5293	up
6/15/2016	316.78	320.24	-3.46	14.47	-0.2391	up
9/14/2016	315.16	317.14	-1.98	12.85	-0.1541	up
12/14/2016	313.74	314.38	-0.64	11.43	-0.0560	up
3/7/2017	314.09	317.28	-3.19	11.78	-0.2708	up
6/14/2017	315.85	324.36	-8.51	13.54	-0.6285	up
7/19/2017	315.02	318.54	-3.52	12.71	-0.2769	up
11/30/2017	313.25	314.87	-1.62	10.94	-0.1481	up
6/9/2018	315.39	319.69	-4.30	13.08	-0.3287	up
9/5/2018	315.18	316.19	-1.01	12.87	-0.0785	up
3/27/2019	319.33	329.69	-10.36	12.02	-0.8623	up
9/9/2019	318.81	321.44	-2.63	16.50	-0.1594	up
3/30/2020	321.29	330.46	-9.17	12.02	-0.7632	up
9/23/2020	318.66	320.32	-1.66	16.35	-0.1015	up
3/15/2021	325.97	325.25	0.72	12.02	0.0603	down
3/22/2021	327.19	NM	--	--	--	--

Middle of screen elevation G101	314.3
Middle of screen elevation G01D	302.3

Date	TPZ117 Groundwater Elevation (ft NAVD88)	TPZ117D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change ^{1} (ft)	Vertical Hydraulic Gradient ^{2} (dh/dl)	
3/15/2021	NI	NI	--	--	--	--
3/22/2021	317.63	319.54	-1.91	28.22	-0.0678	up

Middle of screen elevation TPZ117	312.5
Middle of screen elevation TPZ117D	284.3

TABLE 5.
VERTICAL GRADIENTS

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Date	G151 Groundwater Elevation (ft NAVD88)	G51D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
3/15/2021	328.25	324.99	3.26	11.91	0.2737	down
3/22/2021	330.26	325.58	4.68	11.91	0.3929	down

Middle of screen elevation G151	324.1
Middle of screen elevation G51D	306.5

Date	G54S Groundwater Elevation (ft NAVD88)	G54D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
3/15/2021	Dry	324.16	--	--	--	--
3/22/2021	311.20	323.64	-12.44	8.89	-1.3996	up

Middle of screen elevation G54S	313.9
Middle of screen elevation G54D	278.8

[O: KLT 4/5/21, U: KLT 4/6/21, C: MJM 4/6/21]

Notes:

1. Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.

2. Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.

-- = Not Calculated

dh = head change

dl = distance change
ft = foot/feet

NAVD88 = North American Vertical Datum of 1988

NI = Not Installed

TABLE 6.
GROUNDWATER HORIZONTAL GRADIENTS AND FLOW VELOCITIES

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

$V = K i / n_e$

V = Groundwater Velocity
K = Hydraulic Conductivity
n_e = Effective Porosity

Across CCR Unit (G113 to G112B/G112C)
Clays and Silts

Distance between Wells (ft)	*1666*	*1523*
Hydraulic Conductivity (ft/yr)	*6.11*	
Effective Porosity (%)	*13.5*	

Date	G113 Elevation (ft NAVD88)	G112B/G112C Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient	Velocity (ft/yr)
8/16/2010	337.64	321.20	16.44	0.0108	0.49
11/5/2010	337.24	321.44	15.80	0.0104	0.47
3/15/2011	341.24	332.12	9.12	0.0060	0.27
6/16/2011	339.38	325.59	13.79	0.0091	0.41
9/13/2011	338.14	321.57	16.57	0.0109	0.49
11/29/2011	341.54	326.82	14.72	0.0097	0.44
2/14/2012	340.99	337.90	3.09	0.0020	0.09
5/15/2012	338.79	323.61	15.18	0.0100	0.45
8/7/2012	336.39	319.17	17.22	0.0113	0.51
3/6/2013	340.39	320.57	19.82	0.0119	0.54
4/17/2013	NM	320.51	--	--	--
5/13/2013	340.92	323.18	17.74	0.0106	0.48
3/15/2021	342.35	323.04	19.30	0.0116	0.52
3/22/2021	342.36	321.49	20.86	0.0125	0.57
			Average	***0.0097***	***0.44***

TABLE 6.

GROUNDWATER HORIZONTAL GRADIENTS AND FLOW VELOCITIES

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Across CCR Unit (G111 to G112B/G112C)

Clays and Silts

Distance between Wells (ft)	*2261*	*1898*			
Hydraulic Conductivity (ft/yr)	*6.11*				
Effective Porosity (%)	*13.5*				

Date	**G111 Elevation (ft NAVD88)**	**G112B/G112C Elevation (ft NAVD88)**	**Change in Elevation (ft)**	**Horizontal Gradient**	**Velocity (ft/yr)**
8/16/2010	351.17	321.20	29.97	0.0158	0.71
11/5/2010	349.40	321.44	27.96	0.0147	0.67
3/15/2011	354.27	332.12	22.15	0.0117	0.53
6/16/2011	352.75	325.59	27.16	0.0143	0.65
9/13/2011	350.72	321.57	29.15	0.0154	0.69
11/29/2011	354.49	326.82	27.67	0.0146	0.66
2/14/2012	354.62	337.90	16.72	0.0088	0.40
5/15/2012	352.49	323.61	28.88	0.0152	0.69
8/7/2012	349.95	319.17	30.78	0.0162	0.73
3/6/2013	353.97	320.57	33.40	0.0148	0.67
4/17/2013	NM	320.51	--	--	--
5/13/2013	354.49	323.18	31.31	0.0138	0.63
3/15/2021	354.92	323.04	31.88	0.0141	0.64
3/22/2021	354.60	321.49	33.11	0.0146	0.66
			Average	***0.0142***	***0.64***

TABLE 6.
GROUNDWATER HORIZONTAL GRADIENTS AND FLOW VELOCITIES

PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Sidegradient of CCR Unit (G111 to TPZ114)
Clays and Silts

Distance between Wells (ft)	*1520*
Hydraulic Conductivity (ft/yr)	*6.11*
Effective Porosity (%)	*13.5*

Date	G111 Elevation (ft NAVD88)	TPZ114 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient	Velocity (ft/yr)
3/15/2021	354.92	NI	--	--	--
3/22/2021	354.60	312.72	41.88	0.0276	1.25
			Average	***0.0276***	***1.25***

Sidegradient of CCR Unit (G113 to TPZ116)
Clays and Silts

Distance between Wells (ft)	*1141*
Hydraulic Conductivity (ft/yr)	*6.11*
Effective Porosity (%)	*13.5*

Date	G113 Elevation (ft NAVD88)	TPZ116 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient	Velocity (ft/yr)
3/15/2021	342.35	NI	--	--	--
3/22/2021	342.36	319.93	22.42	0.0197	0.89
			Average	***0.0197***	***0.89***

TABLE 6.
GROUNDWATER HORIZONTAL GRADIENTS AND FLOW VELOCITIES
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Downgradient of CCR Unit (TPZ116 to TPZ117)
Clays and Silts

Distance between Wells (ft)	*629*
Hydraulic Conductivity (ft/yr)	*6.11*
Effective Porosity (%)	*13.5*

Date	TPZ116 Elevation (ft NAVD88)	TPZ117 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient	Velocity (ft/yr)
3/15/2021	NI	NI	--	--	--
3/22/2021	319.93	317.63	2.30	0.0037	0.17
			Average	***0.0037***	***0.17***

[O: KLT 4/5/21, C: MJM 4/6/21]

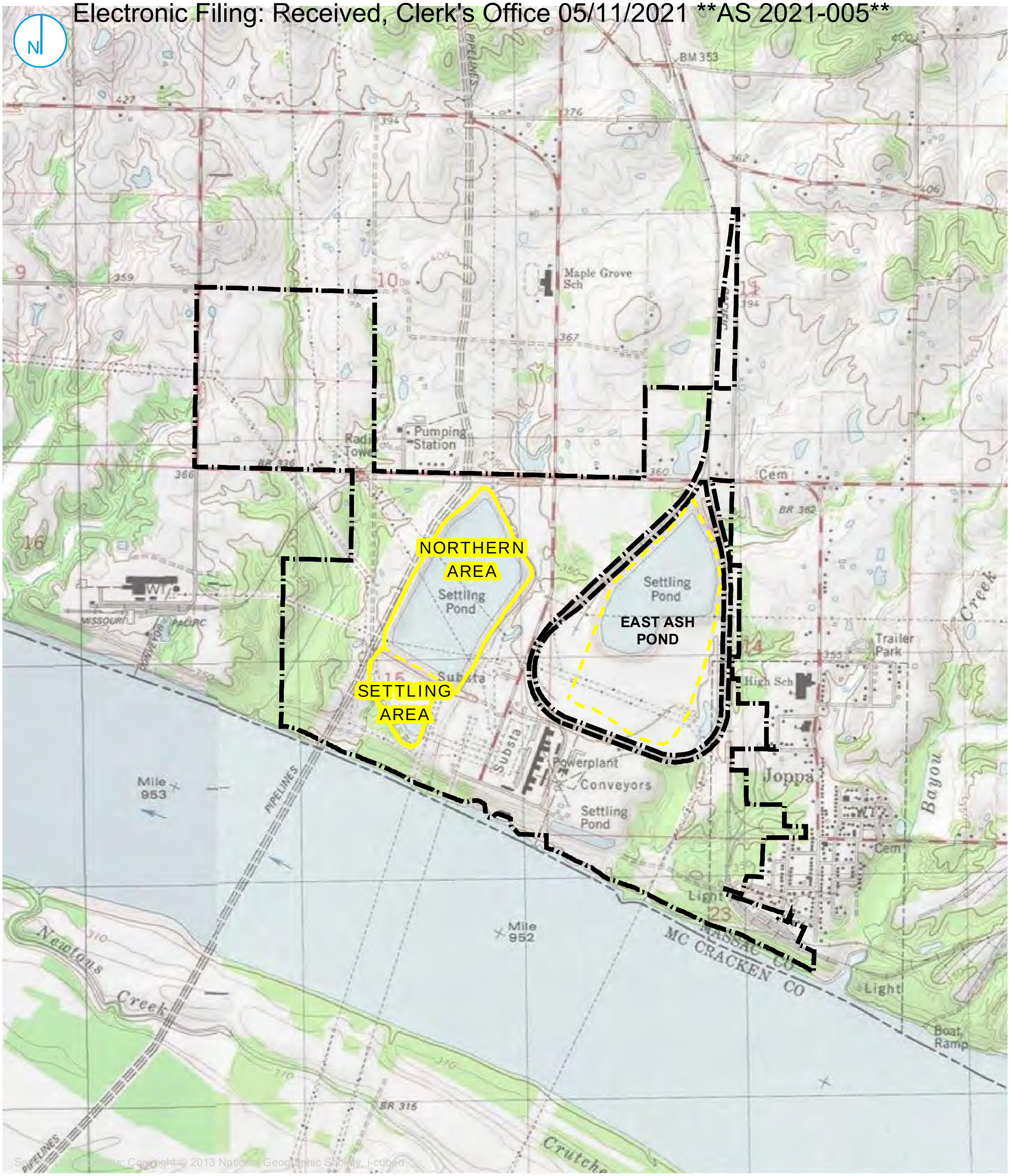
Notes:

1. Hydraulic conductivity value derived from slug tests completed in 2010 by Geotechnology, Inc, and reported in the 2013 Phase I Hydrogeological Assessment Report by Natural Resource Technology, Inc.
2. Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material and 0.07 for clay from *Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. Basic ground-water hydrology, U.S. Geological Survey Water-Supply Paper 2220, 86p.*

-- = Not Calculated
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
NI = Not Installed
NM = Not Measured
yr = year
% = percent

FIGURES

Y:\Mapping\Projects\21\2126\MXD\845\Figure 1_Joppa Site Location.mxd



PROJECT: 169000XXXX | DATED: 5/10/2021 | DESIGNER: STOLZSD

▭ 2021 LIMITS OF JOPPA WEST
⬚ CCR MONITORED UNIT
⬚ JOPPA OWNED PROPERTY

0 1,000 2,000
Feet

SITE LOCATION MAP
JOPPA WEST

FIGURE 1

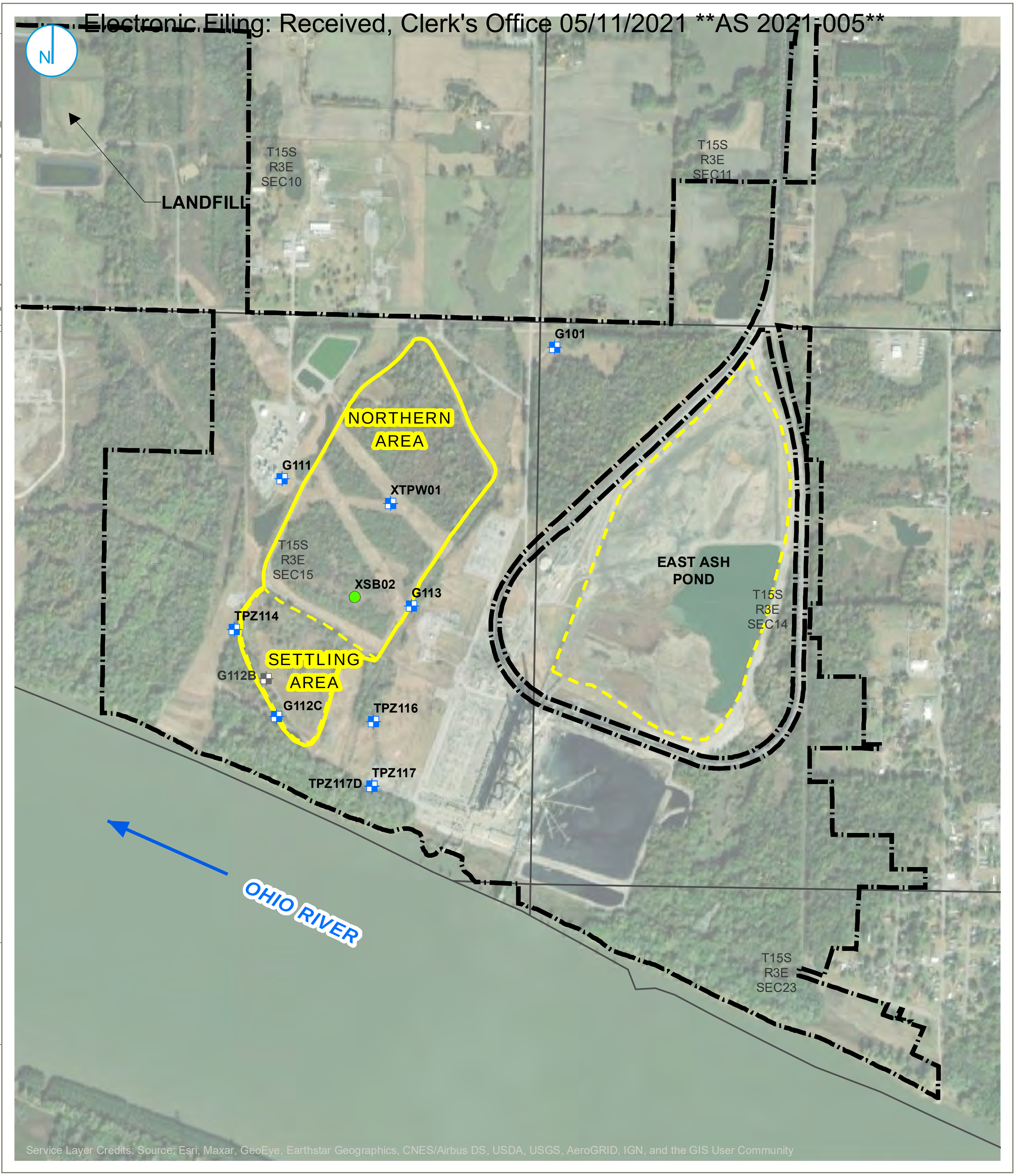
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

RAMBOLL

Y:\Mapping\Projects\21\2126\MXD\845\Figure 2_Site Overview Map.mxd

PROJECT: 169000XXXX | DATED: 5/10/2021 | DESIGNER: STOLZSD



- ● SOIL BORING
- ▣ MONITORING WELL
- ▣ ABANDONED MONITORING WELL
- ▭ 2021 LIMITS OF JOPPA WEST
- ▭ CCR MONITORED UNIT
- ▭ JOPPA OWNED PROPERTY
- ▭ PLSS SECTION BOUNDARY

0 625 1,250 Feet

SITE OVERVIEW MAP
JOPPA WEST

PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

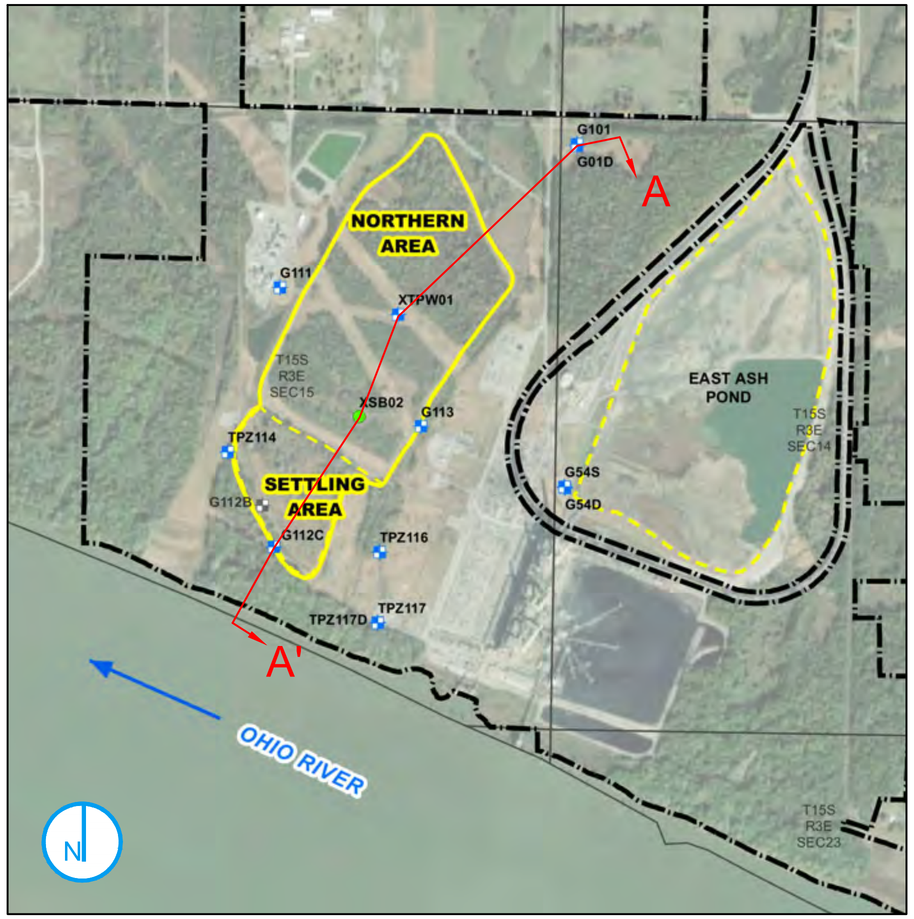
FIGURE 2

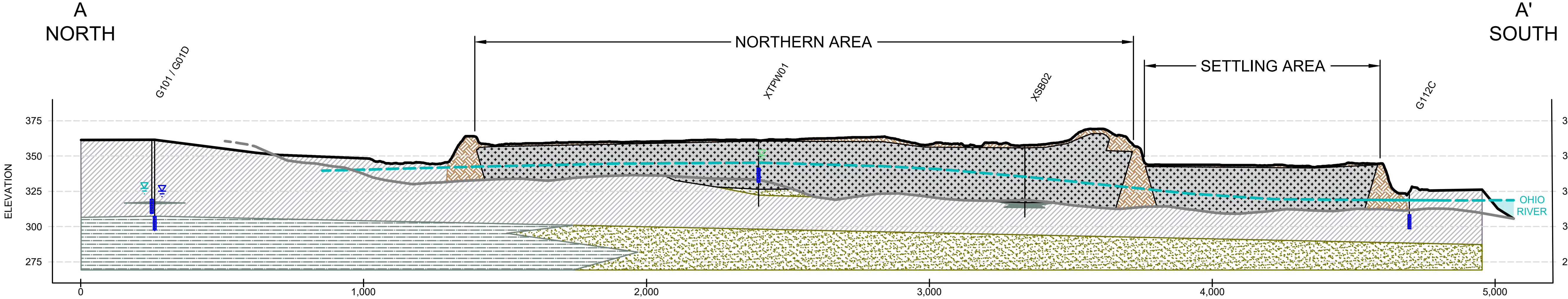
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

C:\Users\ENGELHSA\OneDrive - Ramboll\Projects\Vistra\Joppa\CAD\Joppa West Cross Sections.dwg

Notes

1. 2021 ground surface created by Geosyntec and Ramboll, based on IngenAE 2021 survey; AutoCAD files dated 4/6/2021.
2. 1932 ground surface provided by Geosyntec.
3. Groundwater elevations are based on groundwater levels collected on March 22, 2021.
4. Vertical datum = NAVD 88.





DESIGNER: ENGELHSA

PROJECT: 1940100806-006 DATED: 5/10/2021

GROUND SURFACE (2021)
GROUND SURFACE (1932)
SHALLOW GROUNDWATER ELEVATION
DEEP GROUNDWATER ELEVATION
PHREATIC SURFACE ELEVATION
BORING
WELL SCREEN

LITHOLOGY
FILL
CCR AREA
CLAY TO SILT
SAND WITH CLAY TO SILTY SAND
SAND TO GRAVEL

0 400 Feet
Horizontal Scale

0 80 Feet
Vertical Scale
5 x Vertical Exaggeration

CROSS-SECTION A-A'
JOPPA WEST

PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

FIGURE 3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

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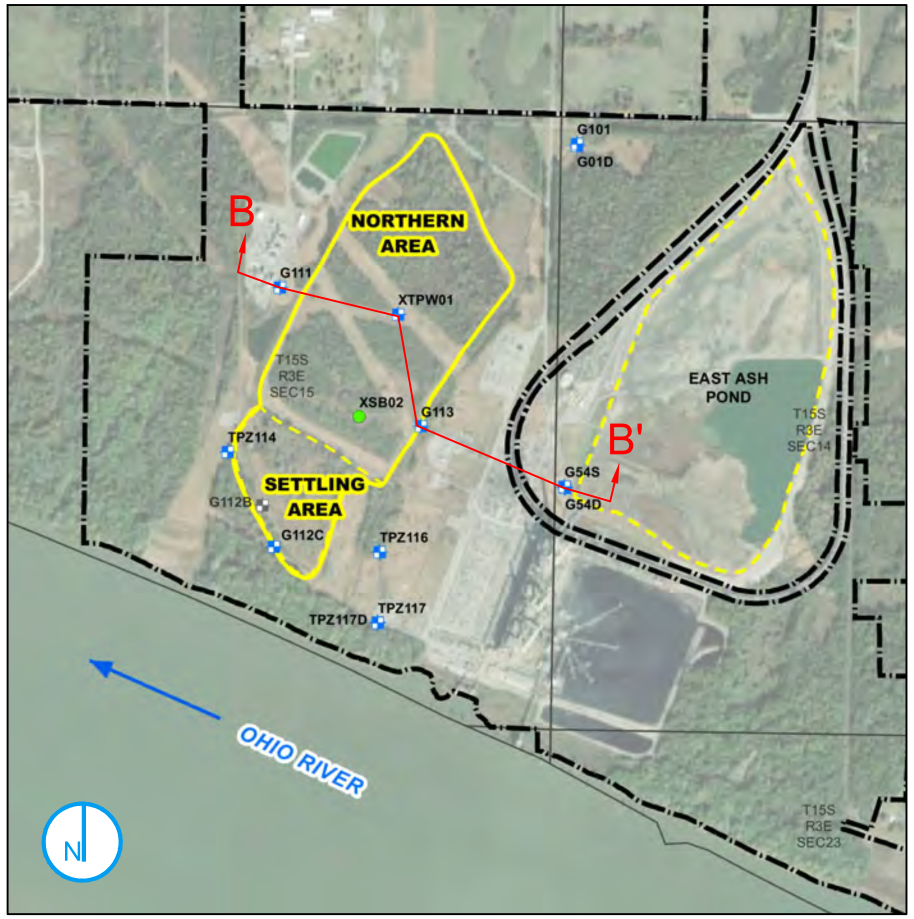
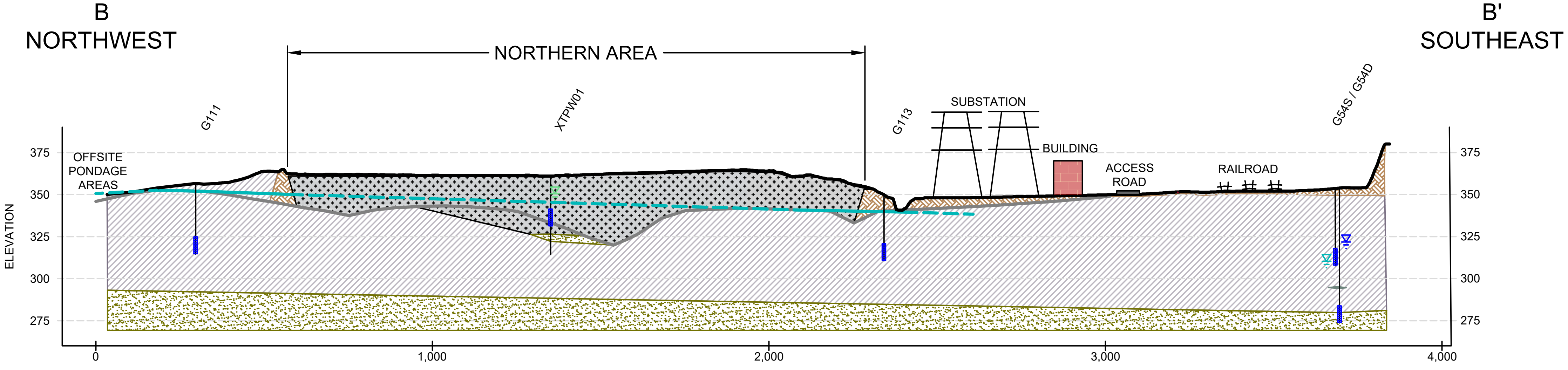
PROJECT: 1940100806-006 DATED: 5/10/2021 DESIGNER: ENGELHSA

Notes
1. 2021 ground surface created by Geosyntec and Ramboll, based on IngenAE 2021 survey; AutoCAD files dated 4/6/2021.
2. 1932 ground surface provided by Geosyntec.
3. Groundwater elevations are based on groundwater levels collected on March 22, 2021.
4. Vertical datum = NAVD 88.





GROUND SURFACE (2021)
GROUND SURFACE (1932)
SHALLOW GROUNDWATER ELEVATION
DEEP GROUNDWATER ELEVATION
PHREATIC SURFACE ELEVATION
BORING
WELL SCREEN

LITHOLOGY
FILL
CCR AREA
CLAY TO SILT
SAND WITH CLAY TO SILTY SAND
SAND TO GRAVEL

0 400 Feet
Horizontal Scale

0 80 Feet
Vertical Scale
5 x Vertical Exaggeration

CROSS-SECTION B-B'
JOPPA WEST

PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

FIGURE 4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

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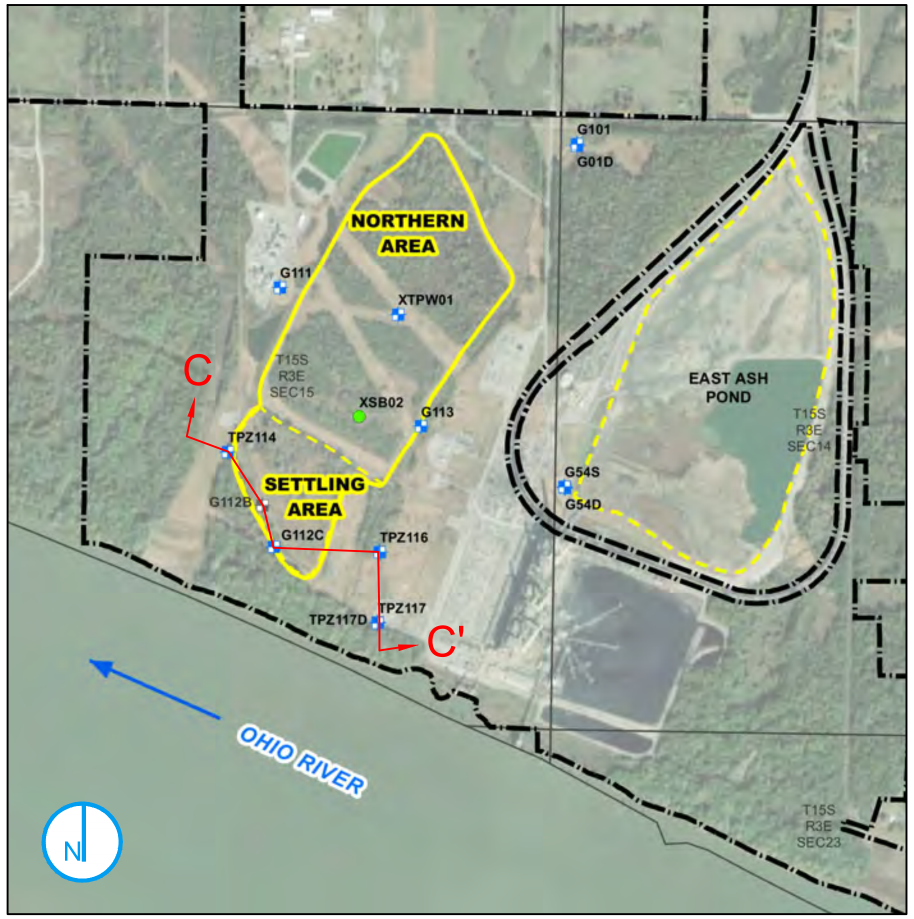
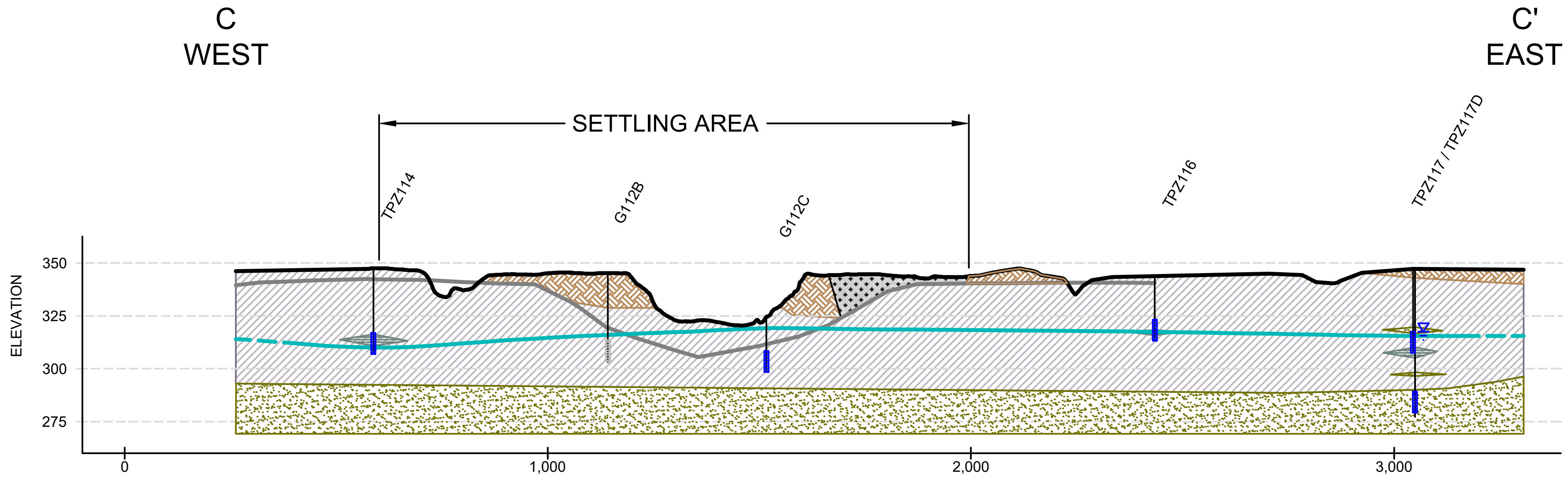
PROJECT: 1940100806-006 DATED: 5/10/2021 DESIGNER: ENGELHSA

Notes

1. 2021 ground surface created by Geosyntec and Ramboll, based on IngenAE 2021 survey; AutoCAD files dated 4/6/2021.
2. 1932 ground surface provided by Geosyntec.
3. Groundwater elevations are based on groundwater levels collected on March 22, 2021.
4. Vertical datum = NAVD 88.





GROUND SURFACE (2021)

GROUND SURFACE (1932)

SHALLOW GROUNDWATER ELEVATION

DEEP GROUNDWATER ELEVATION

BORING

WELL SCREEN (gray = abandoned)

LITHOLOGY

▨ FILL

▨ CCR AREA

▨ CLAY TO SILT

▨ SAND WITH CLAY TO SILTY SAND

▨ SAND TO GRAVEL

0 400 Feet

Horizontal Scale

0 80 Feet

Vertical Scale

5 x Vertical Exaggeration

CROSS-SECTION C-C'

JOPPA WEST

PART 845 ADJUSTED STANDARD PETITION

JOPPA POWER STATION

JOPPA, ILLINOIS

FIGURE 5

RAMBOLL AMERICAS

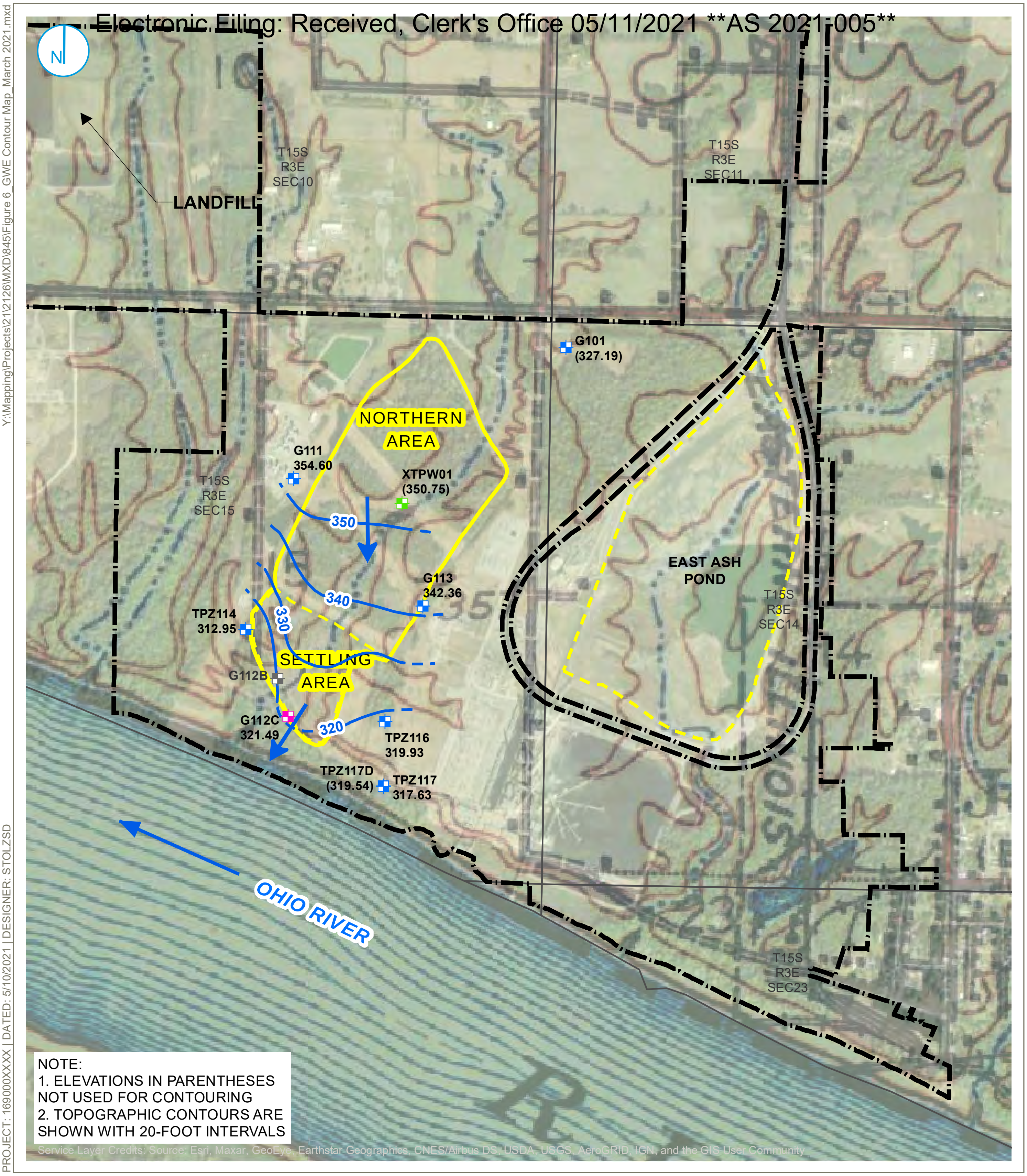
ENGINEERING SOLUTIONS, INC.

A RAMBOLL COMPANY

RAMBOLL

Y:\Mapping\Projects\21\2126\MXD\845\Figure 6_GWE Contour Map_March 2021.mxd

PROJECT: 169000XXXX | DATED: 5/10/2021 | DESIGNER: STOLZSD



NOTE:
1. ELEVATIONS IN PARENTHESES NOT USED FOR CONTOURING
2. TOPOGRAPHIC CONTOURS ARE SHOWN WITH 20-FOOT INTERVALS

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- MONITORING WELL
- ABANDONED MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- MONITORING WELL LOCATION WITH GROUNDWATER EXCEEDANCES ATTRIBUTABLE TO JOPPA WEST
- CCR SOURCE WATER WELL
- 2021 LIMITS OF JOPPA WEST
- CCR MONITORED UNIT
- JOPPA OWNED PROPERTY
- PLSS SECTION BOUNDARY

0 625 1,250
Feet

GROUNDWATER ELEVATION CONTOUR MAP
MARCH 22, 2021
JOPPA WEST

FIGURE 6

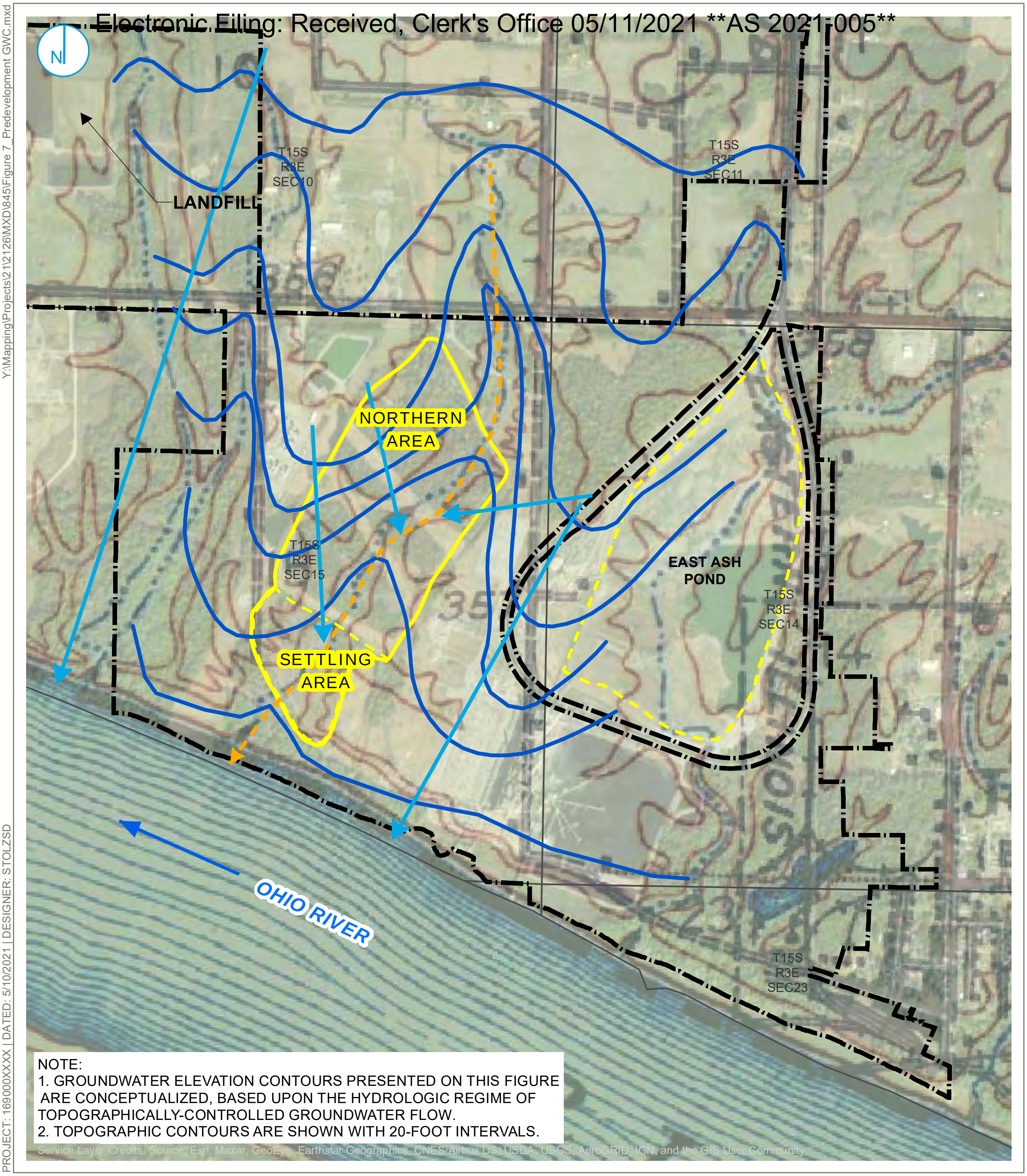
PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\21\2126\MXD\845\Figure 7_Predevelopment GWC.mxd

PROJECT: 169000XXXX | DATED: 5/10/2021 | DESIGNER: STOLZSD



NOTE:
1. GROUNDWATER ELEVATION CONTOURS PRESENTED ON THIS FIGURE ARE CONCEPTUALIZED, BASED UPON THE HYDROLOGIC REGIME OF TOPOGRAPHICALLY-CONTROLLED GROUNDWATER FLOW.
2. TOPOGRAPHIC CONTOURS ARE SHOWN WITH 20-FOOT INTERVALS.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

CONCEPTUAL PRE-DEVELOPMENT GROUNDWATER ELEVATION CONTOURS
INTERPRETED PRE-DEVELOPMENT GROUNDWATER FLOW DIRECTIONS
INTERMITTENT STREAM
2021 LIMITS OF JOPPA WEST
CCR MONITORED UNIT
JOPPA OWNED PROPERTY
PLSS SECTION BOUNDARY

0 625 1,250
Feet

CONCEPTUALIZED PRE-DEVELOPMENT GROUNDWATER ELEVATION CONTOURS JOPPA WEST

PART 845 ADJUSTED STANDARD PETITION
JOPPA POWER STATION
JOPPA, ILLINOIS

FIGURE 7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 1

CURRICULUM VITAE FOR BRIAN G. HENNINGS, PG

BRIAN G HENNINGS, PG

Managing Hydrogeologist

Mr. Hennings has extensive experience as a hydrogeologist for site investigation and remediation activities at sites with soil, groundwater, and sediment contaminated with petroleum products, chlorinated organics, coal gasification byproducts, metals, and polychlorinated biphenyls (PCBs). Experience with hydrogeologic field and model investigations at power plants, utility and industrial waste management sites, manufactured gas plant (MGP) sites, fractured bedrock systems, rivers, and wetlands. Involved with research projects for the Electric Power Research Institute (EPRI) at power plants and Coal Combustion Product (CCP) management sites. Modeling experience includes applying analytical and numerical groundwater flow and transport models developed by the U.S. Geological Survey (USGS) and EPRI.

Consulting activities include project management, project proposals, budgeting, scheduling, data analysis, report preparation, well installation, soil vapor sampling, aquifer testing, and sample collection of rock, soil, groundwater, and river sediments.

PROJECTS

COAL COMBUSTION RESIDUALS (CCR)

Independent Power Production Client, Corrective Measures Assessments (CMA), Various Locations (IL, OH), Project Hydrogeologist – Responsible for CMA required by 40 CFR Part 257, Subpart D (CCR Rule) for six unlined surface impoundments, including reviewing existing and relevant project information, identifying data gaps, developing defensible evaluation criteria, performing screening level and detailed alternative analyses and preparing CMA Reports to document the evaluation process, results, and remedy selection process.

Independent Power Production Client, Coal Ash Impoundment Closure, Project Hydrogeologist – Evaluated closure alternatives for six inactive impoundments containing coal ash located in IL. Performed groundwater modeling (MODFLOW and MT3DMS) to simulate flow and transport of inorganic contaminants released from the impoundments and collaborated with engineers to simulate remedial alternatives in support of closure.

EPRI, Technical Update, Lead Hydrogeologist – Collected paired low-flow and no-purge groundwater samples in cooperation with EPRI. Compared results to determine if no-purge sampling yields a viable alternative to low-flow sampling in cases where excessive drawdown occurs during sampling.

SPECIAL COMPETENCIES

- Hydrogeologic investigations at utility and industrial sites including both organic and inorganic wastes using a wide variety of sampling techniques
- Project management of client sites within a portfolio or multi-site program
- Groundwater flow and transport modeling
- Investigation of fluvial environments
- Hydrogeologic characterization of wetlands
- Aquifer testing and data analysis
- Treatment system O&M
- Soil Vapor Investigations
- Fractured bedrock and potable water systems
- Data management, data interpretation/presentation

TOTAL YEARS OF EXPERIENCE

18

EDUCATION

MS, Geology
BS, Geology

PROFESSIONAL LICENSES

Professional Geologist, FL, IL, MO, WI

Utility Client, Coal Ash Impoundment Closure, Venice, IL, Project Hydrogeologist – Evaluated closure alternatives for a 60-acre coal ash impoundment adjacent to a flood control levy along the Mississippi River. Performed groundwater modeling (MODFLOW and MT3DMS) to simulate flow and transport of inorganic contaminants, including a geosynthetic cover and storm water management. Storm water at this site is managed on the cover using 5,000-gallons per minute (gpm) pumping stations due to site constraints.

Utility Client, Coal Ash Landfill Groundwater Barrier, MI, Project Hydrogeologist – Evaluated and supported design of a 5,000-ft long, 100-ft deep, soil-bentonite groundwater cutoff wall and associated groundwater extraction system for hydraulic gradient control at a coal ash landfill in Lansing, MI. Performed groundwater modeling (MODFLOW and MT3DMS) to simulate flow and transport of inorganic contaminants released from the landfill and to simulate placement of the remedial alternative.

EPRI, Leachate, Groundwater, and CCR Study, Project Hydrogeologist - Leachate, groundwater and CCR sampling at power plants and storage facilities in many states including: WI, IL, IN, MI, MN, MO, NB, ND, OH, WV, MD, NC, SC, and TX in cooperation with EPRI. Responsible for collecting flue gas desulfurization, leachate, groundwater, and soil samples from ash landfills, holding ponds of various construction, leachate collection systems, and outfall structures. Samples required preservation techniques for metal speciation and low-level mercury analysis. Managed solid and liquid sample database for tracking sample attributes, shipping, and receiving.

Utility Client, Site Characterization, Project Hydrogeologist – Assessment investigation of CCRs, soil, and groundwater at a coal-fired power plant in cooperation with EPRI. Developed and implemented sampling and analysis plans, aquifer testing, data interpretation, and reporting.

Utility Client, MI, Site Characterization, Project Hydrogeologist – Hydrogeologic and contaminant assessment of a major fly ash disposal facility in MI. Completed groundwater and sediment investigation to evaluate potential contaminant migration from the impoundments into Lake Huron. Sampling included surface water, pore-water, and upwelling groundwater from various locations and depths within the near-shore environment, with focus on the groundwater-surface water interface (GSI).

PUBLICATIONS/PRESENTATIONS

Keller, Nate, Brian Hennings, Nikki Pagano, Meng Wang, and Rachel Banoff. 2020 **Data Intelligence - How Big Data Analytics Can Increase Practitioners' Understanding of Coal Combustion Residual Sites.** USWAG CCR Workshop, 2020.

Hennings, B., Luke G., Walczak, J., 2019 **Groundwater Corrective Action Assessment Using Fate and Transport Modeling**. World of Coal Ash Conference (WOCA), May 2019, St. Louis, MO.

Walczak, J., Wang, M., Hennings, B., 2017 **Evaluating Impoundment Closure Scenarios using Fate and Transport Modeling**. World of Coal Ash Conference (WOCA), May 2017, Lexington, KY.

Hennings, B.G., Dombrowski, F., **Groundwater Relief System, Two Rivers MGP Site in Two Rivers Wisconsin**. MGP Symposium: October 16 – 18, 2017.

B. Hennings, M. Wang, B. Hensel, **Comparison of Paired No-Purge and Low-Flow Groundwater Samples**. EPRI, Paulo Alto, CA: 2017. 3002010953.

W. Roy, B. Hensel, B. Hennings, **Gross Alpha and Gross Beta Measurements in Coal Combustion Product Leachate**. EPRI, Paulo Alto, CA: 2008. 1015546

B. Hensel, B. Hennings, D. Wallschlager, J. London, C. Ferrarello, J Talbott, **Characterization of Field Leachates at Coal Combustion Product Management Sites: Arsenic, Selenium, Chromium, and Mercury Speciation**. EPRI, Paulo Alto, CA and U.S. Department of energy, Pittsburg, PA: 2006. 1012578

ATTACHMENT 2
2021 FIELD ACTIVITIES

2021 Field Activities

In March 2021 Ramboll completed six soil borings and installed five temporary monitoring wells at Joppa West, redeveloped existing wells surrounding Joppa West, and collected a round of groundwater samples from new and existing monitoring wells.

1. Mobilization

Field mobilization activities were completed in accordance with Ramboll Field Guidance Document (FGD) No. 2.02 Site Preparation, Inspection, and Housekeeping and Standard Practice Instruction (SPI) 27 Subsurface and Overhead Clearance. All soil boring and temporary monitoring well locations were cleared using the Illinois One-Call System – Joint Utility Locating Information for Excavators (JULIE). Locations were additionally cleared using ground penetrating radar (GPR) by Ground Penetrating Radar Systems, LLC (GPRS) on March 16, 2021. Work near buried or overhead utilities only proceeded after utilities and reasonable setbacks were field-verified with the Trunkline Gas Company, LLC (Trunkline) representative and Joppa Plant contact.

Daily activities included, but were not limited to, the following:

- Safety tailgate meetings
- COVID-19 temperature check
- COVID-19 sign-in
- Status update following daily fieldwork

2. Drilling and Soil Characterization

Six soil borings were completed by Cascade Drilling LP (Cascade) using rotary-sonic drilling methods from March 15-17, 2021 (Expert Report Figure 2). Borings were advanced to depths between 30 and 70 feet below ground surface (ft bgs). Soil was continuously logged and recorded as indicated in FGD No. 5.09 Field Soil Boring Log Preparation. Lithologies were identified according to FGD No. 5.01 Soil Classification. Soil boring XSB02 was abandoned on the same day it was advanced using a high solids bentonite grout; other soil borings were converted to temporary monitoring wells (see Section 3.2 below). Boring logs and the abandonment form are attached in Expert Report Attachment 3.

3. Groundwater Characterization

3.1 Groundwater Level Measurements

A round of groundwater level measurements were collected from existing wells on March 16, 2021 prior to commencing drilling activities and are summarized in Expert Report Table 1. Groundwater levels were measured to assess the elevation and confirm the direction of groundwater flow. Water level measurements were collected from all existing Joppa West monitoring wells and accessible monitoring wells around Joppa East. Water levels were measured using an electronic Solinst® water level meter as indicated in FGD No. 6.04 Groundwater and Free Product Level Measurements.

3.2 Temporary Monitoring Well Installation

Five of the six borings were converted to temporary monitoring wells. Soil boring and temporary monitoring well locations are shown on Expert Report Figure 2. Temporary monitoring well locations were selected to evaluate the presence or absence of CCR impacts to groundwater downgradient of Joppa West. All temporary wells were constructed consistent with IAC 35 § 811.318 monitoring well construction guidelines, using 2-inch diameter, schedule 40 polyvinyl chloride (PVC) with 10-foot, 0.010-inch slotted screens. Wells TPZ114, TPZ116, TPZ117, and TPZ117D were finished with 5-foot steel protective covers, a lock, and three steel bollards for additional protection. XTPW01 was not completed with bollards for additional well protection as it is not in a high traffic area. Well construction details are provided in Expert Report Table 2. All well construction forms are provided in Expert Report Attachment 3.

3.3 Monitoring Well Development

Monitoring well development and redevelopment was completed between March 15-18, 2021 according to FGD 6.07 Well Development. Existing monitoring well G101 was redeveloped by using a stainless-steel Hurricane XL pump to surge and pump water from the well until the well went dry three times. Monitoring wells G111, G112C, and G113 were redeveloped by surging with a bailer and bailing each well dry three times. Temporary monitoring wells TPZ114, TPZ116, and TPZ117 were surged and pumped dry three times using a stainless-steel Hurricane XL pump to complete well development. Temporary monitoring wells TPZ117D and XTPW01 were surged and pumped using a stainless-steel Hurricane XL pump until at least ten well volumes of water were removed. Well development and redevelopment forms are attached in Expert Report Attachment 3.

3.4 Sampling Schedule and Parameters

Ramboll collected analytical groundwater samples on March 22, 2021. Monitoring well inspections were completed and groundwater levels were recorded prior to groundwater sample collection as indicated in FGD 6.04 Groundwater and Free Product Level Measurements. A summary of groundwater levels and elevations is provided in Expert Report Table 1.

Existing monitoring wells are equipped with dedicated QED bladder pumps and were purged according to low-flow sampling techniques outlines in FGD 6.20 Groundwater Sampling - Low-Flow. Temporary monitoring wells TPZ116, TPZ117D, and XTPW01 were purged using a peristaltic pump, in accordance with FGD No. 6.02 Groundwater Purging and Sampling. Peristaltic pump sampling techniques were unsuccessful at temporary monitoring wells TPZ114 and TPZ117 due to the depth to groundwater exceeding the limits of the pump. Both temporary monitoring wells were subsequently purged dry using a bailer and grab samples were collected.

Field parameters were monitored for stability during purging using an Aqua TROLL 600 Multiparameter Sonde according to FGD 6.02 Groundwater Purging and Sampling. Field parameters measured include:

- Dissolved oxygen (DO)
- Oxidation-Reduction Potential (ORP)
- pH
- Specific Conductance (SpC)
- Temperature
- Turbidity

Groundwater samples were submitted to Teklab, Inc. Environmental Laboratory (Teklab) in Collinsville, Illinois for analysis of the following parameters:

- Alkalinity (bicarbonate and carbonate) by Method 2320B
- General chemistry by Methods 9251, 9214, and 9036 (chloride, fluoride, and sulfate)
- Total metals by Methods 6010B, 6020A, and 7470A (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, potassium, selenium, sodium, and thallium)
- Total dissolved solids (TDS) by Method 2540C

Field and Laboratory parameter results are summarized in Expert Report Table 3, analytical laboratory reports are provided in Expert Report Attachment 5, and field and laboratory results compared to groundwater standards are summarized in Expert Report Table 4.

4. Site Surveying

An updated site survey was completed by IngenAE, LLC (IngenAE) on February 23 and March 22, 2021. Data were collected using an aerial drone survey. Horizontal survey points were collected in North American Datum of 1983 (NAD83), Illinois State Plane Coordinate Zone - East and vertical survey points were collected in North American Vertical Datum of 1988 (NAVD88). Updated survey work included the following:

- A topographic survey of the Joppa West Ash Pond and Settling Pond Area completed by IngenAE
- An initial survey of completed soil boring and temporary wells at Joppa West
- An updated survey of existing monitoring wells at Joppa West

Survey data are provided in Expert Report Attachment 4 and well elevations are summarized in Expert Report Table 2.

5. Sample Quality Assurance/Quality Control (QA/QC)

QA/QC samples were collected. Duplicate samples were collected at a frequency of one per ten parent samples. MS/MSD samples were collected at a frequency of one per twenty parent samples.

6. Equipment Decontamination

Non-dedicated sampling equipment was decontaminated according to FGD 14.01 Sampling Equipment Decontamination.

7. Investigative Waste Handling

Investigative wastes derived from site field activities included soil cuttings, purge water, and general solids refuse (e.g., gloves, tubing, etc.), and were handled in accordance with FGD No. 15.01 Waste Handling and Management Procedures. Soil cuttings were land-spread on the Site adjacent to the borings the soils originated from. Purge water was discharged to the land surface in the immediate vicinity of the well the waste originated from. General solids waste was bagged and disposed of for municipal solid waste management.

ATTACHMENT 3

BORING LOGS, WELL DIAGRAMS, WELL DEVELOPMENT, AND ABANDONMENT FORMS

SOIL BORING LOG INFORMATION

Page 1 of 3

Facility/Project Name: Joppa Power Station
License/Permit/Monitoring Number:
Boring Number: TPZ114

Boring Drilled By: Name of crew chief (first, last) and Firm: Russ Gordon, Cascade Drilling
Date Drilling Started: 3/17/2021
Date Drilling Completed: 3/17/2021
Drilling Method: Mini Sonic

Common Well Name: TPZ114
Final Static Water Level: Feet (NAVD88)
Surface Elevation: 346.96 Feet (NAVD88)
Borehole Diameter: 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 199,376.79 N, 828,684.49 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R
Lat 37° 12' 47.0556"
Long -88° 7' 56.8632"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID:
County: Massac
State: IL
Civil Town/City/ or Village: Joppa

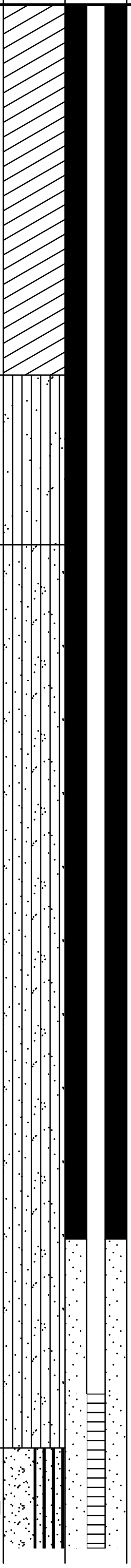
Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
1 CS	60 32			0 - 16.8' **LEAN CLAY:** CL, grayish brown (10YR 5/2), gravel (0-5%), sand (0-5%), roots (0-5%), no dilatancy, medium plasticity, low toughness, moist.										CS = Core Sample
			1	1' yellowish brown (10YR 5/6).					0.25					
			2						0.25					
			3						0.25					
			4						0.25					
2 CS	60 63		5	5' yellowish brown (10YR 5/8), pale brown (10YR 6/3) laminations (0-5%).										
			6		CL				0.25					
			7						0.5					
			8	7.7' very dark grayish brown (10YR 3/2) pocket (1 inch thick).					0.75					
			9						0.25					
3 CS	120 123		10	10' 7.5YR 4/4 (0-5%), medium to low plasticity.										
			11						0.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

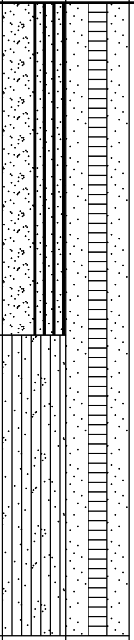
Boring Number TPZ114



Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				0 - 16.8' **LEAN CLAY:** CL, grayish brown (10YR 5/2), gravel (0-5%), sand (0-5%), roots (0-5%), no dilatancy, medium plasticity, low toughness, moist. *(continued)*	CL		0.25					
			13				0.75					
			14				0.25					
			15									
			16				0.25					
			17	16.8 - 19' **SILT WITH SAND:** (ML)s, 10YR 5/4, pale brown (10YR 6/3) mottling (15-30%), clay (15-30%), no dilatancy, low plasticity, medium toughness, moist.	(ML)s		0.75					
			18				0.75					
			19	19 - 30.7' **SANDY SILT:** to **POORLY-GRADED SAND WITH SILT:** s(ML), light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) (5-15%) mottling, organic material (0-5%), cohesive, no dilatancy, low plasticity, high toughness, moist TO light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) (5-15%) mottling, organic material (0-5%), non-cohesive, dense, moist.	s(ML)		1.25					
4 CS	120 125		20									
			21									
			22									
			23									
			24									
			25				2.1					
			26									
			27									
			28									
			29									
5 CS	120 124		30									
			31	30.7 - 36.2' **POORLY-GRADED SAND WITH SILT:** SP-SM, light brownish gray (10YR 6/2), brown (10YR 5/3) laminations (0-5%), fine, subrounded, dense, moist.	SP-SM							
			32									

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number TPZ114



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33 34 35 36	30.7 - 36.2' **POORLY-GRADED SAND WITH SILT:** SP-SM, light brownish gray (10YR 6/2), brown (10YR 5/3) laminations (0-5%), fine, subrounded, dense, moist. *(continued)*	SP-SM									
			37 38 39	36.2 - 40' **SANDY SILT:** s(ML), light brownish gray (10YR 6/2), yellowish brown (10YR 5/8) mottling (0-5%), clay (5-15%), gravel (0-5%), no dilatancy, nonplastic to low plasticity, high toughness, moist.	s(ML)				2.5 1.75 2.25					
			40	40' End of Boring.										

SOIL BORING LOG INFORMATION

Page 1 of 2

Facility/Project Name Joppa Power Station	License/Permit/Monitoring Number	Boring Number TPZ116	
Boring Drilled By: Name of crew chief (first, last) and Firm Russ Gordon Cascade Drilling	Date Drilling Started 3/17/2021	Date Drilling Completed 3/17/2021	Drilling Method Mini Sonic
Common Well Name TPZ116	Final Static Water Level Feet (NAVD88)	Surface Elevation 343.26 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 198,505.91 N, 830,005.03 E [✓ E]/ W

1/4 of 1/4 of Section , T N, R

Lat 37° 12' 38.5164"

Long -88° 8' 13.2468"

Local Grid Location Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County Massac	State IL	Civil Town/City/ or Village Joppa

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 36			0 - 0.5' **SILT WITH SAND:** (ML)s, dark grayish brown (10YR 4/2), organic material (15-30%), wet.	(ML)s									CS = Core Sample
				0.5 - 17.5' **CLAYEY SILT** ML/CL, pale brown (10YR 6/3), sand (5-15%), gravel (0-5%), roots (0-5%), no dilatancy, low plasticity, low toughness, wet to moist.										
			1						0.25					
			2						0.25					
			3						0.25					
			4						0.25					
2 CS	60 47		5											
			6		ML/CL				0.75					
			7						1.5					
			8						1.75					
			9						1					
3 CS	120 106		10	10' - 15' gray (10YR 5/1) laminations (5-15%), light olive brown (2.5Y 5/6) mottling (0-5%).										
			11						0.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

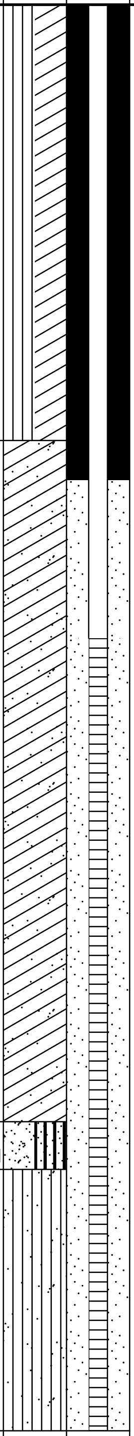
Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204

Tel: (414)837-3607
Fax: (414)837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number TPZ116

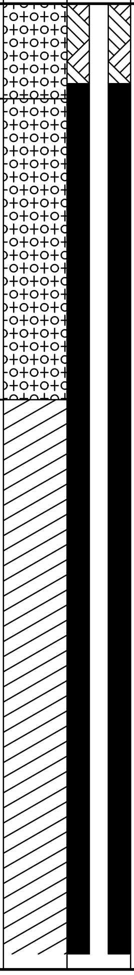
Page 2 of 2



Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
4 CS	120 114		13 14 15 16 17	0.5 - 17.5' **CLAYEY SILT** ML/CL, pale brown (10YR 6/3), sand (5-15%), gravel (0-5%), roots (0-5%), no dilatancy, low plasticity, low toughness, wet to moist. *(continued)*	ML/CL		0.5 2 2.5 1.75 1.75					
			18 19 20 21 22 23 24 25 26	17.5 - 26.1' **LEAN CLAY WITH SAND:** to **SILT WITH SAND:** (CL)s, silt (30-45%), no dilatancy, low plasticity, low to medium toughness, moist.	(CL)s		0.5 0.75 1.6					
				26.1 - 26.7' **POORLY-GRADED SAND WITH SILT:** SP-SM, pale brown (10YR 6/3), dense, moist.	SP-SM							
			27 28 29 30	26.7 - 30' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), gravel (5-15%), moist.	(ML)s		3.25 3					
				30' End of Boring.								

SOIL BORING LOG INFORMATION

Facility/Project Name: Joppa Power Station
License/Permit/Monitoring Number:
Boring Number: TPZ117
Boring Drilled By: Name of crew chief (first, last) and Firm: Russ Gordon, Cascade Drilling
Date Drilling Started: 3/16/2021
Date Drilling Completed: 3/16/2021
Drilling Method: Mini Sonic
Common Well Name: TPZ117
Final Static Water Level: Feet (NAVD88)
Surface Elevation: 347.48 Feet (NAVD88)
Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 197,895.96 N, 829,988.66 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R
Lat 37° 12' 32.4864"
Long -88° 8' 13.0848"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W
Facility ID:
County: Massac
State: IL
Civil Town/City/ or Village: Joppa



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 1.2' **CLAYEY GRAVEL WITH SAND:** (GC)s, Blind drill to 40 feet below ground surface. See TPZ117D boring log for detailed lithology..	(GC)s									Blind Drill
			2 3 4	1.2 - 5' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g									
			5 6 7 8 9 10 11 12	5 - 15' **LEAN CLAY:** CL.	CL									

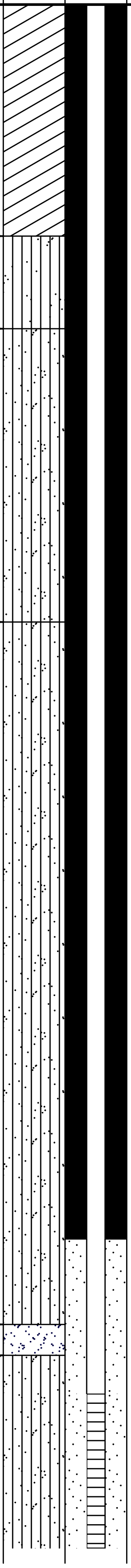
I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number TPZ117



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13 14	5 - 15' **LEAN CLAY:** CL. *(continued)*	CL									
			15 16	15 - 16.2' **SILT WITH SAND:** (ML)s.	(ML)s									
			17 18 19	16.2 - 20' **SANDY SILT:** s(ML).	s(ML)									
			20 21 22 23 24 25 26 27 28 29	20 - 29.1' **SANDY SILT:** s(ML).	s(ML)									
				29.1 - 29.5' **POORLY-GRADED SAND:** SP.	SP									
			30 31 32	29.5 - 37.8' **SANDY SILT:** s(ML).	s(ML)									

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number TPZ117

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			33 34 35 36 37	29.5 - 37.8' **SANDY SILT:** s(ML). *(continued)*	s(ML)									
			38 39	37.8 - 39.3' **POORLY-GRADED SAND WITH CLAY:** SP-SC.	SP-SC									
			40	39.3 - 40' **SANDY SILT:** s(ML).	s(ML)									
				40' End of Boring.										

RAMBOLL

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SOIL BORING LOG INFORMATION

Page 1 of 6

Facility/Project Name Joppa Power Station	License/Permit/Monitoring Number	Boring Number TPZ117D

Boring Drilled By: Name of crew chief (first, last) and Firm Russ Gordon Cascade Drilling	Date Drilling Started 3/15/2021	Date Drilling Completed 3/15/2021	Drilling Method Mini Sonic
Common Well Name TPZ117D	Final Static Water Level Feet (NAVD88)	Surface Elevation 347.26 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 197,891.54 N, 829,987.18 E [✓ E]/ W

1/4 of 1/4 of Section , T N, R

Lat 37° 12' 32.4432"

Long -88° 8' 13.0668"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County Massac	State IL	Civil Town/City/ or Village Joppa

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 37		0.5 1.0	0 - 1.2' **CLAYEY GRAVEL WITH SAND:** (GC)s, brown (10YR 5/3), gray (10YR 5/1) mottling (0-5%), fine to coarse gravel, fine to coarse sand, wet.	(GC)s									CS= Core Sample
			1.5 2.0 2.5 3.0 3.5 4.0 4.5	1.2 - 5' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, brown (10YR 4/3), gray (10YR 5/1) mottling (5-15%), fine to coarse gravel, fine to coarse sand, no dilatancy, low toughness, low plasticity, very soft, moist.	s(CL)g				0.25 0.25					
2 CS	60 60		5.0 5.5 6.0 6.5 7.0 7.5 8.0	5 - 15' **LEAN CLAY:** CL, pale brown (10YR 6/3), light olive brown (2.Y 5/6) mottling (15-30%), silt (15-30%), fine sand (5-15%), no dilatancy, low toughness, medium plasticity, very soft, moist.	CL				0.25 0.25					

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204	Tel: (414)837-3607 Fax: (414)837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number TPZ117D

Page 2 of 6

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			8.5	5 - 15' **LEAN CLAY:** CL, pale brown (10YR 6/3), light olive brown (2.Y 5/6) mottling (15-30%), silt (15-30%), fine sand (5-15%), no dilatancy, low toughness, medium plasticity, very soft, moist. *(continued)*					0.5					
			9.0	8' dark grayish brown (10YR 4/2) mottling (15-30%), light olive brown (2.5Y 5/6) mottling (0-5%), medium toughness.					0.25					
			9.5											
3 CS	120 92		10.0	10' light olive brown (2.5Y 5/6) fine sand stringers.										
			10.5											
			11.0						0.25					
			11.5		CL									
			12.0	11.8' - 11.9' layer of gravel.					0.25					
			12.5											
			13.0						0.5					
			13.5											
			14.0						0.25					
			14.5	14.5' sand (30-45%).										
			15.0	15 - 16.2' **SILT WITH SAND:** (ML)s, pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), low plasticity, moist.										
			15.5		(ML)s									
			16.0						0.25					
			16.5	16.2 - 20' **SANDY SILT:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (5-15%), organic material (0-5%), no dilatancy, medium to low toughness, non-plastic to low plasticity, moist.										
			17.0						0.25					
			17.5											
			18.0		s(ML)				0.25					
			18.5											
			19.0						0.25					
			19.5											
5 CS	120 120		20.0	20 - 29.1' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist.										
			20.5		s(ML)									
			21.0						1.5					

Boring Number TPZ117D

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			21.5	20 - 29.1' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist. *(continued)*										
			22.0						1.5					
			22.5											
			23.0						0.25					
			23.5											
			24.0						0.75					
			24.5						0.5					
			25.0											
			25.5		s(ML)									
			26.0						0.25					
			26.5											
			27.0						0.25					
			27.5											
			28.0						0.25					
			28.5											
			29.0	29.1 - 29.5' **POORLY-GRADED SAND:** SP, pale brown (10YR 6/3), fine sand, wet.	SP				0.25					
			29.5	29.5 - 37.8' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist.										
6 CS	120 114		30.0											
			30.5											
			31.0						0.75					
			31.5	31.2' - 32.8' light olive brown (2.5Y 5/6) mottling (5-15%).										
			32.0		s(ML)				0.25					
			32.5											
			33.0						0.75					
			33.5											
			34.0						0.75					
			34.5											

SOIL BORING LOG INFORMATION SUPPLEMENT

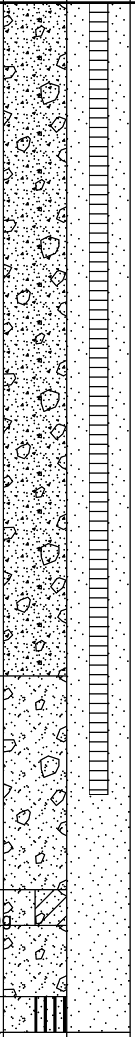
Boring Number TPZ117D

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			35.0	29.5 - 37.8' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist. *(continued)*										
			35.5											
			36.0						0.25					
			36.5		s(ML)									
			37.0						0.25					
			37.5	37.6 - 37.8' light olive brown (2.5Y 5/6).										
			38.0	37.8 - 39.3' **POORLY-GRADED SAND WITH CLAY:** SP-SC, pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (0-5%) subrounded, fine sand, wet.										
			38.5		SP-SC									
			39.0											
			39.5	39.3 - 43.8' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist.					0.5					
7 CS	120 102		40.0											
			40.5											
			41.0						0.25					
			41.5		s(ML)									
			42.0						0.25					
			42.5											
			43.0						0.25					
			43.5											
			44.0	43.8 - 49' **SANDY SILT:** to **SILTY SAND:** s(ML), strong brown (7.5YR 5/8), subrounded to subangular, fine sand, dense, cohesive, low to no plasticity, moist.					0.25					
			44.5											
			45.0											
			45.5											
			46.0		s(ML)				0.25					
			46.5											
			47.0						0.25					
			47.5											
			48.0											

Boring Number TPZ117D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties Compressive Strength (tsf)	Soil Properties Moisture Content	Soil Properties Liquid Limit	Soil Properties Plasticity Index	Soil Properties P 200	RQD/ Comments
			48.5	43.8 - 49' **SANDY SILT:** to **SILTY SAND:** s(ML), strong brown (7.5YR 5/8), subrounded to subangular, fine sand, dense, cohesive, low to no plasticity, moist. *(continued)*	s(ML)				0.25					
			49.0 49.5	49 - 50' **POORLY-GRADED SAND:** SP, brown (7.5YR 4/2), subangular, fine sand, loose, moist.	SP									
8 CS	120 96		50.0 50.5	50 - 57.2' **SANDY SILT:** to **SILTY SAND:** s(ML), pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (5-15%), very dark gray (10YR 3/2) mottling (0-5%), clay (15-30%), organic material (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, moist.	s(ML)									
			51.0 51.5						0.25					
			52.0 52.5						0.25					
			53.0 53.5						0.25					
			54.0 54.5 55.0 55.5						0.25					
			56.0 56.5 57.0						0.25					
			57.5	57.2 - 58' **POORLY-GRADED SAND:** SP, reddish yellow (7.5YR 6/8 to 7.5YR 6/6), subrounded to subangular, fine to medium sand, clay (0-10%), wet.	SP									
			58.0	58 - 58.2' **SILTY SAND:** SM, pale brown (10YR 6/3), fine sand, dry.	SM									
			58.5 59.0 59.5	58.2 - 60' **POORLY-GRADED SAND:** SP, reddish yellow (7.5YR 6/8 to 7.5YR 6/6), subrounded to subangular, fine to medium sand, clay (0-10%), wet.	SP									
9 CS	120 108		60.0 60.5 61.0	60 - 67' **WELL-GRADED SAND WITH GRAVEL:** to **WELL-GRADED GRAVEL WITH SAND:** (SW)g, very dark brown (7.5YR 2.5/2), subrounded, fine to coarse gravel, clay (0-5%), cobbles (0-5%), loose, wet.	(SW)g									

Boring Number TPZ117D



Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			61.5 62.0 62.5 63.0 63.5 64.0 64.5 65.0 65.5 66.0 66.5	60 - 67' **WELL-GRADED SAND WITH GRAVEL: to WELL-GRADED GRAVEL WITH SAND:** (SW)g, very dark brown (7.5YR 2.5/2), subrounded, fine to coarse gravel, clay (0-5%), cobbles (0-5%), loose, wet. *(continued)* 62.5' - 63.5' clay (5-15%). 64' grades to strong brown (7.5YR 5/8).	(SW)g							
			67.0 67.5 68.0 68.5	67 - 68.8' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, strong brown (7.5YR 5/8 to 7.5YR 5/6), medium to coarse sand, fine to coarse gravel, cobbles (0-5%).	(SP)g							
			69.0	68.8 - 69.1' **POORLY-GRADED SAND WITH CLAY AND GRAVEL:** (SP-SC)g, strong brown (7.5YR 5/8 to 7.5YR 5/6), medium to coarse sand, fine to coarse gravel, clay (15-30%), cobbles (0-5%).	(SP-SC)g							
			69.5	69.1 - 69.7' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, strong brown (7.5YR 5/8 to 7.5YR 5/6), medium to coarse sand, fine to coarse gravel, cobbles (0-5%).	(SP)g							
			70.0	69.7 - 70' **POORLY-GRADED SAND WITH SILT:** SP-SM, pale brown (10YR 6/3), strong brown (7.5YR 5/6) mottling (0-5%), dense, moist.	SP-SM							

70' End of Boring.

SOIL BORING LOG INFORMATION

Page 1 of 5

Facility/Project Name Joppa Power Station	License/Permit/Monitoring Number	Boring Number XSB02	
Boring Drilled By: Name of crew chief (first, last) and Firm Russ Gordon Cascade Drilling	Date Drilling Started 3/16/2021	Date Drilling Completed 3/16/2021	Drilling Method Mini Sonic
Common Well Name	Final Static Water Level Feet (NAVD88)	Surface Elevation 356.88 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 199,691.30 N, 829,863.10 E [✓ E]/ W

1/4 of 1/4 of Section , T N, R

Lat ____° ____' ______"

Long ____° ____' ______"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Massac	IL	Joppa

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 53		0.5 1.0	0 - 1.2' **FILL, LEAN CLAY:** CL, yellowish brown (10YR 5/6), roots (30-45%), sand (0-5%), medium to high plasticity, low toughness, moist. 0.3' roots (0-5%).	(FILL) CL				0.5					CS = Core Sample
			1.5	1.2 - 1.8' **FILL, POORLY-GRADED SAND:** SP, dark brown (10YR 3/3), fine to medium, silt (5-15%), loose, moist.	(FILL) SP									
			2.0	1.8 - 2.5' **FILL, POORLY-GRADED SAND WITH SILT:** SP-SM, dark brown (10YR 3/3), fine to medium, loose, moist.	(FILL) SP-SM									
			2.5 3.0 3.5 4.0 4.5	2.5 - 5' **FILL, POORLY-GRADED SAND:** SP, ash, very dark gray (10YR 3/1) to very dark gray (7.5YR 3/1), fine, gravel (5-15%), silt (5-15%), loose, moist.	(FILL) SP									
2 CS	60 48		5.0 5.5 6.0 6.5 7.0	5 - 10' **FILL, WELL-GRADED SAND:** SW, ash, black (5YR 2.5/1), gravel (0-5%), loose, moist.	(FILL) SW									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204

Tel: (414)837-3607
Fax: (414)837-3608

Boring Number XSB02

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
				5 - 10' **FILL, WELL-GRADED SAND:** SW, ash, black (5YR 2.5/1), gravel (0-5%), loose, moist. *(continued)*										
			7.5											
			8.0											
			8.5		(FILL) SW									
			9.0											
			9.5											
3 CS	60 52		10.0	10 - 11' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.										
			10.5		(FILL) ML									
			11.0	11 - 11.2' **FILL, WELL-GRADED SAND:** SW, ash, black (5YR 2.5/1), gravel (0-5%), loose, wet.	(FILL) SW									
			11.5	11.2 - 12.3' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.	(FILL) ML									
			12.0						0.25					
			12.5	12.3 - 12.5' **FILL, WELL-GRADED SAND:** SW, ash, black (5YR 2.5/1), gravel (0-5%), loose, wet. 12.5 - 20.4' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.	(FILL) SW									
			13.0						0.25					
			13.5											
			14.0						0.25					
			14.5											
4 CS	60 64		15.0	15' black (10YR 2/1) laminations (0-5%).										
			15.5		(FILL) ML									
			16.0						0.25					
			16.5											
			17.0						0.25					
			17.5											
			18.0						0.25					
			18.5											

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
5 CS	120 115		19.0 19.5 20.0	12.5 - 20.4' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet. *(continued)* 19.3' layer of fine sand and gravel (1/2 inch thick).	(FILL) ML				0.25					
			20.5	20.4 - 20.7' **FILL, WELL-GRADED SAND:** SW, ash, black (10YR 2/1), gravel (5-15%), loose, wet.	(FILL) SW									
			21.0	20.7 - 21' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), black (10YR 2/1) laminations (0-5%), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.	(FILL) ML									
			21.5 22.0 22.5 23.0	21 - 23.2' **FILL, WELL-GRADED SAND:** SW, ash, black (10YR 2/1), gravel (5-15%), loose, wet.	(FILL) SW									
			23.5 24.0 24.5	23.2 - 25' **FILL, POORLY-GRADED SAND:** SP, ash, dark gray (10YR 4/1), fine, loose, wet. 24' very dark gray (10YR 3/1), fine to medium, silt (5-15%), gravel (0-5%), dense, wet.	(FILL) SP									
			25.0 25.5	25 - 26' **FILL, WELL-GRADED SAND:** SW, ash, black (10YR 2/1), gravel (5-15%), loose, wet.	(FILL) SW									
			26.0 26.5 27.0	26 - 27.2' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), black (10YR 2/1) laminations (0-5%), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.	(FILL) ML				0.25					
				27.2 - 27.4' **FILL, WELL-GRADED SAND:** SW, ash, black (10YR 2/1), gravel (5-15%), loose, wet.	(FILL) SW									
			27.5 28.0 28.5	27.4 - 28.6' **FILL, SILT:** ML, ash, very dark gray (10YR 3/1), black (10YR 2/1) laminations (0-5%), sand (5-15%), slow dilatancy, nonplastic, medium toughness, wet.	(FILL) ML									
6 CS	120 80		29.0 29.5 30.0	28.6 - 32.5' **FILL, POORLY-GRADED SAND:** SP, ash, dark gray (10YR 4/1), fine, loose, wet.	(FILL) SP									

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			30.5 31.0 31.5 32.0	28.6 - 32.5' **FILL, POORLY-GRADED SAND:** SP, ash, dark gray (10YR 4/1), fine, loose, wet. *(continued)*	(FILL) SP									
			32.5 33.0 33.5 34.0 34.5 35.0 35.5 36.0 36.5 37.0 37.5 38.0 38.5 39.0 39.5	32.5 - 40' **FILL, WELL-GRADED SAND:** SW, ash, black (10YR 2/1), gravel (5-15%), loose, wet.	(FILL) SW									
7 CS	120 108		40.0 40.5 41.0 41.5 42.0	40 - 43.7' **POORLY-GRADED SAND WITH CLAY:** SP-SC, grayish brown (10YR 5/2), fine, subrounded to subangular, organic material (0-5%), dense to loose, wet.	SP-SC									

Boring Number XSB02

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			42.5	40 - 43.7' **POORLY-GRADED SAND WITH CLAY:** SP-SC, grayish brown (10YR 5/2), fine, subrounded to subangular, organic material (0-5%), dense to loose, wet. *(continued)*										
			43.0		SP-SC									
			43.5											
			44.0	43.7 - 50' **SILT WITH SAND:** (ML)s, very dark gray (10YR 3/1), light brownish gray (10YR 6/2) mottling (5-15%), clay (15-30%), slow dilatancy, low plasticity, medium toughness, moist.										
			44.5	44.5' very dark brown (10YR 2/2), pale brown (10YR 6/3), and light olive brown (2.5Y 5/6).										
			45.0						0.25					
			45.5											
			46.0	45.7' pale brown (10YR 6/3), light olive brown (2.5Y 5/6) mottling (15-30%), gravel (0-5%), organic material (0-5%).					0.25					
			46.5											
			47.0		(ML)s				0.25					
			47.5											
			48.0						0.5					
			48.5											
			49.0						0.75					
			49.5											
			50.0	50' End of Boring.										

SOIL BORING LOG INFORMATION

Page 1 of 3

Facility/Project Name Joppa Power Station		License/Permit/Monitoring Number	Boring Number XTPW01
Boring Drilled By: Name of crew chief (first, last) and Firm Russ Gordon Cascade Drilling	Date Drilling Started 3/16/2021	Date Drilling Completed 3/16/2021	Drilling Method Mini Sonic
Common Well Name XTPW01	Final Static Water Level Feet (NAVD88)	Surface Elevation 361.43 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 200,570.41 N, 830,167.15 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R

Lat 37° 12' 58.9356"
Long -88° 8' 15.108"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Massac	IL	Joppa

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 19			0 - 0.8' **FILL, LEAN CLAY:** CL, yellowish brown (10YR 5/6), sand (5-15%), silt (5-15%), roots (5-15%), slow dilatancy, medium plasticity, moist to wet.	(FILL) CL									CS = Core Sample CU = Cuttings NR = Not Recorded (cuttings)
			1	0.8 - 1.6' **FILL, SANDY SILT:** s(ML), ash, gravel (0-5%), dense, wet.	(FILL) s(ML)									
2 CU	60 NR		2 3 4 5 6 7 8 9	1.6 - 10' **FILL, SILT WITH SAND:** to **POORLY-GRADED SAND:** (ML)s, ash, very dark gray (10YR 3/1), mostly silt-sized layers, sand (15-30%), cohesive, nonplastic, moist to wet TO very dark gray (10YR 3/1), fine sand, loose.	(FILL) (ML)s									
3 CU	60 NR		10 11 12	10 - 15' **FILL, WELL-GRADED SAND:** to **SILT WITH SAND:** SW, ash, very dark gray (10YR 3/1) to black (5YR 2.5/1), mostly well-graded sand, gravel (5-15%), wet TO dark reddish gray (10R 4/1), silt with sand, wet.	(FILL) SW									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

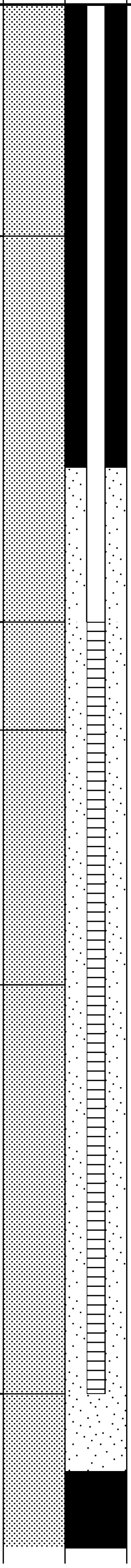
RAMBOLL

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number XTPW01

Page 2 of 3

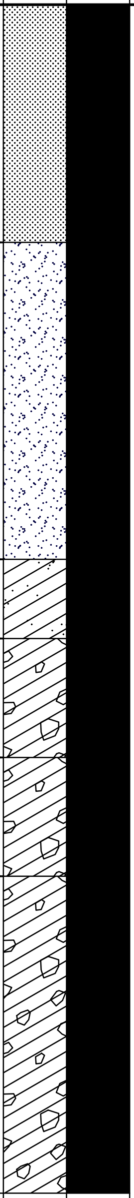
Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)						Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			13 14	10 - 15' **FILL, WELL-GRADED SAND:** to **SILT WITH SAND:** SW, ash, very dark gray (10YR 3/1) to black (5YR 2.5/1), mostly well-graded sand, gravel (5-15%), wet TO dark reddish gray (10R 4/1), silt with sand, wet. *(continued)*	(FILL) SW							
4 CU	60 NR		15 16 17 18 19	15 - 20' **FILL, SILT WITH SAND:** to **WELL-GRADED SAND:** (ML)s, ash, very dark gray (10YR 3/1), dark gray (10YR 4/1) mottling, fine sand laminations TO black (5YR 2.5/1), gravel (5-15%), wet.	(FILL) (ML)s							
5 CS	120 122		20 21	20 - 21.4' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, ash, very dark grayish brown (10YR 3/2), subrounded to angular, silt (0-5%), wet.	(FILL) (SW)g							
			22 23 24	21.4 - 24.7' **FILL, POORLY-GRADED SAND:** SP, ash, black (5YR 2.5/1), medium to coarse, subrounded to angular, gravel (5-15%). 22.6' very dark gray (10YR 3/1).	(FILL) SP							
			25 26 27 28 29	24.7 - 30' **FILL, POORLY-GRADED SAND:** SP, ash, fine, subangular, silt (5-15%), gravel (0-5%), dense, wet. 25.5' - 25.7' very dark grayish brown (10YR 3/2), subrounded to angular, silt (0-5%), wet. 25.7' dark gray (10YR 4/1). 26.3' - 26.4' very dark grayish brown (10YR 3/2), subrounded to angular, silt (0-5%), wet. 26.7' layer of coarse sand and gravel (1/2 inch thick). 27' layer of coarse sand and gravel (1/2 inch thick).	(FILL) SP							
6 CU	120 NR		30 31 32	30 - 35' **FILL, SILT WITH SAND:** to **WELL-GRADED SAND:** (ML)s, ash, very dark gray (10YR 3/1) to grayish brown (10YR 5/2), fine sand laminations, black (5YR 2.5/1), gravel (5-15%), wet.	(FILL) (ML)s							



SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number XTPW01

Page 3 of 3



Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties Compressive Strength (tsf)	Soil Properties Moisture Content	Soil Properties Liquid Limit	Soil Properties Plasticity Index	Soil Properties P 200	RQD/ Comments
			33 34	30 - 35' **FILL, SILT WITH SAND:** to **WELL-GRADED SAND:** (ML)s, ash, very dark gray (10YR 3/1) to grayish brown (10YR 5/2), fine sand laminations, black (5YR 2.5/1), gravel (5-15%), wet. *(continued)*	(FILL) (ML)s									
			35 36 37 38	35 - 39' **POORLY-GRADED SAND:** SP, grayish brown (10YR 5/2) to pale brown (10YR 6/3), silt and clay (5-15%), loose, wet.	SP									
			39	39 - 40' **LEAN CLAY WITH SAND:** (CL)s, pale brown (10YR 6/3) to light olive brown (2.5Y 5/6), light red (2.5YR 7/8) mottling (0-5%), silt (5-15%), no dilatancy, medium plasticity, low to medium toughness, moist.	(CL)s									
7 CS	84 53		40 41	40 - 41.5' **LEAN CLAY WITH GRAVEL:** (CL)g, yellowish brown (10YR 5/6), 10YR 5/1 (15-30%) and light brownish gray (10YR 6/2) mottling (15-30%), sand (5-15%), no dilatancy, low plasticity, medium toughness, moist.	(CL)g				0.5					
			42	41.5 - 43' **LEAN CLAY WITH GRAVEL:** to **LEAN CLAY WITH SAND:** (CL)g, yellowish brown (10YR 5/6), 10YR 5/1 (15-30%) and light brownish gray (10YR 6/2) mottling (15-30%), sand (15-30%), no dilatancy, low plasticity, medium toughness, moist.	(CL)g									
			43 44 45 46	43 - 47' **LEAN CLAY WITH GRAVEL:** (CL)g, yellowish brown (10YR 5/6), 10YR 5/1 (15-30%) and light brownish gray (10YR 6/2) mottling (15-30%), sand (5-15%), no dilatancy, low plasticity, medium toughness, moist.	(CL)g				0.75 0.75 0.5					
			47	47' End of Boring.										

RAMBOLL Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station

Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.

Well Name: TPZ114

Facility License, Permit or Monitoring No.:

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 37° 12' 47.1" Long. -88° 7' 56.9" or

St. Plane 199,377 ft. N, 828,684 ft. E. [✓ E]/W

Facility ID:

Date Well Installed: 03/17/2021

Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Type of Well:

Well Installed By: (Person's Name and Firm) Russ Gordon, Cascade Drilling

Distance from Waste/Source: ft.

State: IL

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

A. Protective pipe, top elevation 350.58 ft. (NAVD88)

B. Well casing, top elevation 349.95 ft. (NAVD88)

C. Land surface elevation 347.0 ft. (NAVD88)

D. Surface seal, bottom 345.0 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:

GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required): Potable Water from Plant

E. Bentonite seal, top 345.0 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 319.0 ft. (NAVD88) or 28.0 ft.

H. Screen joint, top 317.0 ft. (NAVD88) or 30.0 ft.

I. Well bottom 307.0 ft. (NAVD88) or 40.0 ft.

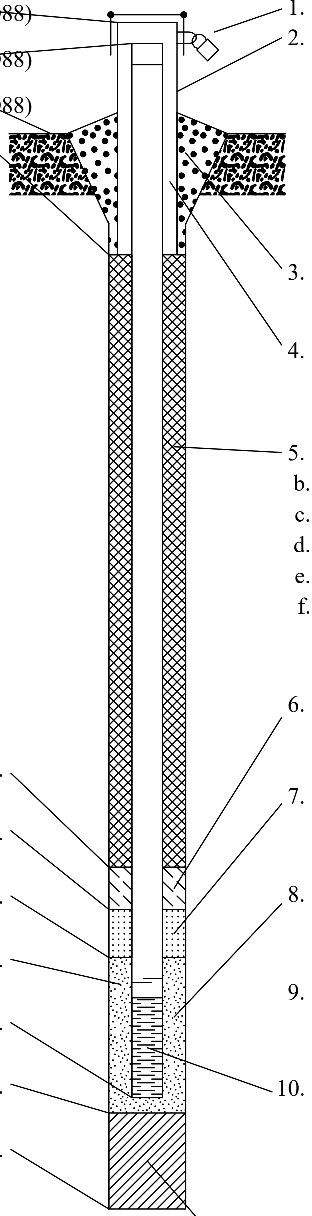
J. Filter pack, bottom 307.0 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 307.0 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ______ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ______ % Bentonite . . . Bentonite-cement grout ☐
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. K&E Well Gravel #1
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/21/2021

Signature

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name Joppa Power Station	Local Grid Location of Well ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 37° 12' 38.5" Long. -88° 8' 13.2" or	TPZ116
Facility ID	St. Plane 198,506 ft. N, 830,005 ft. E. [✓ E]/W	Date Well Installed 03/17/2021
Type of Well	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon
Distance from Waste/ Source ft. | State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known | Gov. Lot Number	Cascade Drilling

A. Protective pipe, top elevation 346.02 ft. (NAVD88)

B. Well casing, top elevation 345.77 ft. (NAVD88)

C. Land surface elevation 343.3 ft. (NAVD88)

D. Surface seal, bottom 341.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☒ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ________

17. Source of water (attach analysis, if required):
Potable Water from Plant

E. Bentonite seal, top 341.3 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 325.3 ft. (NAVD88) or 18.0 ft.

H. Screen joint, top 323.3 ft. (NAVD88) or 20.0 ft.

I. Well bottom 313.3 ft. (NAVD88) or 30.0 ft.

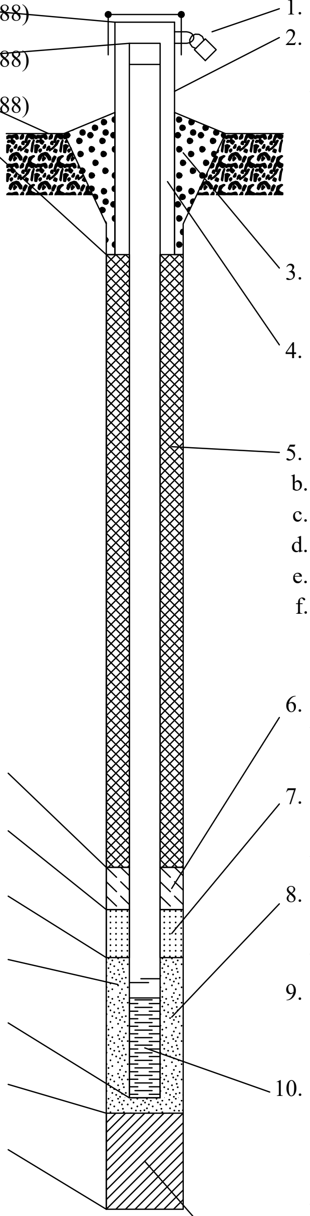
J. Filter pack, bottom 313.3 ft. (NAVD88) or 30.0 ft.

K. Borehole, bottom 313.3 ft. (NAVD88) or 30.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   - a. Inside diameter: 4.0 in.
   - b. Length: 5.0 ft.
   - c. Material: Steel ☒ Other ☐
   - d. Additional protection? ☒ Yes ☐ No
     If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐
   Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   - b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   - c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   - d. ____% Bentonite . . . Bentonite-cement grout ☐
   - e. ____Ft^3 volume added for any of the above
   - f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   - b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   - c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   - a. Not Applicable
   - b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   - a. K&E Well Gravel #1
   - b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   Other ☐
10. Screen material: Schedule 40 PVC
    - a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    - b. Manufacturer Johnson Screens
    - c. Slot size: 0.010 in.
    - d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/21/2021

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station

Local Grid Location of Well: ________ft. ☐ N. ☐ S. ________ft. ☐ E. ☐ W.

Well Name: TPZ117

Facility License, Permit or Monitoring No.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 37° 12' 32.5" Long. -88° 8' 13.1" or

St. Plane 197,896 ft. N, 829,989 ft. E. [✓ E]/W

Facility ID

Date Well Installed: 03/16/2021

Section Location of Waste/Source

Type of Well

____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Well Installed By: (Person's Name and Firm)
Russ Gordon
Cascade Drilling

Distance from Waste/ Source ft.

State: IL

Location of Well Relative to Waste/Source
u ☐ Upgradient s ☐ Sidegradient
d ☐ Downgradient n ☐ Not Known

Gov. Lot Number

A. Protective pipe, top elevation 350.09 ft. (NAVD88)

B. Well casing, top elevation 349.55 ft. (NAVD88)

C. Land surface elevation 347.5 ft. (NAVD88)

D. Surface seal, bottom 345.5 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____________

17. Source of water (attach analysis, if required):
Potable Water from Plant

E. Bentonite seal, top 345.5 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 319.5 ft. (NAVD88) or 28.0 ft.

H. Screen joint, top 317.5 ft. (NAVD88) or 30.0 ft.

I. Well bottom 307.5 ft. (NAVD88) or 40.0 ft.

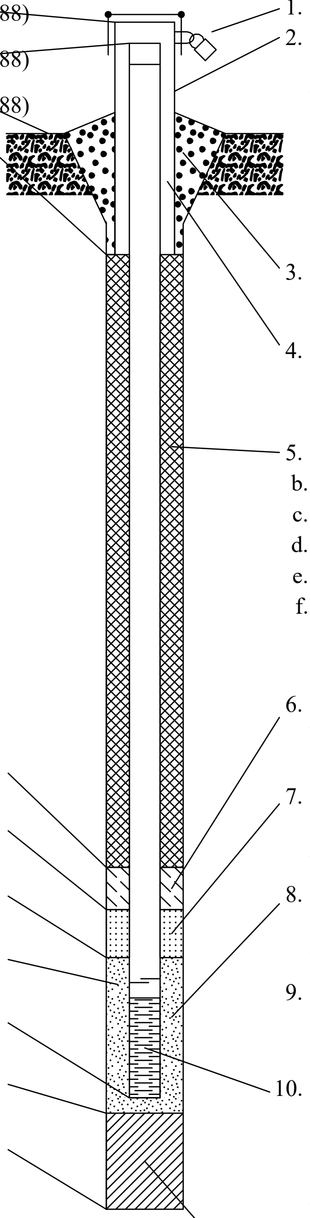
J. Filter pack, bottom 307.5 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 307.5 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ______Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ______Lbs/gal mud weight . . . Bentonite slurry ☐
d. ______% Bentonite . . . Bentonite-cement grout ☐
e. ______Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☐
Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ______ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. K&E Well Gravel #1
b. Volume added ______ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒
Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/21/2021

Signature

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station

Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.

Well Name: TPZ117D

Facility License, Permit or Monitoring No.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 37° 12' 32.4" Long. -88° 8' 13.1" or

St. Plane 197,892 ft. N, 829,987 ft. E. [✓ E]/W

Facility ID

Date Well Installed: 03/15/2021

Section Location of Waste/Source

Type of Well

____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Well Installed By: (Person's Name and Firm)

Russ Gordon

Cascade Drilling

Distance from Waste/Source ft.

State: IL

Location of Well Relative to Waste/Source
u ☐ Upgradient s ☐ Sidegradient
d ☐ Downgradient n ☐ Not Known

Gov. Lot Number

A. Protective pipe, top elevation 349.84 ft. (NAVD88)

B. Well casing, top elevation 349.27 ft. (NAVD88)

C. Land surface elevation 347.3 ft. (NAVD88)

D. Surface seal, bottom 345.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:

GP ☐ GM ☐ GC ☐ GW ☒ SW ☒ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):

Potable Water from Plant

E. Bentonite seal, top 293.3 ft. (NAVD88) or 54.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 291.3 ft. (NAVD88) or 56.0 ft.

H. Screen joint, top 289.3 ft. (NAVD88) or 58.0 ft.

I. Well bottom 279.3 ft. (NAVD88) or 68.0 ft.

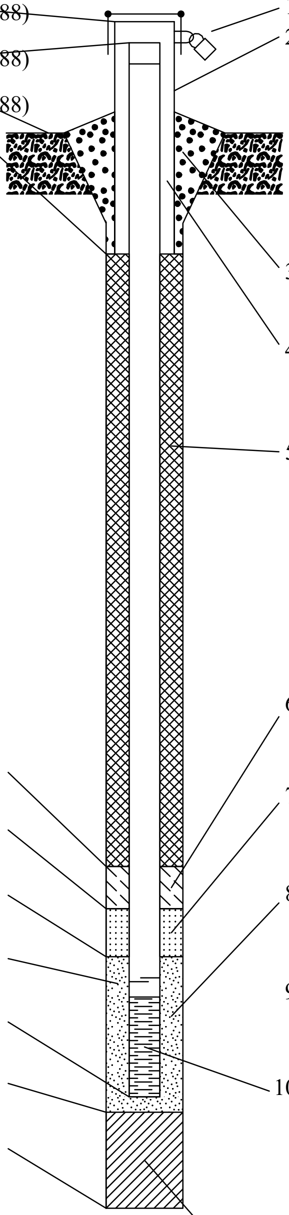
J. Filter pack, bottom 277.3 ft. (NAVD88) or 70.0 ft.

K. Borehole, bottom 277.3 ft. (NAVD88) or 70.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒
   Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.5 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____% Bentonite . . . Bentonite-cement grout ☐
e. ______Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ______ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. K&E Well Gravel #1
b. Volume added ______ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒
Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/21/2021

Signature

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204

Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well:

Distance from Waste/Source: ft.

State: IL

Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 37° 12' 58.9" Long. -88° 8' 15.1" or

St. Plane 200,570 ft. N, 830,167 ft. E. [✓ E]/W

Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: XTPW01

Date Well Installed: 03/16/2021

Well Installed By: (Person's Name and Firm) Russ Gordon, Cascade Drilling

A. Protective pipe, top elevation 364.08 ft. (NAVD88)

B. Well casing, top elevation 363.52 ft. (NAVD88)

C. Land surface elevation 361.4 ft. (NAVD88)

D. Surface seal, bottom 359.4 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☒ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe:

17. Source of water (attach analysis, if required):
Potable Water from Plant

E. Bentonite seal, top 359.4 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 343.4 ft. (NAVD88) or 18.0 ft.

H. Screen joint, top 341.4 ft. (NAVD88) or 20.0 ft.

I. Well bottom 331.4 ft. (NAVD88) or 30.0 ft.

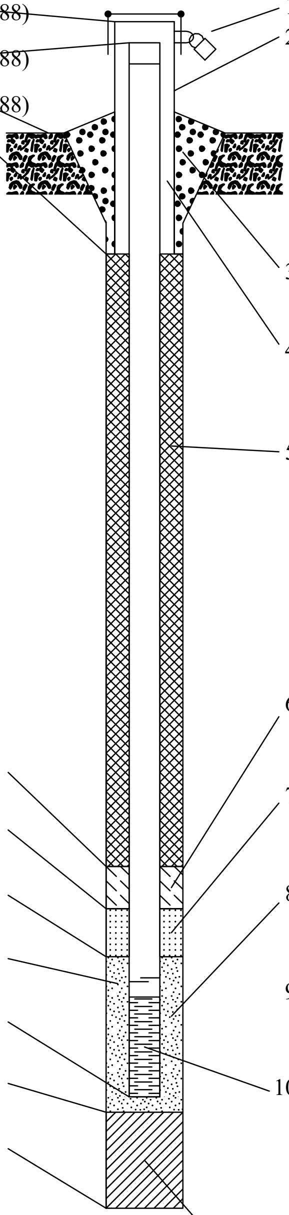
J. Filter pack, bottom 330.4 ft. (NAVD88) or 31.0 ft.

K. Borehole, bottom 314.4 ft. (NAVD88) or 47.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   - a. Inside diameter: 4.0 in.
   - b. Length: 5.0 ft.
   - c. Material: Steel ☒ Other ☐
   - d. Additional protection? ☒ Yes ☐ No
     If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☒
   - b. ______Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   - c. ______Lbs/gal mud weight . . . Bentonite slurry ☐
   - d. ______% Bentonite . . . Bentonite-cement grout ☐
   - e. ______Ft^3 volume added for any of the above
   - f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
   - b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   - c. ______ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
   - a. Not Applicable
   - b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
   - a. K&E Well Gravel #1
   - b. Volume added ______ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
   - a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   - b. Manufacturer: Johnson Screens
   - c. Slot size: 0.010 in.
   - d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
Bentonite Chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/21/2021

Signature:

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

MONITORING WELL DEVELOPMENT

Facility/Project Name: Joppa Power Station
State: IL
Well Name: G101
Facility License, Permit or Monitoring Number:

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well: 60 min.

4. Depth of well (from top of well casing): 49.3 ft.

5. Inside diameter of well: 2.07 in.

6. Volume of water in filter pack and well casing: 11.87 gal.

7. Volume of water removed from well: 27.0 gal.

8. Volume of water added (if any): 0.0 gal.

9. Source of water added: not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	37.00 ft.	49.32 ft.
Date	b.	3/17/2021	3/18/2021
Time	c.	11:02 ☒ a.m. ☐ p.m.	11:20 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) light brown to cloudy	Clear ☒ Turbid ☐ (Describe) slightly cloudy to clear

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

16. Well developed by: Person's Name and Firm
Scott Woods
Ramboll

17. Additional comments on development:
Purged dry 3 times.

Facility Address or Owner/Responsible Party Address
Name:
Firm: Electric Energy, Inc.
Street: 2100 Portland Road
City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:
Print Name: Kristen Theesfeld
Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	G111

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other ________________ ☐

3. Time spent developing well 70 min.

4. Depth of well (from top of well casing) 44.7 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 17.4 gal.

7. Volume of water removed from well 47.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	4.00 ft.	44.69 ft.
Date	b.	3/16/2021	3/16/2021
Time	c.	08:10 ☒ a.m. ☐ p.m.	04:30 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) light brown	Clear ☐ Turbid ☒ (Describe) light brown

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Kristen Theesfeld

Ramboll

17. Additional comments on development:

Purged dry 3 times.

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	G112C

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other ☐

3. Time spent developing well 89 min.

4. Depth of well (from top of well casing) 27.3 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 11.62 gal.

7. Volume of water removed from well 35.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	2.40 ft.	27.30 ft.
Date	b.	3/15/2021	3/15/2021
Time	c.	05:11 ☐ a.m. ☒ p.m.	06:40 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) brown	Clear ☒ Turbid ☐ (Describe) slightly cloudy to clear

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Kristen Theesfeld

Ramboll

17. Additional comments on development:

Purged dry 3 times.

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name: Joppa Power Station

State: IL

Well Name: G113

Facility License, Permit or Monitoring Number:

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☒
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other ______ ☐

3. Time spent developing well: 75 min.

4. Depth of well (from top of well casing): 42.4 ft.

5. Inside diameter of well: 2.07 in.

6. Volume of water in filter pack and well casing: 14.89 gal.

7. Volume of water removed from well: 52.0 gal.

8. Volume of water added (if any): 0.0 gal.

9. Source of water added: not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
    (If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	10.52 ft.	42.37 ft.
Date	b.	3/16/2021	3/17/2021
Time	c.	10:20 ☒ a.m. ☐ p.m.	03:40 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) brown	Clear ☐ Turbid ☒ (Describe) orangish brown

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Kristen Theesfeld

Ramboll

17. Additional comments on development:

Purged dry 3 times.

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	TPZ114

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well 20 min.

4. Depth of well (from top of well casing) 42.6 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 6 gal.

7. Volume of water removed from well 15.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added potable water

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	ft.	42.64 ft.
Date	b.	3/17/2021	3/17/2021
Time	c.	04:15 ☐ a.m. ☒ p.m.	05:30 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) brown	Clear ☐ Turbid ☒ (Describe) brown

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Russ Gordon

Cascade Drilling

17. Additional comments on development:

Purged dry 3 times. Depth to water estimated at 15 feet below top of casing, measuement not collected prior to starting development.

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: JOPPA WEST.GPJ

Date Modified: 4/21/2021

MONITORING WELL DEVELOPMENT

Facility/Project Name: Joppa Power Station
State: IL
Well Name: TPZ116
Facility License, Permit or Monitoring Number:

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well: 20 min.

4. Depth of well (from top of well casing): 32.7 ft.

5. Inside diameter of well: 2.07 in.

6. Volume of water in filter pack and well casing: 5 gal.

7. Volume of water removed from well: 10.0 gal.

8. Volume of water added (if any): 0.0 gal.

9. Source of water added: potable water

10. Analysis performed on water added? ☐ Yes ☒ No
    (If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	ft.	32.65 ft.
Date	b.	3/18/2021	3/18/2021
Time	c.	07:00 ☒ a.m. ☐ p.m.	03:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) brown	Clear ☐ Turbid ☒ (Describe) brown

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Russ Gordon
Cascade Drilling

17. Additional comments on development:
Purged dry 3 times. Depth to water estimated at 20 feet below top of casing, measuement not collected prior to starting development.

Facility Address or Owner/Responsible Party Address
Name:
Firm: Electric Energy, Inc.
Street: 2100 Portland Road
City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature:
Print Name: Kristen Theesfeld
Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	TPZ117

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well 20 min.

4. Depth of well (from top of well casing) 40.0 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 6.3 gal.

7. Volume of water removed from well 15.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added potable water

10. Analysis performed on water added? ☐ Yes ☒ No
    (If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	30.18 ft.	39.96 ft.
Date	b.	3/17/2021	3/17/2021
Time	c.	01:45 ☐ a.m. ☒ p.m.	05:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) brown	Clear ☐ Turbid ☒ (Describe) brown

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Russ Gordon

Cascade Drilling

17. Additional comments on development:

Purged dry 3 times.

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	TPZ117D

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well 85 min.

4. Depth of well (from top of well casing) 70.4 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 11.7 gal.

7. Volume of water removed from well 175.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added potable water

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	29.02 ft.	30.66 ft.
Date	b.	3/17/2021	3/17/2021
Time	c.	11:45 ☒ a.m. ☐ p.m.	01:15 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		4.8 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark brown	Clear ☒ Turbid ☐ (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Kristen Theesfeld
Ramboll

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name:
Firm: Electric Energy, Inc.
Street: 2100 Portland Road
City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:
Print Name: Kristen Theesfeld
Firm: Ramboll

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Joppa Power Station	IL	XTPW01

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐
   - surged with block and bailed ☐
   - surged with block and pumped ☐
   - surged with block, bailed, and pumped ☐
   - compressed air ☐
   - bailed only ☐
   - pumped only ☐
   - pumped slowly ☐
   - other surged with pump and pumped ☒

3. Time spent developing well 90 min.

4. Depth of well (from top of well casing) 32.7 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 7.57 gal.

7. Volume of water removed from well 150.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added potable water

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	15.00 ft.	15.00 ft.
Date	b.	3/17/2021	3/17/2021
Time	c.	02:30 ☐ a.m. ☒ p.m.	04:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		8.3 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) black	Clear ☒ Turbid ☐ (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm

Russ Gordon

Cascade Drilling

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name:

Firm: Electric Energy, Inc.

Street: 2100 Portland Road

City/State/Zip: Joppa IL 62953

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature:

Print Name: Kristen Theesfeld

Firm: Ramboll

RAMBOLL

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.

Well ID No.

County: Massac

Common Well Name ________ ________ Gov't Lot (if applicable)

Grid Location: ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ R. ____

________ ft. ☐ N. ☐ S., ________ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

S C N

State Plane 199,691 ft. N. 829,863 ft. E.

Reason For Abandonment: Investigation completed

Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Joppa Power Station

Facility ID

License/Permit/Monitoring No.

Street Address of Well: 2100 Portland Road

City, Village, or Town: Joppa

Present Well Owner

Original Owner: Electric Energy, Inc.

Street Address or Route of Owner: 2100 Portland Road

City, State, Zip Code: Joppa, IL 62953

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date ________

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☐ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ________

Formation Type:

☐ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) ________

Casing Diameter (in.) 2.00

Casing Depth (ft.) ________

Lower Drillhole Diameter (in.) ________

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? ________ Feet

Depth to Water (Feet) ________

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☐ No	

Was Casing Cut Off Below Surface?	☐ Yes	☐ No
Did Sealing Material Rise to Surface?	☒ Yes	☐ No
Did Material Settle After 24 Hours?	☒ Yes	☐ No
If Yes, Was Hole Retopped?	☒ Yes	☐ No

Required Method of Placing Sealing Material

☒ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☐ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☐ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
topsoil	Surface	0.0		
3/8" bentonite chips	4.0	1.0	0.5	
high solids bentonite grout	50.0	4.0	4	

(6) Comments: XSB02 abandoned by Russ Gordon of Cascade Drilling, LP with oversight from Ramboll.

(7) Name of Person or Firm Doing Sealing Work: Ramboll

Date of Abandonment: 3/16/21

Signature of Person Doing Work: Kristen Theesfeld

Date Signed: 4/22/21

Street or Route: 234 W Florida Street, 5th Floor

Telephone Number: (414)837-3607

City, State, Zip Code: Milwaukee, WI 53204

ATTACHMENT 4
SURVEY DATA (INGEN AE)

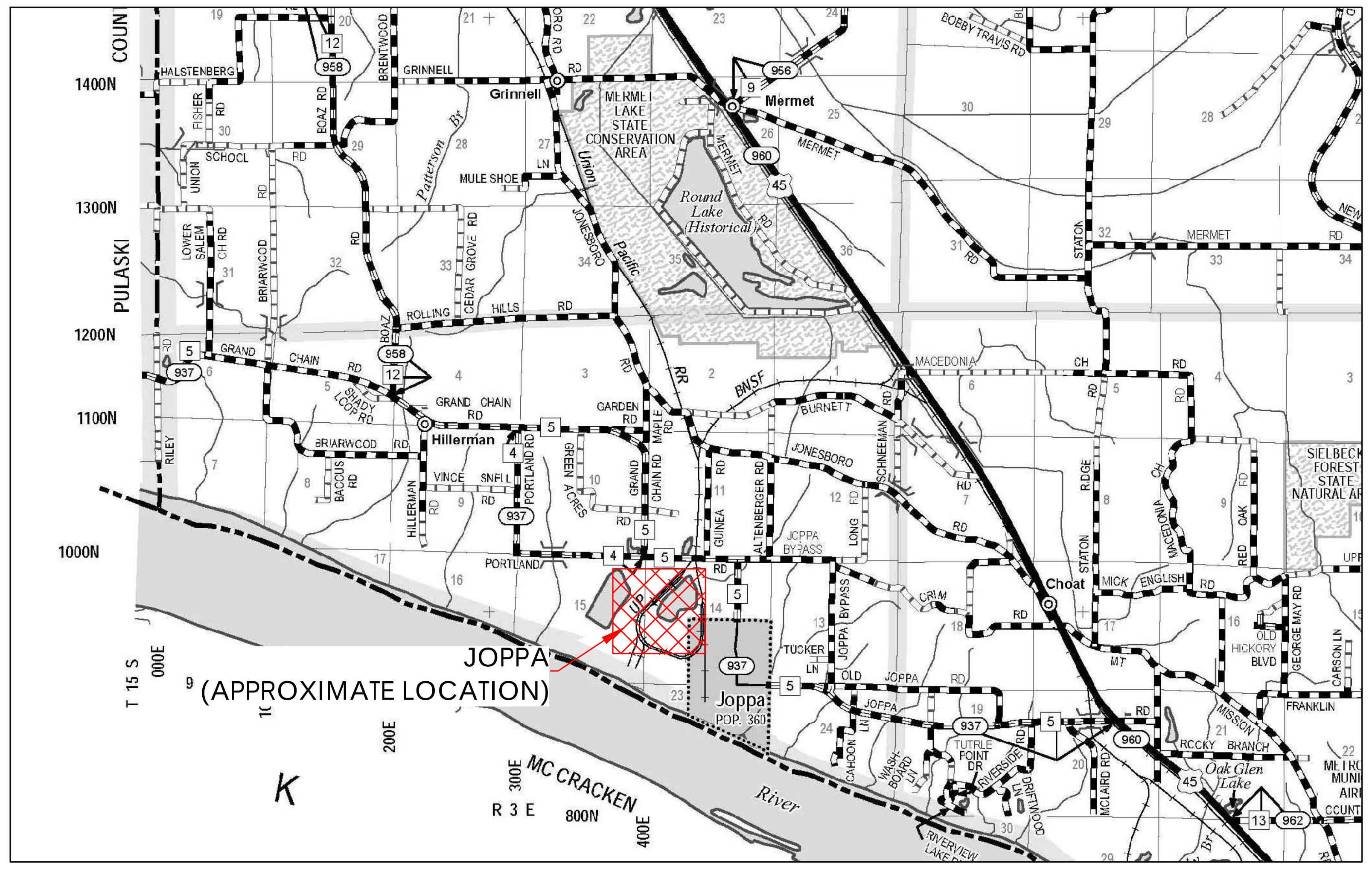
Luminant

ELECTRIC ENERGY, INC.
JOPPA POWER STATION
DECEMBER 2020 TOPOGRAPHY

JOPPA, ILLINOIS

ADDRESS
2100 PORTLAND ROAD
JOPPA, ILLINOIS 62953

VISTRA ENERGY



PROJECT LOCATION MAP
N.T.S.

VICINITY MAP
N.T.S.

LIST OF DRAWINGS

1	-	COVER SHEET
2	-	EXISTING TOPOGRAPHY CCR LANDFILL
3	-	AERIAL PHOTOGRAPHY CCR LANDFILL
4	-	EXISTING TOPOGRAPHY WEST ASH POND
5	-	AERIAL PHOTOGRAPHY WEST ASH POND
6	-	EXISTING TOPOGRAPHY EAST ASH POND
7	-	AERIAL PHOTOGRAPHY EAST ASH POND

PREPARED BY:

IngenAE
502 Earth City Plaza, Suite 120
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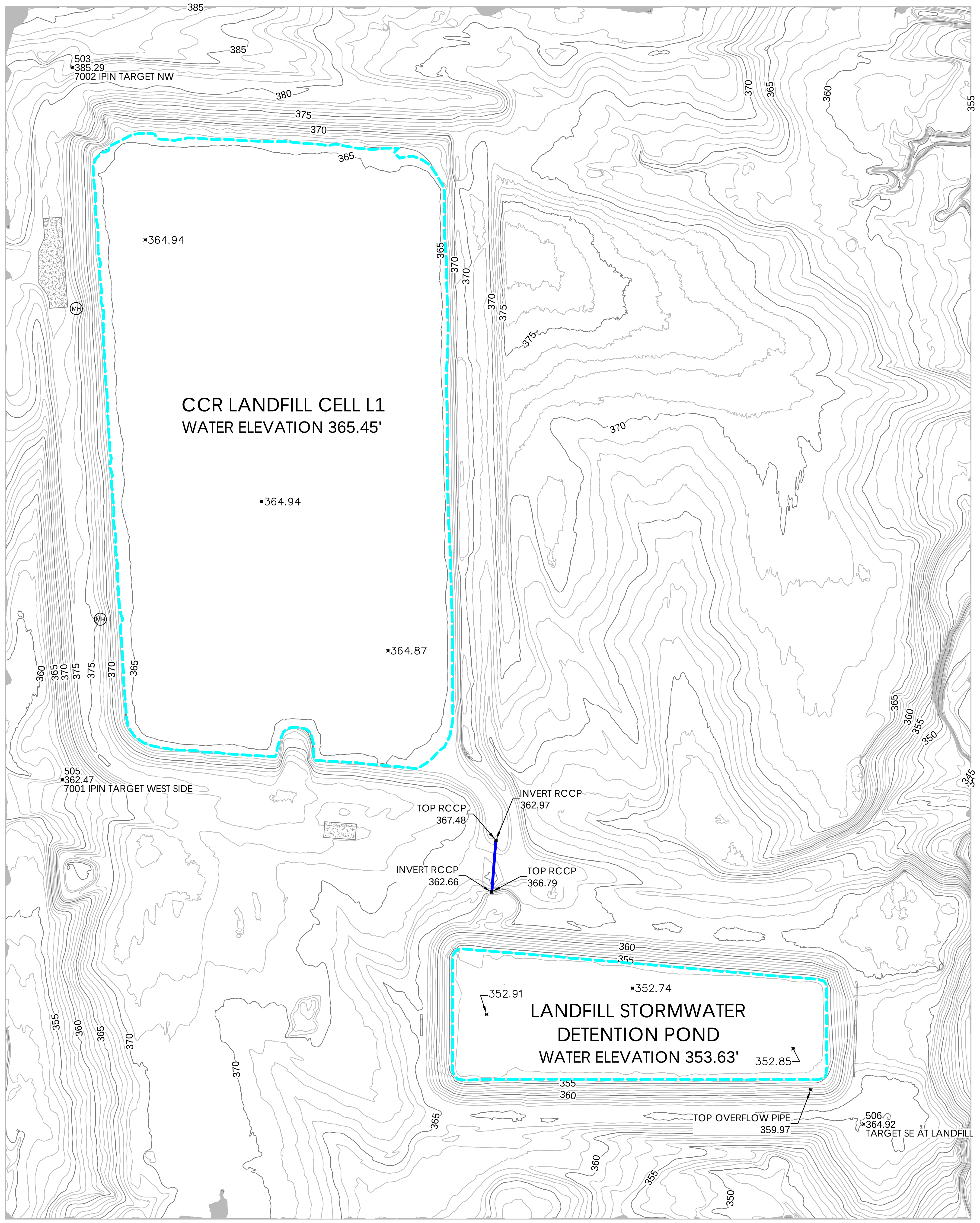

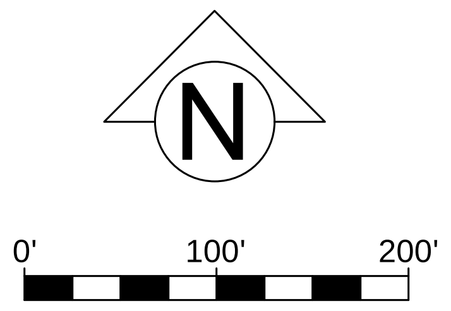

LEGEND

	EXISTING CONTOUR (1' INTERVAL)
	EXISTING CONTOUR (5' INTERVAL)
	LIMITS OF BATHYMETRIC SURVEY
	PIPING
▨	CONCRETE
⊖	MANHOLE
×396.23	BOTTOM OF BATHYMETRIC SURVEY ELEVATION

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY.
2. TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 12/8/2020 & 12/9/2020.
3. NO UNDERGROUND OR OVERHEAD UTILITIES WERE LOCATED DURING THIS SURVEY.
4. THE ACCUMULATED DATA FROM AERIAL DRONE SURVEY, GROUND TRUTHING FIELD DATA COLLECTION SURVEYS AND TOPOGRAPHIC/BATHYMETRIC SURVEYS USED TO PRODUCE THE TOPOGRAPHIC DRAWING AS SHOWN HEREON IS BASED ON ILLINOIS STATE PLANE COORDINATE-ZONE WEST NAD 1983 AND NAVD 88 ELEVATION DATUM.

Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
505	204043.40	826300.71	362.47	7001 IPIN TARGET WEST SIDE
506	203554.60	827437.98	364.92	TARGET SE AT LANDFILL
507	201597.03	829627.78	366.07	TARGET BY SEWER PONDS
508	200907.92	831134.32	362.36	TARGET ON BERM
509	198555.06	829233.33	344.04	TARGET SW OLD POND
513	201797.05	833491.00	373.57	TARGET N ACTIVE POND
514	198440.74	833202.06	375.74	TARGET SE ACTIVE POND
515	198967.84	831773.64	380.16	TARGET SW ACTIVE POND

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Submissions / Revisions:	Date:
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Luminant

Project Name & Location:

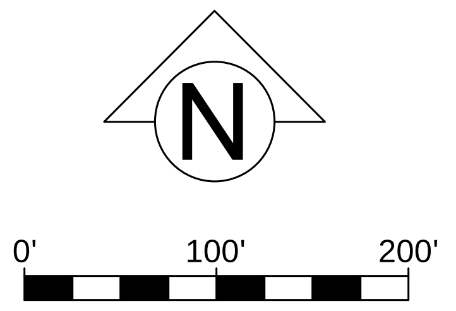
JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

Drawing Name:

EXISTING
TOPOGRAPHY
CCR LANDFILL

Date: 4/1/2021
Project No.:
Type: SITE
Drawing No.: 2
Drawn By: CB
Approved By: BH
Scale: AS NOTED



LEGEND

- - - - - LIMITS OF BATHYMETRIC SURVEY

NOTES:
1. EXISTING AERIAL SHOWN ARE FROM AERIAL SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/18/2020.
2. THE WELL LOCATIONS AND ELEVATIONS, BORING LOCATIONS AND BENCHMARK DATA WAS RETRIEVED IN SUBSEQUENT SURVEYS DONE BY INGENAE DATED FEBRUARY 23, 2021 & MARCH 22, 2021.

Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
505	204043.40	826300.71	362.47	7001 IPIN TARGET WEST SIDE
506	203554.60	827437.98	364.92	TARGET SE AT LANDFILL
507	201597.03	829627.78	366.07	TARGET BY SEWER PONDS
508	200907.92	831134.32	362.36	TARGET ON BERM
509	198555.06	829233.33	344.04	TARGET SW OLD POND
513	201797.05	833491.00	373.57	TARGET N ACTIVE POND
514	198440.74	833202.06	375.74	TARGET SE ACTIVE POND
515	198967.84	831773.64	380.16	TARGET SW ACTIVE POND

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Luminant

Project Name & Location:

JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

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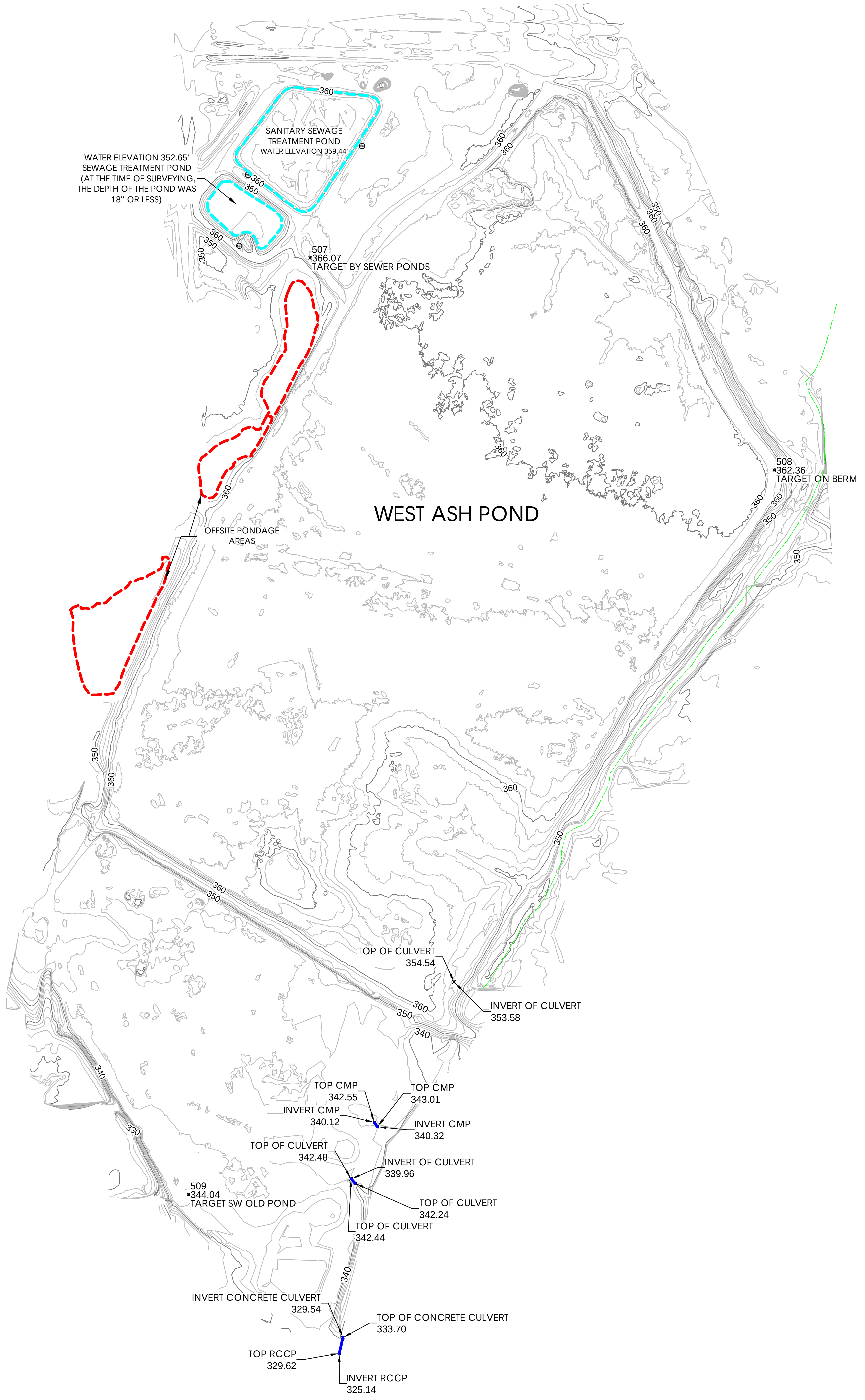
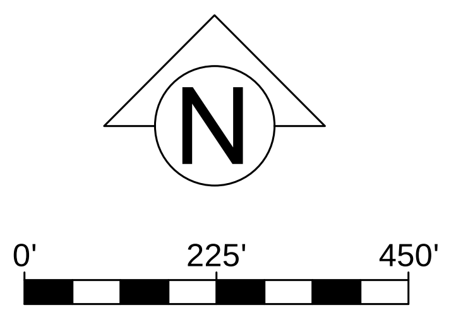
Drawing Name:
AERIAL
PHOTOGRAPHY
CCR LANDFILL

Date: 4/1/2021
Project No.
Type: SITE
Drawing No. 3
Drawn By: CB
Approved By: BH
Scale: AS NOTED





LEGEND

───	EXISTING CONTOUR (2' INTERVAL)
───	EXISTING CONTOUR (10' INTERVAL)
- - -	LIMITS OF BATHYMETRIC SURVEY
- - -	OFFSITE PONDAGE AREAS
-·-·-	DRAINAGE SWALE
⊖	MANHOLE

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY.
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Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
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13	

Luminant

Project Name & Location:

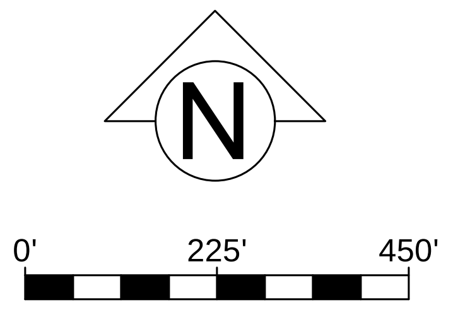
JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

Drawing Name:

EXISTING
TOPOGRAPHY
WEST ASH POND

Date: 4/6/2021
Project No.
Type: SITE
Drawing No. 4
Drawn By: CB
Approved By: BH
Scale: AS NOTED



LEGEND

🟦 - - - -	LIMITS OF BATHYMETRIC SURVEY
🟥 - - - -	OFFSITE PONDAGE AREAS
🟥	WELL
🟩	SOIL BORING

NOTES:

1. EXISTING AERIAL SHOWN ARE FROM AERIAL SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/18/2020.
2. THE WELL LOCATIONS AND ELEVATIONS, BORING LOCATIONS AND BENCHMARK DATA WAS RETRIEVED IN SUBSEQUENT SURVEYS DONE BY INGENAE DATED FEBRUARY 23, 2021 & MARCH 22, 2021.

Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
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514	198440.74	833202.06	375.74	TARGET SE ACTIVE POND
515	198967.84	831773.64	380.16	TARGET SW ACTIVE POND

SOIL BEARING 3/22/2021 BY INGENAE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1007	199691.3	829863.1	356.88	XSB-01 GROUND

WELL LOCATION POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1061	202117.8	833699.1	354.84	G-03 GROUND
1062	202117.8	833699.1	355.49	G-03 TOP CONCRETE
1063	202117.8	833699.1	358.56	G-03 TOP METAL CASING
1064	202117.8	833699.1	357.87	G-03 TOP PVC WELL
1041	201154.3	834001.0	356.15	G-04 GROUND
1042	201154.3	834001.0	356.72	G-04 TOP CONCRETE
1043	201154.3	834001.0	359.53	G-04 TOP METAL CASING
1044	201154.3	834001.0	359.07	G-04 TOP PVC WELL
1045	200844.2	834088.7	358.45	G-05 GROUND
1046	200844.2	834088.7	358.92	G-05 TOP CONCRETE
1047	200844.2	834088.7	361.68	G-05 TOP METAL CASING
1048	200844.2	834088.7	361.21	G-05 TOP PVC WELL
1060	199292.6	834115.5	352.60	G-06 GROUND
1059	199292.6	834115.5	353.27	G-06 TOP CONCRETE
1058	199292.6	834115.5	355.65	G-06 TOP METAL CASING
1057	199292.6	834115.5	355.24	G-06 TOP PVC WELL
1053	199302.8	834116.6	352.47	G-06S GROUND
1054	199302.8	834116.6	353.17	G-06S TOP CONCRETE
1055	199302.8	834116.6	355.92	G-06S TOP METAL CASING
1056	199302.8	834116.6	355.35	G-06S TOP PVC WELL
1049	198590.8	834089.4	350.34	G-07 GROUND
1050	198590.8	834089.4	350.86	G-07 TOP CONCRETE
1051	198590.8	834089.4	353.86	G-07 TOP METAL CASING
1052	198590.8	834089.4	353.53	G-07 TOP PVC WELL
1034	198423.0	833492.8	341.72	G-08 GROUND
1035	198423.0	833492.8	341.98	G-08 TOP CONCRETE
1036	198423.0	833492.8	344.22	G-08 TOP METAL CASING
1037	198423.0	833492.8	343.54	G-08 TOP PVC WELL
1026	198356.9	832589.5	348.69	G-09 GROUND
1027	198356.9	832589.5	349.24	G-09 TOP CONCRETE
1028	198356.9	832589.5	351.99	G-09 TOP METAL CASING
1029	198356.9	832589.5	351.70	G-09 TOP PVC WELL
1033	198358.8	832585.2	348.60	G-09M GROUND
1032	198358.8	832585.2	349.21	G-09M TOP CONCRETE
1031	198358.8	832585.2	351.88	G-09M TOP METAL CASING
1030	198358.8	832585.2	351.53	G-09M TOP PVC WELL
1022	198700.5	832089.0	350.75	G-10 GROUND
1023	198700.5	832089.0	351.11	G-10 TOP CONCRETE
1024	198700.5	832089.0	353.83	G-10 TOP METAL CASING
1025	198700.5	832089.0	353.49	G-10 TOP PVC WELL
1030	202049.5	831717.0	361.03	G-101 GROUND
1031	202049.5	831717.0	363.72	G-101 TOP METAL CASING
1032	202049.5	831717.0	363.47	G-101 TOP PVC COUPLING WELL
1014	199843.0	831952.8	363.38	G-11 GROUND
1015	199843.0	831952.8	363.78	G-11 TOP CONCRETE
1016	199843.0	831952.8	366.88	G-11 TOP METAL CASING
1017	199843.0	831952.8	366.55	G-11 TOP TOP PVC WELL
1024	200806.9	829139.4	356.52	G-111 GROUND
1025	200806.9	829139.4	359.13	G-111 TOP METAL CASING
1026	200806.9	829139.4	358.97	G-111 TOP PVC WELL
1027	198552.2	829088.3	323.46	G-112C GROUND
1028	198552.2	829088.3	326.31	G-112C TOP METAL CASING
1029	198552.2	829088.3	325.89	G-112C TOP PVC WELL
1020	199599.9	830365.7	350.59	G-113 GROUND
1021	199599.9	830365.7	352.95	G-113 TOP METAL CASING
1022	199599.9	830365.7	352.91	G-113 TOP PVC COUPLING WELL
1033	200438.6	832154.5	360.79	G-151 GROUND
1034	200438.6	832154.5	363.55	G-151 TOP METAL CASING
1035	200438.6	832154.5	363.38	G-151 TOP PVC COUPLING WELL
1039	198094.5	832931.7	345.84	G-152B GROUND
1040	198094.5	832931.7	347.99	G-152B TOP METAL CASING
1041	198094.5	832931.7	347.56	G-152B TOP PVC COUPLING WELL
1036	200068.3	833978.7	351.56	G-153 GROUND
1037	200068.3	833978.7	354.32	G-153 TOP METAL CASING
1038	200068.3	833978.7	354.11	G-153 TOP PVC COUPLING WELL
1018	199073.9	831608.8	353.58	G-54S GROUND
1019	199073.9	831608.8	353.75	G-54S TOP CONCRETE
1020	199073.9	831608.8	356.93	G-54S TOP METAL CASING
1021	199073.9	831608.8	356.57	G-54S TOP PVC WELL
1001	199376.8	828684.5	346.96	TPZ-114 GROUND
1002	199376.8	828684.5	350.58	TPZ-114 TOP METAL CASING
1003	199376.8	828684.5	349.95	TPZ-114 TOP PVC WELL
1015	198505.9	830005.0	343.26	TPZ-116 GROUND
1016	198505.9	830005.0	346.02	TPZ-116 TOP METAL CASING
1017	198505.9	830005.0	345.77	TPZ-116 TOP PVC WELL
1008	197896.0	829988.7	347.48	TPZ-117 GROUND
1009	197896.0	829988.7	350.09	TPZ-117 TOP METAL CASING
1010	197896.0	829988.7	349.55	TPZ-117 TOP PVC WELL
1011	197891.5	829987.2	347.26	TPZ-117D GROUND
1012	197891.5	829987.2	349.84	TPZ-117D TOP METAL CASING
1013	197891.5	829987.2	349.27	TPZ-117D TOP PVC WELL
1001	200767.2	833197.3	380.75	XPW-01 GROUND
1002	200767.2	833197.3	381.22	XPW-01 TOP CONCRETE
1003	200767.2	833197.3	383.82	XPW-01 TOP METAL CASING
1004	200767.2	833197.3	383.36	XPW-01 TOP PVC WELL
1005	200371.3	832342.6	373.23	XPW-02 GROUND
1006	200371.3	832342.6	373.77	XPW-02 TOP CONCRETE
1007	200371.3	832342.6	376.53	XPW-02 TOP METAL CASING
1008	200371.3	832342.6	376.05	XPW-02 TOP PVC WELL
1009	199020.7	832213.2	378.65	XPW-03 GROUND
1010	199020.7	832213.2	379.18	XPW-03 TOP CONCRETE
1011	199020.7	832213.2	382.04	XPW-03 TOP METAL CASING
1012	199020.7	832213.2	381.52	XPW-03 TOP PVC WELL
1004	200570.4	830167.2	361.43	XTPW-01 GROUND
1005	200570.4	830167.2	364.08	XTPW-01 TOP METAL CASING
1006	200570.4	830167.2	363.52	XTPW-01 TOP PVC WELL

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Luminant

Project Name & Location:

JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

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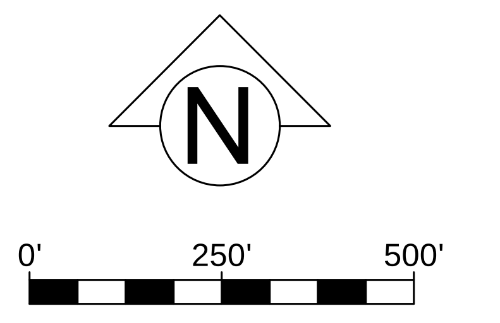
Drawing Name:

AERIAL
PHOTOGRAPHY
WEST ASH POND

Date: 4/1/2021
Project No.
Type: SITE
Drawing No. 5
Drawn By: CB
Approved By: BH
Scale: AS NOTED



LEGEND

- EXISTING CONTOUR (2' INTERVAL)
- EXISTING CONTOUR (10' INTERVAL)
- LIMITS OF BATHYMETRIC SURVEY
- PIPING
- DRAINAGE SWALE
- ▨ CONCRETE
- ⊖ MANHOLE
- ×396.23 BOTTOM ELEVATION OF SURVEY

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY.
2. TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 12/8/2020 & 12/9/2020.
3. NO UNDERGROUND OR OVERHEAD UTILITIES WERE LOCATED DURING THIS SURVEY.
4. THE ACCUMULATED DATA FROM AERIAL DRONE SURVEY, GROUND TRUTHING FIELD DATA COLLECTION SURVEYS AND TOPOGRAPHIC/BATHYMETRIC SURVEYS USED TO PRODUCE THE TOPOGRAPHIC DRAWING AS SHOWN HEREON IS BASED ON ILLINOIS STATE PLANE COORDINATE-ZONE WEST NAD 1983 AND NAVD 88 ELEVATION DATUM.

Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
505	204043.40	826300.71	362.47	7001 IPIN TARGET WEST SIDE
506	203554.60	827437.98	364.92	TARGET SE AT LANDFILL
507	201597.03	829627.78	366.07	TARGET BY SEWER PONDS
508	200907.92	831134.32	362.36	TARGET ON BERM
509	198555.06	829233.33	344.04	TARGET SW OLD POND
513	201797.05	833491.00	373.57	TARGET N ACTIVE POND
514	198440.74	833202.06	375.74	TARGET SE ACTIVE POND
515	198967.84	831773.64	380.16	TARGET SW ACTIVE POND

BENCHMARKS SET 2/23/2021 BY INGENAE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1013	200113.0	833859.3	375.78	XSG-01 TOP 4FT MARK ON GAUGE

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
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13	

Luminant

Project Name & Location:

JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:

EXISTING
TOPOGRAPHY
EAST ASH POND

Date: 4/1/2021
Project No.
Type: SITE
Drawing No. 6
Drawn By: CB
Approved By: BH
Scale: AS NOTED

LEGEND

▬ ▬ ▬ LIMITS OF BATHYMETRIC SURVEY

⌖ WELLS

NOTES:

1. EXISTING AERIAL SHOWN ARE FROM AERIAL SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/18/2020.
2. THE WELL LOCATIONS AND ELEVATIONS, BORING LOCATIONS AND BENCHMARK DATA WAS RETRIEVED IN SUBSEQUENT SURVEYS DONE BY INGENAE DATED FEBRUARY 23, 2021 & March 22, 2021.

Aerial Target Point Table

Point #	Northing	Easting	Elevation	Description
503	205054.12	826315.63	385.29	7002 IPIN TARGET NW
505	204043.40	826300.71	362.47	7001 IPIN TARGET WEST SIDE
506	203554.60	827437.98	364.92	TARGET SE AT LANDFILL
507	201597.03	829627.78	366.07	TARGET BY SEWER PONDS
508	200907.92	831134.32	362.36	TARGET ON BERM
509	198555.06	829233.33	344.04	TARGET SW OLD POND
513	201797.05	833491.00	373.57	TARGET N ACTIVE POND
514	198440.74	833202.06	375.74	TARGET SE ACTIVE POND
515	198967.84	831773.64	380.16	TARGET SW ACTIVE POND

WELL LOCATION POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1061	202117.8	833699.1	354.84	G-03 GROUND
1062	202117.8	833699.1	355.49	G-03 TOP CONCRETE
1063	202117.8	833699.1	358.56	G-03 TOP METAL CASING
1064	202117.8	833699.1	357.87	G-03 TOP PVC WELL
1041	201154.3	834001.0	356.15	G-04 GROUND
1042	201154.3	834001.0	356.72	G-04 TOP CONCRETE
1043	201154.3	834001.0	359.53	G-04 TOP METAL CASING
1044	201154.3	834001.0	359.07	G-04 TOP PVC WELL
1045	200844.2	834088.7	358.45	G-05 GROUND
1046	200844.2	834088.7	358.92	G-05 TOP CONCRETE
1047	200844.2	834088.7	361.68	G-05 TOP METAL CASING
1048	200844.2	834088.7	361.21	G-05 TOP PVC WELL
1060	199292.6	834115.5	352.60	G-06 GROUND
1059	199292.6	834115.5	353.27	G-06 TOP CONCRETE
1058	199292.6	834115.5	355.65	G-06 TOP METAL CASING
1057	199292.6	834115.5	355.24	G-06 TOP PVC WELL
1053	199302.8	834116.6	352.47	G-06S GROUND
1054	199302.8	834116.6	353.17	G-06S TOP CONCRETE
1055	199302.8	834116.6	355.92	G-06S TOP METAL CASING
1056	199302.8	834116.6	355.35	G-06S TOP PVC WELL
1049	198590.8	834089.4	350.34	G-07 GROUND
1050	198590.8	834089.4	350.86	G-07 TOP CONCRETE
1051	198590.8	834089.4	353.86	G-07 TOP METAL CASING
1052	198590.8	834089.4	353.53	G-07 TOP PVC WELL
1034	198423.0	833492.8	341.72	G-08 GROUND
1035	198423.0	833492.8	341.98	G-08 TOP CONCRETE
1036	198423.0	833492.8	344.22	G-08 TOP METAL CASING
1037	198423.0	833492.8	343.54	G-08 TOP PVC WELL
1026	198356.9	832589.5	348.69	G-09 GROUND
1027	198356.9	832589.5	349.24	G-09 TOP CONCRETE
1028	198356.9	832589.5	351.99	G-09 TOP METAL CASING
1029	198356.9	832589.5	351.70	G-09 TOP PVC WELL
1033	198358.8	832585.2	348.60	G-09M GROUND
1032	198358.8	832585.2	349.21	G-09M TOP CONCRETE
1031	198358.8	832585.2	351.88	G-09M TOP METAL CASING
1030	198358.8	832585.2	351.53	G-09M TOP PVC WELL
1022	198700.5	832089.0	350.75	G-10 GROUND
1023	198700.5	832089.0	351.11	G-10 TOP CONCRETE
1024	198700.5	832089.0	353.83	G-10 TOP METAL CASING
1025	198700.5	832089.0	353.49	G-10 TOP PVC WELL
1030	202049.5	831717.0	361.03	G-101 GROUND
1031	202049.5	831717.0	363.72	G-101 TOP METAL CASING
1032	202049.5	831717.0	363.47	G-101 TOP PVC COUPLING WELL
1014	199843.0	831952.8	363.38	G-11 GROUND
1015	199843.0	831952.8	363.78	G-11 TOP CONCRETE
1016	199843.0	831952.8	366.88	G-11 TOP METAL CASING
1017	199843.0	831952.8	366.55	G-11 TOP TOP PVC WELL
1024	200806.9	829139.4	356.52	G-111 GROUND
1025	200806.9	829139.4	359.13	G-111 TOP METAL CASING
1026	200806.9	829139.4	358.97	G-111 TOP PVC WELL
1027	198552.2	829088.3	323.46	G-112C GROUND
1028	198552.2	829088.3	326.31	G-112C TOP METAL CASING
1029	198552.2	829088.3	325.89	G-112C TOP PVC WELL
1020	199599.9	830365.7	350.59	G-113 GROUND
1021	199599.9	830365.7	352.95	G-113 TOP METAL CASING
1022	199599.9	830365.7	352.91	G-113 TOP PVC COUPLING WELL
1033	200438.6	832154.5	360.79	G-151 GROUND
1034	200438.6	832154.5	363.55	G-151 TOP METAL CASING
1035	200438.6	832154.5	363.38	G-151 TOP PVC COUPLING WELL
1039	198094.5	832931.7	345.84	G-152B GROUND
1040	198094.5	832931.7	347.99	G-152B TOP METAL CASING
1041	198094.5	832931.7	347.56	G-152B TOP PVC COUPLING WELL
1036	200068.3	833978.7	351.56	G-153 GROUND
1037	200068.3	833978.7	354.32	G-153 TOP METAL CASING
1038	200068.3	833978.7	354.11	G-153 TOP PVC COUPLING WELL
1018	199073.9	831608.8	353.58	G-54S GROUND
1019	199073.9	831608.8	353.75	G-54S TOP CONCRETE
1020	199073.9	831608.8	356.93	G-54S TOP METAL CASING
1021	199073.9	831608.8	356.57	G-54S TOP PVC WELL
1001	199376.8	828684.5	346.96	TPZ-114 GROUND
1002	199376.8	828684.5	350.58	TPZ-114 TOP METAL CASING
1003	199376.8	828684.5	349.95	TPZ-114 TOP PVC WELL
1015	198505.9	830005.0	343.26	TPZ-116 GROUND
1016	198505.9	830005.0	346.02	TPZ-116 TOP METAL CASING
1017	198505.9	830005.0	345.77	TPZ-116 TOP PVC WELL
1008	197896.0	829988.7	347.48	TPZ-117 GROUND
1009	197896.0	829988.7	350.09	TPZ-117 TOP METAL CASING
1010	197896.0	829988.7	349.55	TPZ-117 TOP PVC WELL
1011	197891.5	829987.2	347.26	TPZ-117D GROUND
1012	197891.5	829987.2	349.84	TPZ-117D TOP METAL CASING
1013	197891.5	829987.2	349.27	TPZ-117D TOP PVC WELL
1001	200767.2	833197.3	380.75	XPW-01 GROUND
1002	200767.2	833197.3	381.22	XPW-01 TOP CONCRETE
1003	200767.2	833197.3	383.82	XPW-01 TOP METAL CASING
1004	200767.2	833197.3	383.36	XPW-01 TOP PVC WELL
1005	200371.3	832342.6	373.23	XPW-02 GROUND
1006	200371.3	832342.6	373.77	XPW-02 TOP CONCRETE
1007	200371.3	832342.6	376.53	XPW-02 TOP METAL CASING
1008	200371.3	832342.6	376.05	XPW-02 TOP PVC WELL
1009	199020.7	832213.2	378.65	XPW-03 GROUND
1010	199020.7	832213.2	379.18	XPW-03 TOP CONCRETE
1011	199020.7	832213.2	382.04	XPW-03 TOP METAL CASING
1012	199020.7	832213.2	381.52	XPW-03 TOP PVC WELL
1004	200570.4	830167.2	361.43	XTPW-01 GROUND
1005	200570.4	830167.2	364.08	XTPW-01 TOP METAL CASING
1006	200570.4	830167.2	363.52	XTPW-01 TOP PVC WELL

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Project Name & Location:

JOPPA
POWER STATION

2100 PORTLAND ROAD
JOPPA, IL 62953

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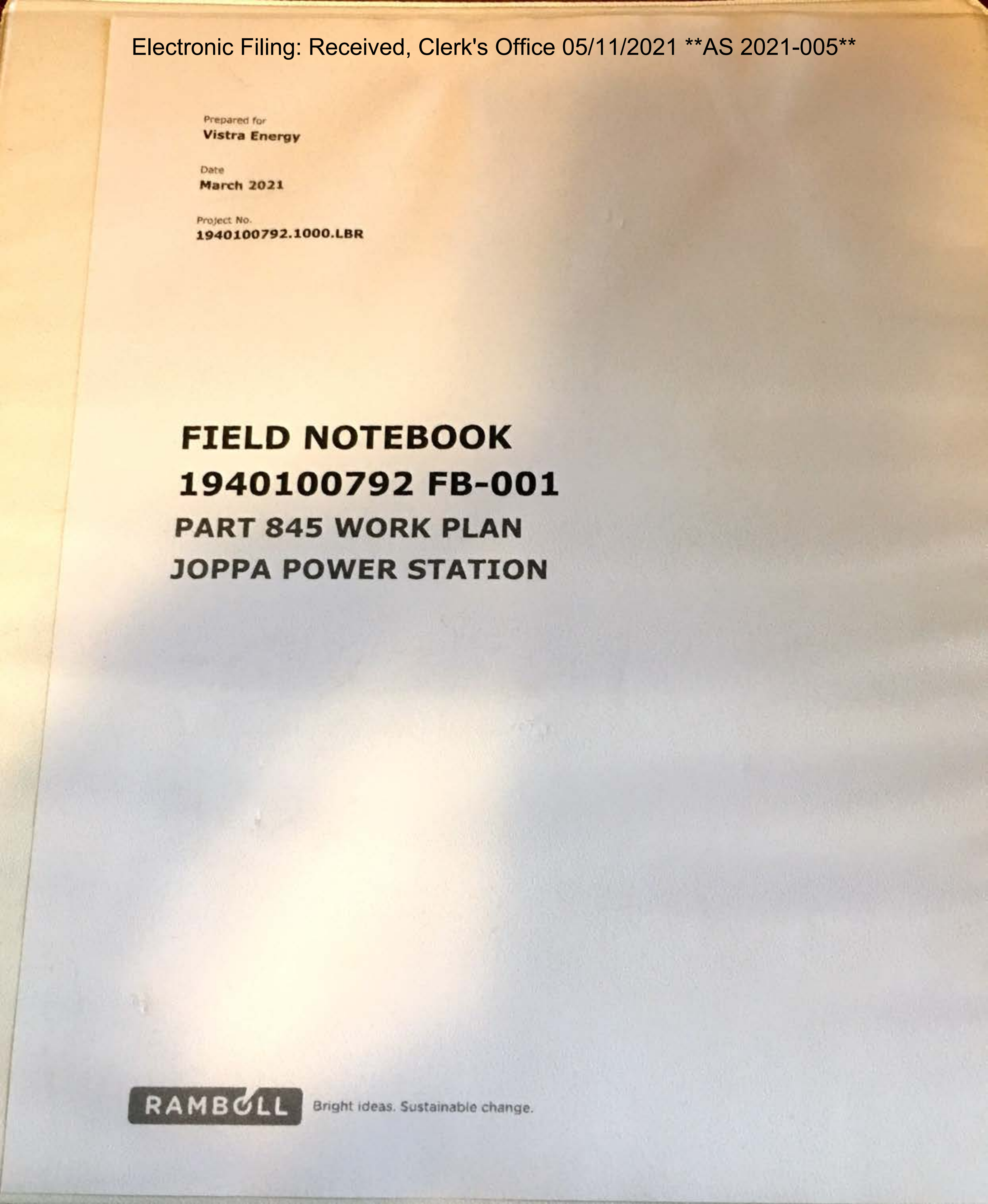
Drawing Name:

AERIAL
PHOTOGRAPHY
EAST ASH POND

Date: 4/1/2021
Project No.:
Type: SITE
Drawing No.: 7
Drawn By: CB
Approved By: BH
Scale: AS NOTED

ATTACHMENT 5
GROUNDWATER SAMPLING FIELD NOTES AND LABORATORY ANALYTICAL REPORT



Prepared for
Vistra Energy

Date
March 2021

Project No.
1940100792.1000.LBR

FIELD NOTEBOOK
1940100792 FB-001
PART 845 WORK PLAN
JOPPA POWER STATION

RAMBOLL Bright ideas. Sustainable change.

Attachment 1

ACTIVITY SUMMARY REPORT

Activity Summary Report

Attachment 1

Date(s): 3/22/21 – 3/23/21

Page 1 of 3

Project:	Vistra Energy-JOP	Location:	Jobba,IL
Project #:	1940100792	Personnel:	
Task #:		EPA ID:	

Date	Arrival Time	Departure Time	Temperature am / pm	Cloud Cover am / pm	Wind Conditions Am / pm
3/22/21 ~~3/23/21~~	700 ~~630~~	745	40/55°	cloudy/clear	0-5 /0-5

Summary of Field Notes/Sheets Recorded:

☐ Sample Control Log(s)

☐ Well Condition Form(s)

☐ Water Level and Field Parameters Field Form(s)

☐ Well Development An d Groundwater Sampling Field Form(s)

☐ Chain-of-Custody(s)

☐ Equipment Rental Information

☐ Other:

Contractor Summary:

Summary of Equipment On-Site:

GW sampling equipment, truck 163, Rental Dodge

Site Visitor Summary:

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Activity Summary Report

Date(s): 3-22-21 / 3-23-21　　Page 2 of 3
Project Number:

Summary of Work (include sample locations, types, media, etc...)

3-22 NL Gage well network, GW sample G101, TPZ116, G113, XTPW01, G111, TPZ114, G112C, TPZ117D, 117

3-23 prep coolers for lab, depart for lab/warehouse

Issues/ Resolution:

STUCK AT TPZ116, BOTH TRUCKS, Recovered by Jeff Towing paid via CC, walk to TPZ116,
G112C walk to and carry equipment in ravine

IDW:

Additional Comments:

TPZ114 - unsuccessful low flow peri pump, low head, Bailed dry then sampled
TPZ117 - repeat of TPZ114
XTPW01 - QA/QC, TPZ117D - MS/MSD
All wells that have existing pumps have no blowdown tubes

Field Representative: Nate Dunch　　Signature:
Date: 3-23-21

SAMPLE CONTROL LOG

Attachment 2

Sample Control Log

Project Name: Vistra-JOP

Project ID: 1940100792

Task ID: 1000.LBR

Analytical Laboratory:

Geotechnical Laboratory: n/a

Field Staff ID(s):

Month (2-digit)	Date (2-digit)	Year (2-digit)	Sample Number (3-digit)	Unique Sample ID	Sample Media	Sample Location	Sample Depth (feet)	QC Sample Information (duplicate, blank, etc...)	COC Number	Notes (turnaround time, handling notes
NA	→			G101	Gw	G101	~48'	—	1940100792.001	1157 3-22-21
NA	→			TPZ116	Gw	TPZ116	~28'	—		1304
NA	→			G113	Gw	G113	~41'	—		1359
NA	→			XTPW01	Gw	XTPW01	~32	—		1441
NA	→			QA/QC1	Gw	XTPW01	~32	QA/QC1		1446
NA				G111	Gw	G111	~40	—		1600
NA	→			TPZ114	Gw	TPZ114	~40	—		1641
NA	→			G112C	Gw	~~DP~~G112C	~20	—		1725
NA	→			TPZ1170	Gw	TPZ1170	~63 ~~38~~ NMP	— MS/MSD		1847
NA	→			TPZ117	Gw	TPZ117	~39	—		1901

Page 1 of 1

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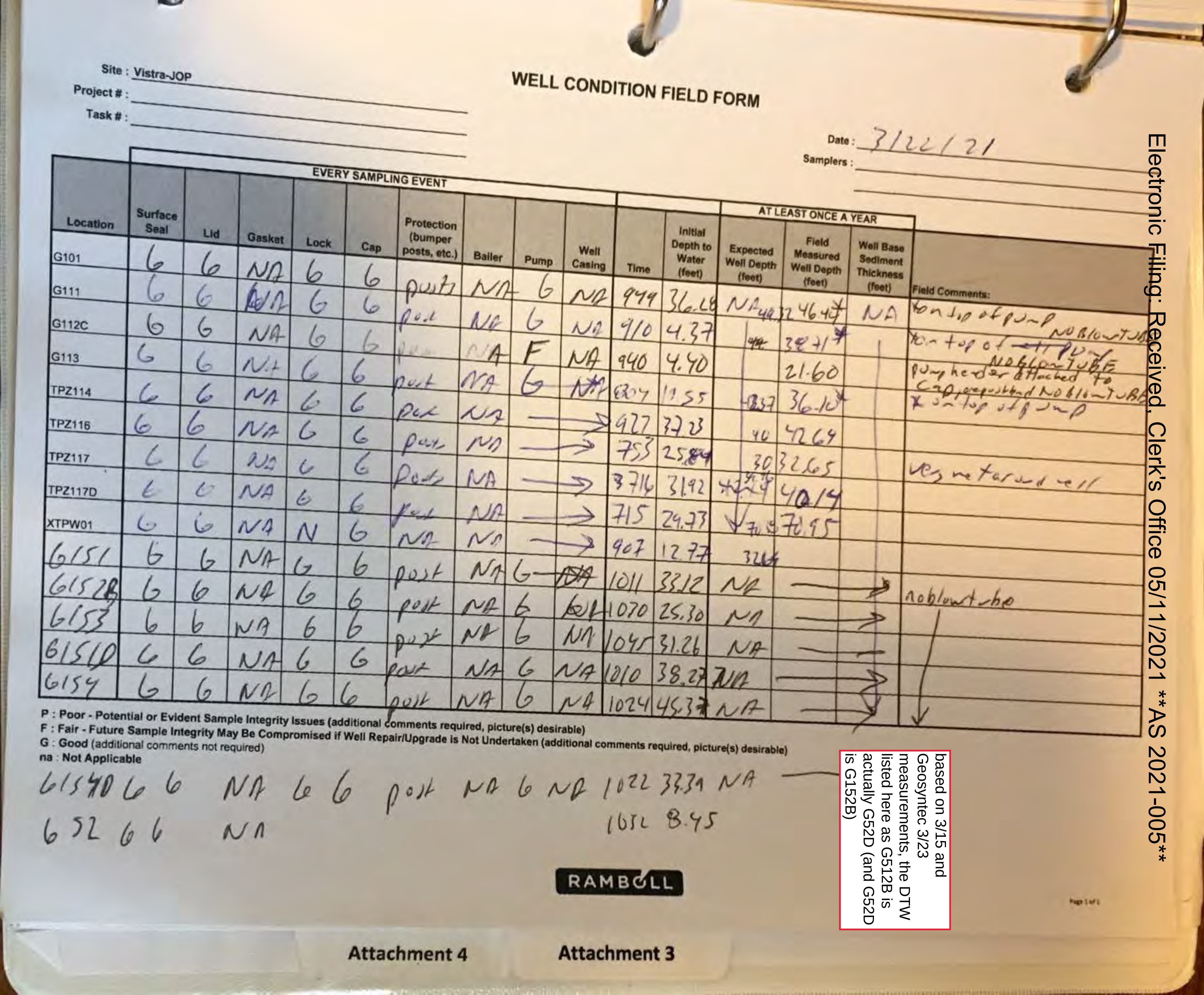
Attachment 4

Attachment 3

Attachment 2

WELL CONDITION FIELD FORMS



WELL CONDITION FIELD FORM

Site : Vistra-JOP
Project # :
Task # :

Date : 3/22/21
Samplers :

	EVERY SAMPLING EVENT											AT LEAST ONCE A YEAR			
Location	Surface Seal	Lid	Gasket	Lock	Cap	Protection (bumper posts, etc.)	Bailer	Pump	Well Casing	Time	Initial Depth to Water (feet)	Expected Well Depth (feet)	Field Measured Well Depth (feet)	Well Base Sediment Thickness (feet)	Field Comments:
G101	G	G	NA	G	G	posts	NA	G	NA	949	36.28	NA 44.32	46.44*	NA	*on top of pump NO BLOW TUBE
G111	G	G	NA	G	G	post	NA	G	NA	910	4.37	~~44~~	38.71*		*on top of ~~[illegible]~~ pump NO BLOW TUBE
G112C	G	G	NA	G	G	post	NA	F	NA	940	4.40		21.60		pump header attached to cap, repositioned NO BLOW TUBE
G113	G	G	NA	G	G	post	NA	G	~~NA~~	6304	11.55	43.37	36.10*		* on top of pump
TPZ114	G	G	NA	G	G	post	NA	→		927	37.23	40	42.64		
TPZ116	G	G	NA	G	G	post	NA	→		753	25.84	30	32.65		[illegible] well
TPZ117	G	G	NA	G	G	posts	NA	→		3716	31.92	~~42.29~~ 49.46	40.14		
TPZ117D	G	G	NA	G	G	post	NA	→		715	29.73	70.9	70.95		
XTPW01	G	G	NA	N	G	NA	NA	→		907	12.77	32.64			
G151	G	G	NA	G	G	post	NA	G	~~NA~~	1011	33.12	NA	→		
G152B	G	G	NA	G	G	post	NA	G	~~NA~~	1070	25.30	NA	→		noblowtube
G153	G	G	NA	G	G	post	NA	G	NA	1045	31.26	NA	→		
G151D	G	G	NA	G	G	post	NA	G	NA	1010	38.27	NA	→		
G154	G	G	NA	G	G	post	NA	G	NA	1024	45.37	NA	→		

P : Poor - Potential or Evident Sample Integrity Issues (additional comments required, picture(s) desirable)
F : Fair - Future Sample Integrity May Be Compromised if Well Repair/Upgrade is Not Undertaken (additional comments required, picture(s) desirable)
G : Good (additional comments not required)
na : Not Applicable

G154D G G NA G G post NA G NA 1022 33.39 NA
G52 G G NA 1052 8.45

based on 3/15 and Geosyntec 3/23 measurements, the DTW listed here as G512B is actually G52D (and G52D is G152B)

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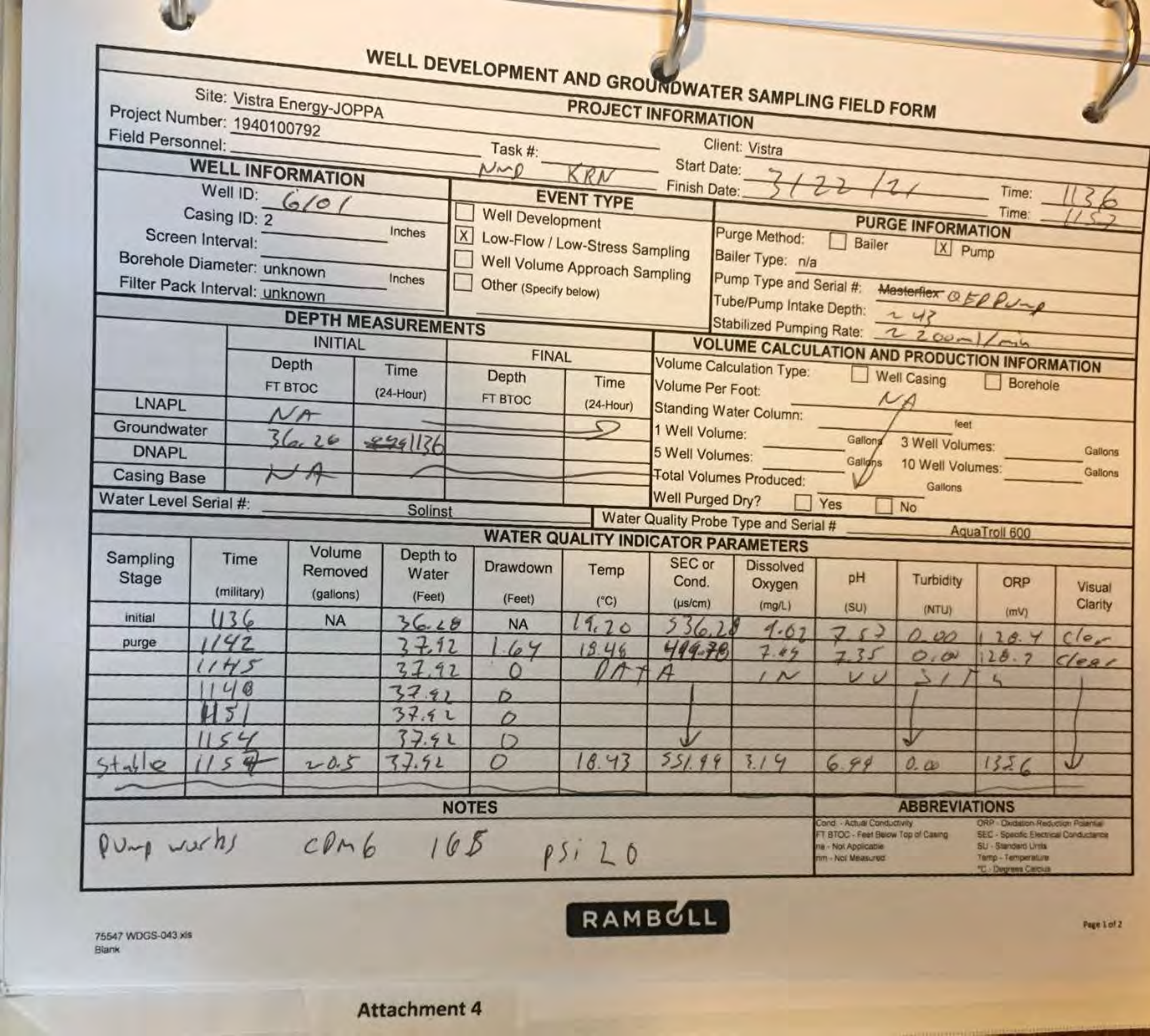
Page 1 of 1

Attachment 4

Attachment 3

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**



WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel: NMD KRN
Task #:
Client: Vistra
Start Date: 3/22/21 Time: 1136
Finish Date: Time: 1157

WELL INFORMATION

Well ID: G101
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: ~~Masterflex~~ QED Pump
Tube/Pump Intake Depth: ~43
Stabilized Pumping Rate: ~200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	36.26	~~[illegible]~~1136		
DNAPL				
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot: NA
Standing Water Column: feet
1 Well Volume: Gallons 3 Well Volumes: Gallons
5 Well Volumes: Gallons 10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☐ No
Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1136	NA	36.28	NA	19.20	536.28	9.02	7.57	0.00	128.4	Clear
purge	1142		37.92	1.64	18.46	499.70	7.49	7.35	0.00	128.7	Clear
	1145		37.92	0	DATA		IN	VU	SIT	U	
	1148		37.92	0							
	1151		37.92	0							
	1154		37.92	0							
Stable	115~~4~~	~0.5	37.92	0	18.43	551.99	3.19	6.99	0.00	135.6	

NOTES

Pump works CPM6 16B psi 20

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

RAMBOLL

75547 WDGS-043.xls
Blank

Page 1 of 2

Attachment 4

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel: MMP KRN
Task #:
Client: Vistra
Start Date: 3/22/21 Time: 1234
Finish Date: Time: 1304

WELL INFORMATION

Well ID: T02116
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: ~~28'~~ ~28'
Stabilized Pumping Rate: 200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	25.45	~~3/22/21~~ 1234	27.79	1364
DNAPL	NA			
Casing Base				

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot:
Standing Water Column: NA feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☐ No

Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1237	NA	25.95	NA	14.19	446.27	5.21	7.19	140.15	103.5	clear w/ bubbles
purge	1240		26.46	0.51	17.67	394.22	5.42	7.17	0	95.5	clear
	1243		26.70	0.22	DATA		IN	VuSITU			
	1246		26.98	0.28							
	~~1251~~ 1249		27.13	0.15							
	~~1254~~ 1252		27.20	0.07							
	~~1257~~ 1255		27.35	0.15							
	~~1300~~ 1258		27.40	0.05							

NOTES

peri pump, walk to well

ABBREVIATIONS

Cond - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celsius

RAMBOLL

Attachment 4

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel: NMD KRN
Task #:
Client: Vistra
Start Date: 3/22/21 Time: 1234
Finish Date: Time: 1704

WELL INFORMATION

Well ID:
Casing ID: 2 inches

EVENT TYPE

☐ Well Development
☐ Well Volume Approach Sampling
☒ Low-Flow / Low Stress Sampling
☐ Other (Specify):

WATER QUALITY INDICATOR PARAMETERS (continued)

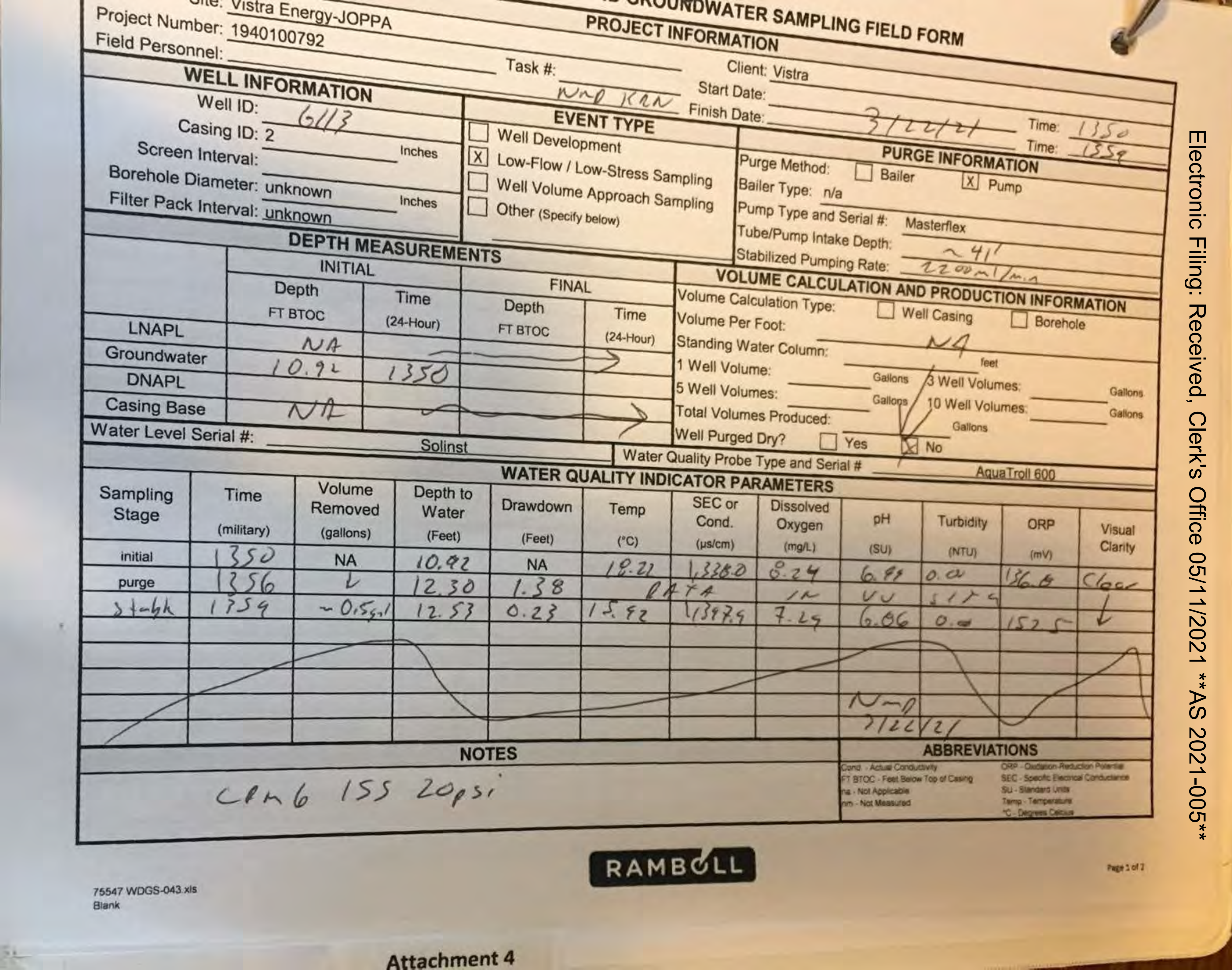
Sampling Stage	Time (military) 130	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
Purge	~~1307~~	NA	77.61	0.21	DATA		IN	VU	Situ		Clear
Stable	~~1306~~ 1304	21.0	77.79	0.18	17.69	340.48	8.07	6.49	18.01	125.0	Clear

NMD 3/22/21

NOTES (continued)

ABBREVIATIONS

Cond - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius



GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #:
WND KRN
Client: Vistra
Start Date: Time: 1350
Finish Date: 3/22/21 Time: 1359

WELL INFORMATION

Well ID: G113
Casing ID: 2
Screen Interval: Inches
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: ~41'
Stabilized Pumping Rate: 2200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	10.92	1350		
DNAPL				
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot:
Standing Water Column: NA feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No
Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1350	NA	10.92	NA	18.21	1,338.0	8.24	6.89	0.0	136.8	Clear
purge	1356	↓	12.30	1.38	DATA		IN	VU	[illegible]		
stable	1359	~0.5gal	12.53	0.23	15.92	1397.9	7.29	6.06	0.0	152.5	↓

WND
3/22/21

NOTES

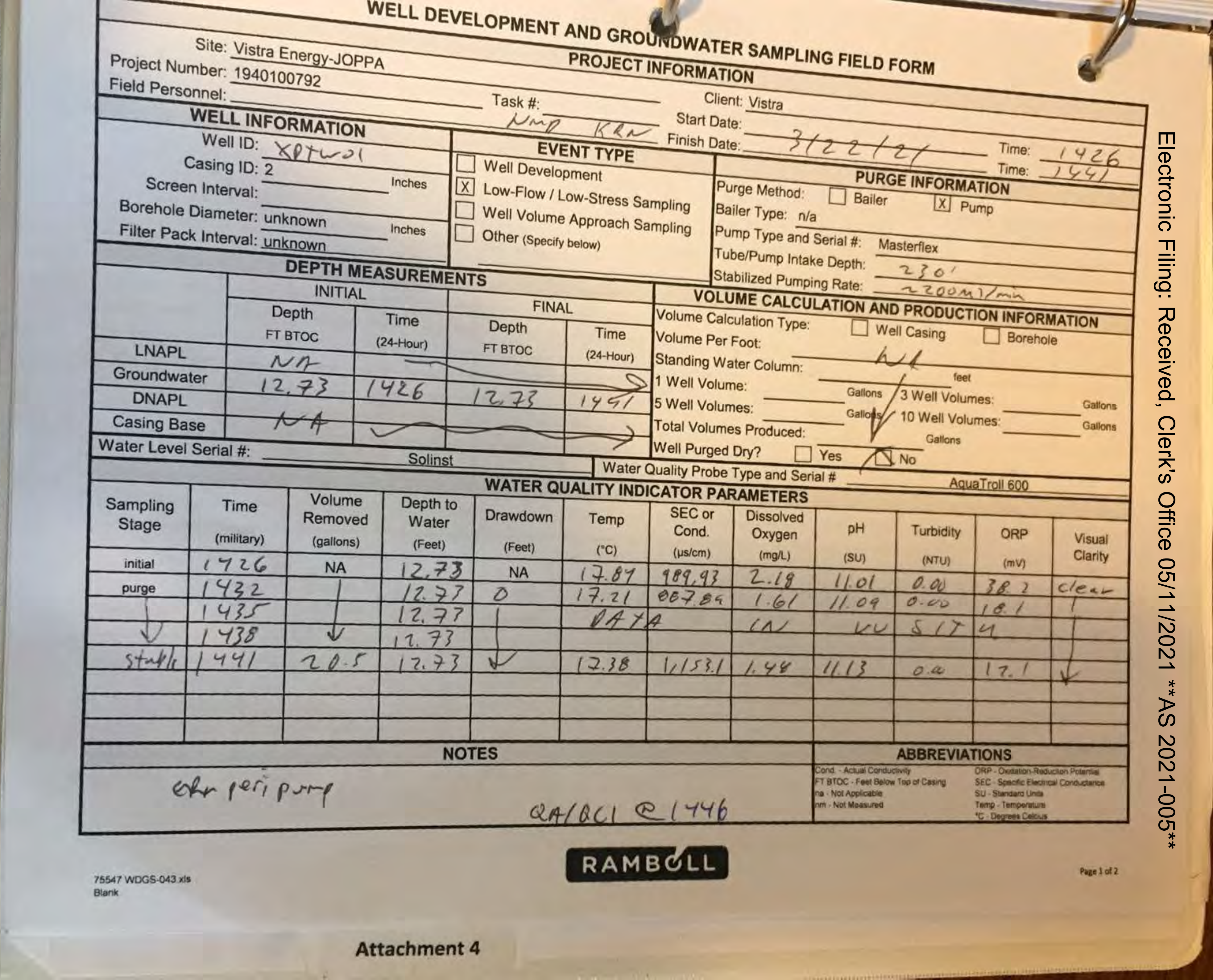
CPm6 155 20psi

ABBREVIATIONS

Cond - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celsius

RAMBOLL

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**



WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #: NMP KRN
Client: Vistra
Start Date:
Finish Date: 3/22/21
Time: 1426
Time: 1441

WELL INFORMATION

Well ID: XPTW01
Casing ID: 2
Screen Interval: Inches
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: 23.0'
Stabilized Pumping Rate: ~200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	12.73	1426	12.73	1441
DNAPL				
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot:
Standing Water Column: NA feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No
Water Quality Probe Type and Serial #: AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1426	NA	12.73	NA	17.87	989.93	2.18	11.01	0.00	38.2	
purge	1432		12.77	0	17.21	887.89	1.61	11.09	0.00	18.1	clear
	1435		12.77		DATA		IN	VU	SIT	4	
	1438		12.73								
stable	1441	20.5	12.73		12.38	1,153.1	1.48	11.13	0.00	17.1	

NOTES

ehr peri pump

QA/QC1 @ 1446

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
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nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

RAMBOLL

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Attachment 4

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #: Nmp KRN
Client: Vistra
Start Date: 3/22/21 Time: 1521
Finish Date: Time: 1600

WELL INFORMATION

Well ID: G111
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: 240'
Stabilized Pumping Rate: 2200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	5.22	1521	9.43	1600
DNAPL	NA			
Casing Base				

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot: NA
Standing Water Column: feet
1 Well Volume: Gallons 3 Well Volumes: Gallons
5 Well Volumes: Gallons 10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No
Water Quality Probe Type and Serial #: AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1521	NA	5.22	NA	17.71	575.33	8.13	7.67	25.30	127.4	Clear
purge	1527		6.73	1.51	18.62	536.00	7.91	7.41	0.00	147.6	Clear
	1530		~~6.73~~ 7.24	0.50		DA	TA	IN	VU	SITU	
	1533		~~6.73~~ 7.78	0.55							
	1536	2	~~6.77~~ 7.98	0.20							
	1539		~~6.77~~ 8.24	0.26							
	1542		~~6.77~~ 8.53	0.29							
	1545		8.77	0.24							

NOTES

CPM 5 129 8/4 discharge 20psi

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
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ORP - Oxidation Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

RAMBOLL

Attachment 4

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA

Project Number: 1940100792

Field Personnel: NMP KRN

Task #:

Client: Vistra

Start Date: 3/22/21 Time: 1521

Finish Date: Time: 1600

WELL INFORMATION

Well ID:

Casing ID: 2 inches

EVENT TYPE

☐ Well Development

☐ Well Volume Approach Sampling

☒ Low-Flow / Low Stress Sampling

☐ Other (Specify):

WATER QUALITY INDICATOR PARAMETERS (continued)

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
purge	1540	NA	8.92	0.15							
	1551	~~9.05~~ 1	9.05	0.13	DATA		IN	VU	SIM		Clear
	1554		9.17	0.12							
	1557		9.30	0.13							
stable	1600	~1.5	9.43	0.13	17.13	572.98	7.79	7.34	75.66	162.1	

NOTES (continued)

ABBREVIATIONS

Cond - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #:
NMD KRW
Client: Vistra
Start Date:
Finish Date: 3/22/21
Time: 1620
Time: 1641

WELL INFORMATION

Well ID: TPZ114
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: 240'
Stabilized Pumping Rate: ~200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater				
DNAPL	N/A			
Casing Base				

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot: N/A
Standing Water Column: feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No

Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1640	NA		NA	~~7.42~~	459.74	7.29	7.42	318.06	124.9	cloudy
purge					19.34						

NOTES

lowflow not working, BAILED DRY then sampled

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

RAMBOLL

Attachment 4

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #: NM KRN
Client: Vistra
Start Date: 3/22/21 Time: 1707
Finish Date: Time: 1725

WELL INFORMATION

Well ID: G112C
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: 220
Stabilized Pumping Rate: 220ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	4.05	1707	4.90	1725
DNAPL				
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot:
Standing Water Column: feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☐ No
Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1707	NA	4.05	NA	18.01	56816	1.56	7.04	323.71	138.2	cloudy
purge	1713	↓	4.90	0.85	16.10	61825	~~0.65~~	6.84	13120.03	151.6	↓
	1716		4.90	0	DATA in VuSitu						
	1719		4.90	0	↓						
	1722		4.90	0							
Stable	1725	20.5	4.90	0	14.57	1,213.5	0.74	6.85	22.16	152.6	clear

NOTES

CPm4 101 10psi

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
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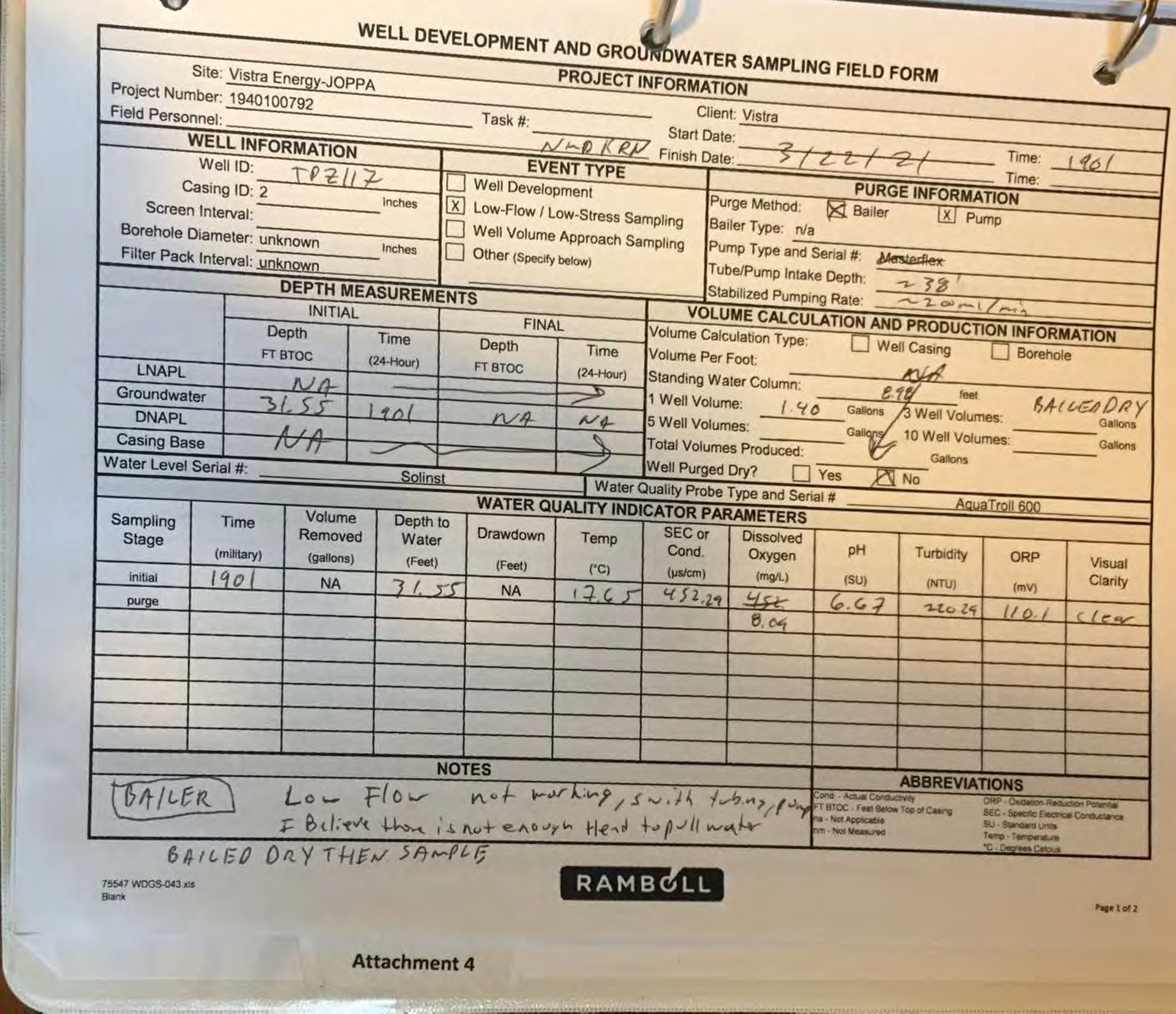
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

RAMBOLL

Attachment 4



WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #: NMD KRN
Client: Vistra
Start Date:
Finish Date: 3/22/21
Time: 1901
Time:

WELL INFORMATION

Well ID: TPZ117
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☒ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: ~~Masterflex~~
Tube/Pump Intake Depth: ~38'
Stabilized Pumping Rate: ~200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	31.55	1901		
DNAPL			NA	NA
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot: N/A
Standing Water Column: 8.98 feet
1 Well Volume: 1.40 Gallons
3 Well Volumes: BAILED DRY Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No
Water Quality Probe Type and Serial # AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	1901	NA	31.55	NA	17.65	452.29	~~45t~~ 8.04	6.67	220.24	110.1	clear
purge											

NOTES

BAILER Low Flow not working, switch tubing, pump
I Believe there is not enough Head to pull water

BAILED DRY THEN SAMPLE

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

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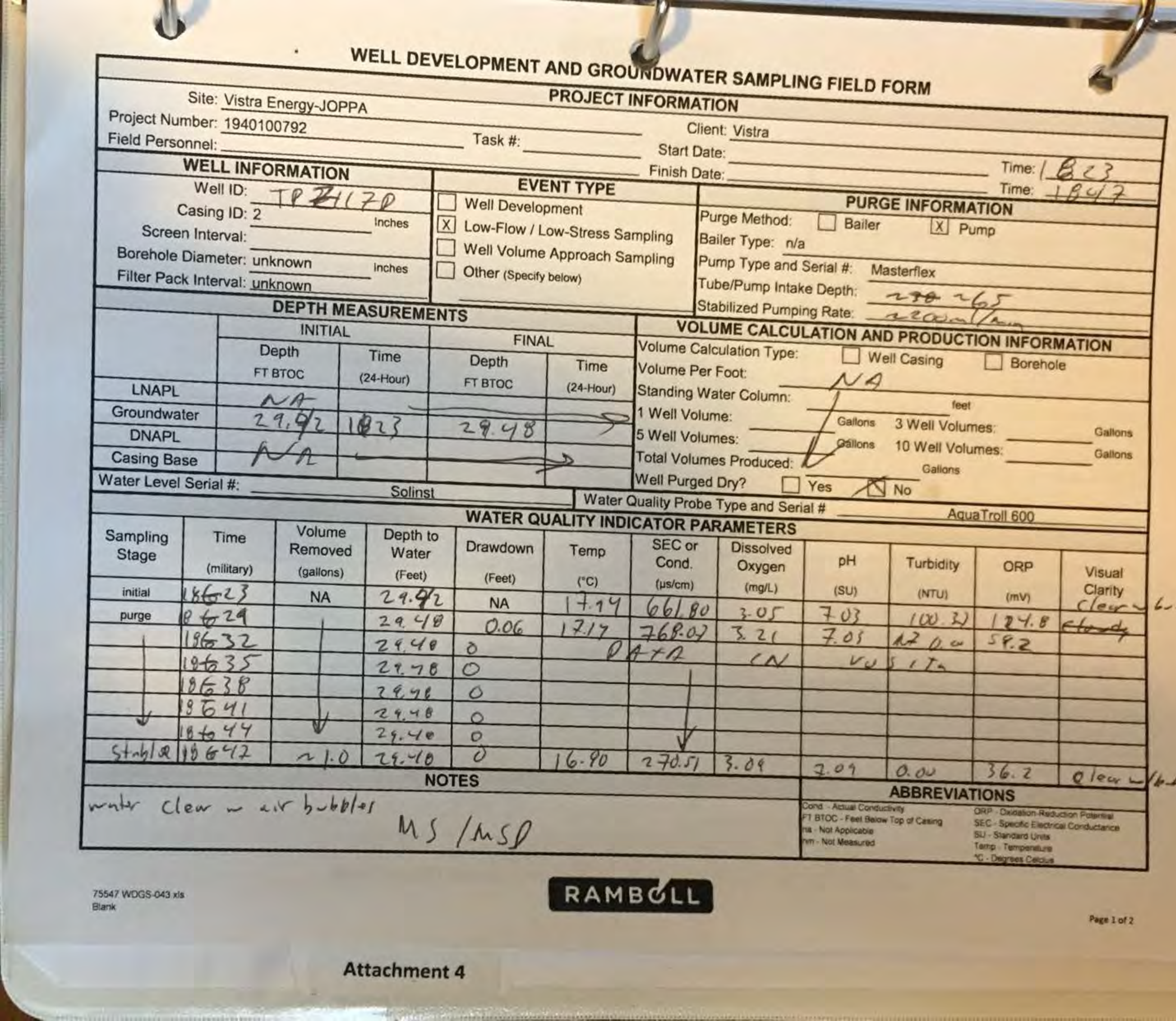
RAMBOLL

Attachment 4



WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: Vistra Energy-JOPPA
Project Number: 1940100792
Field Personnel:
Task #:
Client: Vistra
Start Date: Time: 1823
Finish Date: Time: 1847

WELL INFORMATION

Well ID: TPZH170
Casing ID: 2 Inches
Screen Interval:
Borehole Diameter: unknown Inches
Filter Pack Interval: unknown

EVENT TYPE

☐ Well Development
☒ Low-Flow / Low-Stress Sampling
☐ Well Volume Approach Sampling
☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump
Bailer Type: n/a
Pump Type and Serial #: Masterflex
Tube/Pump Intake Depth: ~~~30~~ ~65
Stabilized Pumping Rate: ~200ml/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	NA			
Groundwater	29.42	1823	29.48	
DNAPL				
Casing Base	NA			

Water Level Serial #: Solinst

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole
Volume Per Foot: NA
Standing Water Column: feet
1 Well Volume: Gallons
3 Well Volumes: Gallons
5 Well Volumes: Gallons
10 Well Volumes: Gallons
Total Volumes Produced: Gallons
Well Purged Dry? ☐ Yes ☒ No
Water Quality Probe Type and Serial #: AquaTroll 600

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	pH (SU)	Turbidity (NTU)	ORP (mV)	Visual Clarity
initial	18623	NA	29.42	NA	17.14	661.80	3.05	7.03	100.32	124.8	clear ~ bubbles
purge	18629		29.48	0.06	17.17	768.07	3.21	7.03	~~17~~ 0.00	59.2	~~cloudy~~
	18632		29.48	0	D	ATA	IN	Vu	SiTu		
	18635		29.78	0							
	18638		29.48	0							
	18641		29.48	0							
	18644		29.40	0							
Stable	18647	~1.0	29.40	0	16.90	270.51	3.09	7.09	0.00	36.2	clear w/bubbles

NOTES

water clear ~ air bubbles
MS /MSD

ABBREVIATIONS

Cond - Actual Conductivity
FT BTOC - Feet Below Top of Casing
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RAMBOLL

Page 1 of 2

Attachment 4

CHAIN-OF-CUSTODY **COPIES ONLY** Original COCs must be filed in accordance with Ramboll Data Management Policies	**Signature**

Low-Flow Test Report:

Test Date / Time: 3/22/2021 11:36:05 AM
Project: G101
Operator Name:

Location Name: G101	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 11:36 AM	00:00	7.57 pH	19.20 °C	538.28 µS/cm	9.02 mg/L	0.00 NTU	128.4 mV	
3/22/2021 11:39 AM	03:00	7.47 pH	18.40 °C	496.69 µS/cm	8.92 mg/L	0.00 NTU	130.4 mV	
3/22/2021 11:42 AM	06:00	7.35 pH	18.48 °C	499.78 µS/cm	7.99 mg/L	0.00 NTU	128.9 mV	
3/22/2021 11:45 AM	09:00	7.20 pH	18.62 °C	507.64 µS/cm	6.90 mg/L	0.00 NTU	130.6 mV	
3/22/2021 11:48 AM	12:00	7.09 pH	18.61 °C	522.93 µS/cm	5.78 mg/L	0.00 NTU	133.9 mV	
3/22/2021 11:51 AM	15:00	7.03 pH	18.49 °C	537.42 µS/cm	4.53 mg/L	0.00 NTU	135.3 mV	
3/22/2021 11:54 AM	18:00	7.00 pH	18.45 °C	548.76 µS/cm	3.66 mg/L	0.00 NTU	135.9 mV	
3/22/2021 11:57 AM	21:00	6.99 pH	18.43 °C	551.99 µS/cm	3.14 mg/L	0.00 NTU	135.6 mV	

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 3/22/2021 12:34:40 PM
Project: TPZ116
Operator Name:

Location Name: TPZ116	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 12:34 PM	00:00	7.19 pH	19.19 °C	446.27 µS/cm	5.21 mg/L	140.15 NTU	103.5 mV	
3/22/2021 12:37 PM	03:00	7.15 pH	17.83 °C	397.99 µS/cm	5.48 mg/L	0.00 NTU	99.4 mV	
3/22/2021 12:40 PM	06:00	7.17 pH	17.67 °C	394.22 µS/cm	5.42 mg/L	0.00 NTU	95.5 mV	
3/22/2021 12:43 PM	09:00	7.18 pH	17.47 °C	381.06 µS/cm	5.79 mg/L	0.00 NTU	93.8 mV	
3/22/2021 12:46 PM	12:00	7.14 pH	17.53 °C	315.85 µS/cm	6.93 mg/L	0.00 NTU	97.3 mV	
3/22/2021 12:49 PM	15:00	6.99 pH	17.21 °C	338.09 µS/cm	8.07 mg/L	0.00 NTU	109.2 mV	
3/22/2021 12:52 PM	18:00	6.94 pH	17.47 °C	319.60 µS/cm	8.45 mg/L	0.00 NTU	117.6 mV	
3/22/2021 12:55 PM	21:00	7.04 pH	17.47 °C	340.59 µS/cm	7.36 mg/L	56.36 NTU	112.5 mV	
3/22/2021 12:58 PM	24:00	6.98 pH	17.43 °C	338.87 µS/cm	8.02 mg/L	46.20 NTU	119.1 mV	
3/22/2021 1:01 PM	27:00	6.98 pH	17.58 °C	336.20 µS/cm	8.21 mg/L	17.70 NTU	122.4 mV	
3/22/2021 1:04 PM	30:00	6.99 pH	17.69 °C	340.93 µS/cm	8.07 mg/L	18.04 NTU	125.0 mV	

Samples

Sample ID:	**Description:**

Created using VuSitu from In-Situ, Inc.

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

Low-Flow Test Report:

Test Date / Time: 3/22/2021 1:50:17 PM
Project: G113
Operator Name:

Location Name: G113	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 1:50 PM	00:00	6.99 pH	18.22 °C	1,338.0 µS/cm	8.24 mg/L	0.00 NTU	136.8 mV	
3/22/2021 1:53 PM	03:00	6.88 pH	16.60 °C	1,390.5 µS/cm	7.53 mg/L	0.00 NTU	143.5 mV	
3/22/2021 1:56 PM	06:00	6.85 pH	16.12 °C	1,395.2 µS/cm	7.26 mg/L	0.00 NTU	149.1 mV	
3/22/2021 1:59 PM	09:00	6.86 pH	15.92 °C	1,397.9 µS/cm	7.29 mg/L	0.00 NTU	152.5 mV	

Samples

Sample ID:	**Description:**

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 3/22/2021 2:26:21 PM
Project: XPTW01
Operator Name:

Location Name: XTPW01	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 2:26 PM	00:00	11.01 pH	17.84 °C	989.93 µS/cm	2.18 mg/L	0.00 NTU	38.2 mV	
3/22/2021 2:29 PM	03:00	11.08 pH	17.42 °C	837.03 µS/cm	1.77 mg/L	0.00 NTU	23.5 mV	
3/22/2021 2:32 PM	06:00	11.09 pH	17.21 °C	887.89 µS/cm	1.61 mg/L	0.00 NTU	18.1 mV	
3/22/2021 2:35 PM	09:00	11.09 pH	17.23 °C	1,141.9 µS/cm	1.52 mg/L	0.00 NTU	15.3 mV	
3/22/2021 2:38 PM	12:00	11.10 pH	17.31 °C	1,149.9 µS/cm	1.51 mg/L	0.00 NTU	13.4 mV	
3/22/2021 2:41 PM	15:00	11.13 pH	17.38 °C	1,153.1 µS/cm	1.48 mg/L	0.00 NTU	12.1 mV	

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 3/22/2021 3:21:17 PM
Project: G111
Operator Name:

Location Name: G111	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 3:21 PM	00:00	7.67 pH	17.71 °C	575.33 µS/cm	8.13 mg/L	26.30 NTU	127.4 mV	
3/22/2021 3:24 PM	03:00	7.42 pH	17.45 °C	566.52 µS/cm	7.67 mg/L	0.00 NTU	143.6 mV	
3/22/2021 3:27 PM	06:00	7.41 pH	18.62 °C	336.00 µS/cm	7.91 mg/L	0.00 NTU	147.2 mV	
3/22/2021 3:30 PM	09:00	7.36 pH	17.05 °C	578.40 µS/cm	7.73 mg/L	0.00 NTU	152.6 mV	
3/22/2021 3:33 PM	12:00	7.35 pH	17.16 °C	321.89 µS/cm	7.76 mg/L	0.00 NTU	155.5 mV	
3/22/2021 3:36 PM	15:00	7.35 pH	16.95 °C	477.67 µS/cm	8.13 mg/L	0.00 NTU	157.6 mV	
3/22/2021 3:39 PM	18:00	7.33 pH	16.90 °C	495.22 µS/cm	7.98 mg/L	23.72 NTU	159.5 mV	
3/22/2021 3:42 PM	21:00	7.34 pH	16.75 °C	419.11 µS/cm	8.18 mg/L	54.10 NTU	159.8 mV	
3/22/2021 3:45 PM	24:00	7.34 pH	17.05 °C	37.37 µS/cm	8.17 mg/L	142.86 NTU	161.3 mV	
3/22/2021 3:48 PM	27:00	7.34 pH	17.49 °C	300.85 µS/cm	7.86 mg/L	173.47 NTU	161.1 mV	
3/22/2021 3:51 PM	30:00	7.33 pH	17.55 °C	574.67 µS/cm	8.26 mg/L	10.36 NTU	161.6 mV	
3/22/2021 3:54 PM	33:00	7.33 pH	17.76 °C	576.70 µS/cm	7.70 mg/L	31.75 NTU	161.4 mV	
3/22/2021 3:57 PM	36:00	7.33 pH	17.31 °C	574.31 µS/cm	7.69 mg/L	39.95 NTU	162.5 mV	
3/22/2021 4:00 PM	39:00	7.34 pH	17.13 °C	572.98 µS/cm	7.79 mg/L	75.56 NTU	162.1 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 3/22/2021 4:42:12 PM
Project: TPZ114
Operator Name:

Location Name: TPZ114	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 4:42 PM	00:00	7.42 pH	19.34 °C	458.51 µS/cm	7.33 mg/L	415.52 NTU	125.8 mV	
3/22/2021 4:45 PM	03:00	7.26 pH	19.94 °C	1.03 µS/cm	9.35 mg/L	897.80 NTU	127.5 mV	
3/22/2021 4:48 PM	06:00	7.32 pH	20.69 °C	0.93 µS/cm	9.10 mg/L	908.11 NTU	123.8 mV	
3/22/2021 4:51 PM	09:00	7.35 pH	21.28 °C	0.91 µS/cm	9.02 mg/L	878.53 NTU	122.2 mV	

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 3/22/2021 5:08:31 PM
Project: G112C
Operator Name:

Location Name: G112C	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 5:08 PM	00:00	7.04 pH	18.01 °C	568.16 µS/cm	1.56 mg/L	323.71 NTU	138.7 mV	
3/22/2021 5:11 PM	03:00	6.85 pH	16.66 °C	621.32 µS/cm	0.62 mg/L	123.24 NTU	147.0 mV	
3/22/2021 5:14 PM	06:00	6.84 pH	16.10 °C	618.25 µS/cm	0.65 mg/L	138.03 NTU	151.6 mV	
3/22/2021 5:17 PM	09:00	6.84 pH	15.62 °C	619.24 µS/cm	0.65 mg/L	129.44 NTU	154.5 mV	
3/22/2021 5:20 PM	12:00	6.84 pH	14.89 °C	1,291.5 µS/cm	0.65 mg/L	64.49 NTU	156.1 mV	
3/22/2021 5:23 PM	15:00	6.85 pH	14.77 °C	1,291.1 µS/cm	0.64 mg/L	61.36 NTU	157.1 mV	
3/22/2021 5:26 PM	18:00	6.85 pH	14.57 °C	1,293.5 µS/cm	0.74 mg/L	22.12 NTU	157.6 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 3/22/2021 6:22:56 PM
Project: TPZ117D
Operator Name:

Location Name: TPZ117D	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
3/22/2021 6:22 PM	00:00	7.03 pH	17.94 °C	661.80 µS/cm	3.05 mg/L	100.37 NTU	124.8 mV	
3/22/2021 6:25 PM	03:00	7.03 pH	17.42 °C	785.75 µS/cm	3.20 mg/L	0.00 NTU	78.1 mV	
3/22/2021 6:28 PM	06:00	7.03 pH	17.14 °C	768.07 µS/cm	3.21 mg/L	0.00 NTU	59.2 mV	
3/22/2021 6:31 PM	09:00	7.03 pH	17.01 °C	532.77 µS/cm	3.15 mg/L	0.00 NTU	48.8 mV	
3/22/2021 6:34 PM	12:00	7.05 pH	17.00 °C	761.38 µS/cm	3.06 mg/L	0.00 NTU	44.9 mV	
3/22/2021 6:37 PM	15:00	7.07 pH	16.94 °C	711.50 µS/cm	3.08 mg/L	0.00 NTU	42.1 mV	
3/22/2021 6:40 PM	18:00	7.07 pH	16.90 °C	537.76 µS/cm	3.12 mg/L	0.00 NTU	40.9 mV	
3/22/2021 6:43 PM	21:00	7.08 pH	16.88 °C	742.60 µS/cm	3.08 mg/L	0.00 NTU	36.8 mV	
3/22/2021 6:46 PM	24:00	7.09 pH	16.90 °C	270.51 µS/cm	3.09 mg/L	0.00 NTU	36.2 mV	

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Teklab Inc.
Environmental Laboratory

http://www.teklabinc.com/

April 01, 2021

Melissa Marra
Ramboll
300 S. Wacker Drive
Suite 130
Chicago, IL 60606
TEL: (262) 325-8052
FAX: (414) 837-3608

NELAP ACCREDITED TNI LABORATORY

Illinois	100226
Kansas	E-10374
Louisiana	05002
Louisiana	05003
Oklahoma	9978

RE: Vistra - Joppa West Additional Wells **WorkOrder:** 21031450

Dear Melissa Marra:

TEKLAB, INC received 10 samples on 3/23/2021 9:35:00 AM for the analysis presented in the following report.

Samples are analyzed on an as received basis unless otherwise requested and documented. The sample results contained in this report relate only to the requested analytes of interest as directed on the chain of custody. NELAP accredited fields of testing are indicated by the letters NELAP under the Certification column. Unless otherwise documented within this report, Teklab Inc. analyzes samples utilizing the most current methods in compliance with 40CFR. All tests are performed in the Collinsville, IL laboratory unless otherwise noted in the Case Narrative.

All quality control criteria applicable to the test methods employed for this project have been satisfactorily met and are in accordance with NELAP except where noted. The following report shall not be reproduced, except in full, without the written approval of Teklab, Inc.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Elizabeth A. Hurley

Elizabeth A. Hurley
Project Manager
(618)344-1004 ex 33
ehurley@teklabinc.com

Report Contents

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

This reporting package includes the following:

Definitions

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

Abbr	Definition
*	Analytes on report marked with an asterisk are not NELAP accredited
CCV	Continuing calibration verification is a check of a standard to determine the state of calibration of an instrument between recalibration.
CRQL	A Client Requested Quantitation Limit is a reporting limit that varies according to customer request. The CRQL may not be less than the MDL.
DF	Dilution factor is the dilution performed during analysis only and does not take into account any dilutions made during sample preparation. The reported result is final and includes all dilution factors.
DNI	Did not ignite
DUP	Laboratory duplicate is a replicate aliquot prepared under the same laboratory conditions and independently analyzed to obtain a measure of precision.
ICV	Initial calibration verification is a check of a standard to determine the state of calibration of an instrument before sample analysis is initiated.
IDPH	IL Dept. of Public Health
LCS	Laboratory control sample is a sample matrix, free from the analytes of interest,spiked with verified known amounts of analytes and analyzed exactly like a sample to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.
LCSD	Laboratory control sample duplicate is a replicate laboratory control sample that is prepared and analyzed in order to determine the precision of the approved test method. The acceptable recovery range is listed in the QC Package (provided upon request).
MBLK	Method blank is a sample of a matrix similar to the batch of associated sample (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences should present at concentrations that impact the analytical results for sample analyses.
MDL	"The method detection limit is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results."
MS	Matrix spike is an aliquot of matrix fortified (spiked) with known quantities of specific analytes that is subjected to the entire analytical procedures in order to determine the effect of the matrix on an approved test method's recovery system. The acceptable recovery range is listed in the QC Package (provided upon request).
MSD	Matrix spike duplicate means a replicate matrix spike that is prepared and analyzed in order to determine the precision of the approved test method. The acceptable recovery range is listed in the QC Package (provided upon request).
MW	Molecular weight
NC	Data is not acceptable for compliance purposes
ND	Not Detected at the Reporting Limit
NELAP	NELAP Accredited
PQL	Practical quantitation limit means the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operation conditions.
RL	The reporting limit the lowest level that the data is displayed in the final report. The reporting limit may vary according to customer request or sample dilution. The reporting limit may not be less than the MDL.
RPD	Relative percent difference is a calculated difference between two recoveries (ie. MS/MSD). The acceptable recovery limit is listed in the QC Package (provided upon request).
SPK	The spike is a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery deficiency or for other quality control purposes.
Surr	Surrogates are compounds which are similar to the analytes of interest in chemical composition and behavior in the analytical process, but which are not normally found in environmental samples.
TIC	Tentatively identified compound: Analytes tentatively identified in the sample by using a library search. Only results not in the calibration standard will be reported as tentatively identified compounds. Results for tentatively identified compounds that are not present in the calibration standard, but are assigned a specific chemical name based upon the library search, are calculated using total peak areas from reconstructed ion chromatograms and a response factor of one. The nearest Internal Standard is used for the calculation. The results of any TICs must be considered estimated, and are flagged with a "T". If the estimated result is above the calibration range it is flagged "ET"
TNTC	Too numerous to count (> 200 CFU)

Definitions

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

Qualifiers

# -	Unknown hydrocarbon
C -	RL shown is a Client Requested Quantitation Limit
H -	Holding times exceeded
J -	Analyte detected below quantitation limits
ND -	Not Detected at the Reporting Limit
S -	Spike Recovery outside recovery limits
X -	Value exceeds Maximum Contaminant Level
B -	Analyte detected in associated Method Blank
E -	Value above quantitation range
I -	Associated internal standard was outside method criteria
M -	Manual Integration used to determine area response
R -	RPD outside accepted recovery limits
T -	TIC(Tentatively identified compound)

Teklab, Inc.
Environmental Laboratory

Case Narrative

http://www.teklabinc.com/

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

Cooler Receipt Temp: 1.4 °C

Per Brian Hennings, cancel Ra226/228 analyses. (ehurley - 3/23/2021 11:17:01 AM)

This report was revised on April 1, 2021 per Brian Hennings' request. The reason for the revision is include results for Iron and Manganese. Please replace report dated March 26, 2021 with this report. EAH 4/1/21

Locations

Collinsville

Address 5445 Horseshoe Lake Road
Collinsville, IL 62234-7425
Phone (618) 344-1004
Fax (618) 344-1005
Email jhriley@teklabinc.com

Springfield

Address 3920 Pintail Dr
Springfield, IL 62711-9415
Phone (217) 698-1004
Fax (217) 698-1005
Email KKlostermann@teklabinc.com

Kansas City

Address 8421 Nieman Road
Lenexa, KS 66214
Phone (913) 541-1998
Fax (913) 541-1998
Email jhriley@teklabinc.com

Collinsville Air

Address 5445 Horseshoe Lake Road
Collinsville, IL 62234-7425
Phone (618) 344-1004
Fax (618) 344-1005
Email EHurley@teklabinc.com

Chicago

Address 1319 Butterfield Rd.
Downers Grove, IL 60515
Phone (630) 324-6855
Fax
Email arenner@teklabinc.com

Accreditations

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

State	Dept	Cert #	NELAP	Exp Date	Lab
Illinois	IEPA	100226	NELAP	1/31/2022	Collinsville
Kansas	KDHE	E-10374	NELAP	4/30/2021	Collinsville
Louisiana	LDEQ	05002	NELAP	6/30/2021	Collinsville
Louisiana	LDEQ	05003	NELAP	6/30/2021	Collinsville
Oklahoma	ODEQ	9978	NELAP	8/31/2021	Collinsville
Arkansas	ADEQ	88-0966		3/14/2022	Collinsville
Illinois	IDPH	17584		5/31/2021	Collinsville
Kentucky	UST	0073		1/31/2022	Collinsville
Missouri	MDNR	00930		5/31/2021	Collinsville
Missouri	MDNR	930		1/31/2022	Collinsville

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-001
Client Sample ID: G101
Matrix: GROUNDWATER
Collection Date: 03/22/2021 11:57

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**246**	mg/L	1	03/23/2021 13:13	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:13	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**358**	mg/L	1	03/23/2021 15:35	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	10		**39**	mg/L	1	03/24/2021 11:36	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.23**	mg/L	1	03/23/2021 13:01	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**7**	mg/L	1	03/24/2021 11:36	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:17	175064
Barium	NELAP	0.0025		**0.114**	mg/L	1	03/24/2021 19:17	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:17	175064
Boron	NELAP	0.020	J	**0.015**	mg/L	1	03/25/2021 13:07	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:17	175064
Calcium	NELAP	0.100		**22.6**	mg/L	1	03/24/2021 19:17	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:17	175064
Cobalt	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:17	175064
Iron	NELAP	0.0400		**0.468**	mg/L	1	03/24/2021 19:17	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:17	175064
Lithium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:17	175064
Magnesium	NELAP	0.0500		**7.65**	mg/L	1	03/24/2021 19:17	175064
Manganese	NELAP	0.0070		**0.0249**	mg/L	1	03/24/2021 19:17	175064
Molybdenum	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:17	175064
Potassium	NELAP	0.100		**0.870**	mg/L	1	03/24/2021 19:17	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:17	175064
Sodium	NELAP	0.0500		**98.7**	mg/L	1	03/24/2021 19:17	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**< 0.0010**	mg/L	5	03/24/2021 15:07	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 15:07	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 12:22	175073

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-002
Client Sample ID: TPZ116
Matrix: GROUNDWATER
Collection Date: 03/22/2021 13:04

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**173**	mg/L	1	03/23/2021 13:20	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:20	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**292**	mg/L	1	03/23/2021 15:35	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	10		**24**	mg/L	1	03/24/2021 11:44	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.36**	mg/L	1	03/23/2021 13:03	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**9**	mg/L	1	03/24/2021 11:44	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:20	175064
Barium	NELAP	0.0025		**0.510**	mg/L	1	03/24/2021 19:20	175064
Beryllium	NELAP	0.0005		**0.0006**	mg/L	1	03/24/2021 19:20	175064
Boron	NELAP	0.0200		**< 0.0200**	mg/L	1	03/25/2021 13:13	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:20	175064
Calcium	NELAP	0.100		**46.9**	mg/L	1	03/24/2021 19:20	175064
Chromium	NELAP	0.0050		**0.0124**	mg/L	1	03/24/2021 19:20	175064
Cobalt	NELAP	0.0050	J	**0.0031**	mg/L	1	03/24/2021 19:20	175064
Iron	NELAP	0.0400		**4.44**	mg/L	1	03/24/2021 19:20	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:20	175064
Lithium	NELAP	0.0050		**0.0308**	mg/L	1	03/24/2021 19:20	175064
Magnesium	NELAP	0.0500		**13.6**	mg/L	1	03/24/2021 19:20	175064
Manganese	NELAP	0.0070		**0.0806**	mg/L	1	03/24/2021 19:20	175064
Molybdenum	NELAP	0.010	J	**0.0043**	mg/L	1	03/24/2021 19:20	175064
Potassium	NELAP	0.100		**0.967**	mg/L	1	03/24/2021 19:20	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:20	175064
Sodium	NELAP	0.0500		**34.9**	mg/L	1	03/24/2021 19:20	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010	J	**0.0007**	mg/L	5	03/24/2021 15:25	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 15:25	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:04	175073

Laboratory Results

Client: Ramboll **Work Order:** 21031450

Client Project: Vistra - Joppa West Additional Wells **Report Date:** 01-Apr-21

Lab ID: 21031450-003 **Client Sample ID:** G113

Matrix: GROUNDWATER **Collection Date:** 03/22/2021 13:59

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**422**	mg/L	1	03/23/2021 13:25	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:25	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**870**	mg/L	1	03/23/2021 15:36	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	200		**292**	mg/L	20	03/24/2021 13:54	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.36**	mg/L	1	03/23/2021 13:04	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**19**	mg/L	1	03/24/2021 11:52	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:24	175064
Barium	NELAP	0.0025		**0.108**	mg/L	1	03/24/2021 19:24	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:24	175064
Boron	NELAP	0.0200		**< 0.0200**	mg/L	1	03/25/2021 13:17	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:24	175064
Calcium	NELAP	0.100		**109**	mg/L	1	03/24/2021 19:24	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:24	175064
Cobalt	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:24	175064
Iron	NELAP	0.0400		**0.484**	mg/L	1	03/24/2021 19:24	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:24	175064
Lithium	NELAP	0.0050		**0.0051**	mg/L	1	03/24/2021 19:24	175064
Magnesium	NELAP	0.0500		**51.3**	mg/L	1	03/24/2021 19:24	175064
Manganese	NELAP	0.0070		**0.0095**	mg/L	1	03/24/2021 19:24	175064
Molybdenum	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:24	175064
Potassium	NELAP	0.100		**0.500**	mg/L	1	03/24/2021 19:24	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:24	175064
Sodium	NELAP	0.0500		**140**	mg/L	1	03/24/2021 19:24	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**< 0.0010**	mg/L	5	03/24/2021 15:42	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 15:42	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:06	175073

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-004
Client Sample ID: XTPW01
Matrix: GROUNDWATER
Collection Date: 03/22/2021 14:41

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:33	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**55**	mg/L	1	03/23/2021 13:33	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**824**	mg/L	1	03/23/2021 15:36	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	200		**387**	mg/L	20	03/24/2021 14:34	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10	J	**0.05**	mg/L	1	03/23/2021 13:06	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**2**	mg/L	1	03/24/2021 12:00	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**0.0298**	mg/L	1	03/25/2021 14:29	175064
Barium	NELAP	0.0025		**0.0776**	mg/L	1	03/24/2021 19:28	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:28	175064
Boron	NELAP	0.200		**27.0**	mg/L	10	03/25/2021 13:22	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:28	175064
Calcium	NELAP	0.100		**235**	mg/L	1	03/24/2021 19:28	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:28	175064
Cobalt	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:28	175064
Iron	NELAP	0.0400		**0.0998**	mg/L	1	03/24/2021 19:28	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:28	175064
Lithium	NELAP	0.0050		**0.121**	mg/L	1	03/24/2021 19:28	175064
Magnesium	NELAP	0.0500		**0.122**	mg/L	1	03/24/2021 19:28	175064
Manganese	NELAP	0.0070	J	**0.0025**	mg/L	1	03/24/2021 19:28	175064
Molybdenum	NELAP	0.0100		**0.280**	mg/L	1	03/24/2021 19:28	175064
Potassium	NELAP	1.00		**15.4**	mg/L	10	03/25/2021 13:22	175064
Selenium	NELAP	0.0400		**0.0937**	mg/L	1	03/24/2021 19:28	175064
Sodium	NELAP	0.0500		**6.49**	mg/L	1	03/24/2021 19:28	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**0.0036**	mg/L	5	03/24/2021 16:00	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 16:00	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:08	175073

Laboratory Results

Client: Ramboll **Work Order:** 21031450

Client Project: Vistra - Joppa West Additional Wells **Report Date:** 01-Apr-21

Lab ID: 21031450-005 **Client Sample ID:** QA/QC 1

Matrix: GROUNDWATER **Collection Date:** 03/22/2021 14:46

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:40	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**56**	mg/L	1	03/23/2021 13:40	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**828**	mg/L	1	03/23/2021 15:37	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	200		**388**	mg/L	20	03/24/2021 14:37	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10	J	**0.04**	mg/L	1	03/23/2021 13:08	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**2**	mg/L	1	03/24/2021 12:08	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**0.0363**	mg/L	1	03/24/2021 19:31	175064
Barium	NELAP	0.0025		**0.0767**	mg/L	1	03/24/2021 19:31	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:31	175064
Boron	NELAP	0.200		**26.8**	mg/L	10	03/25/2021 13:27	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:31	175064
Calcium	NELAP	0.100		**236**	mg/L	1	03/24/2021 19:31	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:31	175064
Cobalt	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:31	175064
Iron	NELAP	0.040	J	**0.032**	mg/L	1	03/24/2021 19:31	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:31	175064
Lithium	NELAP	0.0050		**0.122**	mg/L	1	03/24/2021 19:31	175064
Magnesium	NELAP	0.0500		**0.0987**	mg/L	1	03/24/2021 19:31	175064
Manganese	NELAP	0.0070		**< 0.0070**	mg/L	1	03/24/2021 19:31	175064
Molybdenum	NELAP	0.0100		**0.282**	mg/L	1	03/24/2021 19:31	175064
Potassium	NELAP	1.00		**15.6**	mg/L	10	03/25/2021 13:27	175064
Selenium	NELAP	0.0400		**0.0869**	mg/L	1	03/24/2021 19:31	175064
Sodium	NELAP	0.0500		**6.29**	mg/L	1	03/24/2021 19:31	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**0.0042**	mg/L	5	03/24/2021 16:17	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 16:17	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:10	175073

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-006
Client Sample ID: G111
Matrix: GROUNDWATER
Collection Date: 03/22/2021 16:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**253**	mg/L	1	03/23/2021 13:47	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:47	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**364**	mg/L	1	03/23/2021 15:37	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	10		**17**	mg/L	1	03/24/2021 12:32	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.66**	mg/L	1	03/23/2021 13:11	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**10**	mg/L	1	03/24/2021 12:32	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:35	175064
Barium	NELAP	0.0025		**0.207**	mg/L	1	03/24/2021 19:35	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:35	175064
Boron	NELAP	0.0200		**< 0.0200**	mg/L	1	03/25/2021 13:37	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:35	175064
Calcium	NELAP	0.100		**23.4**	mg/L	1	03/24/2021 19:35	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:35	175064
Cobalt	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:35	175064
Iron	NELAP	0.0400		**0.628**	mg/L	1	03/24/2021 19:35	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:35	175064
Lithium	NELAP	0.0050	J	**0.0022**	mg/L	1	03/24/2021 19:35	175064
Magnesium	NELAP	0.0500		**9.48**	mg/L	1	03/24/2021 19:35	175064
Manganese	NELAP	0.0070	J	**0.0066**	mg/L	1	03/24/2021 19:35	175064
Molybdenum	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:35	175064
Potassium	NELAP	0.100		**0.229**	mg/L	1	03/24/2021 19:35	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:35	175064
Sodium	NELAP	0.0500		**98.1**	mg/L	1	03/24/2021 19:35	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010	J	**0.0005**	mg/L	5	03/24/2021 16:34	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 16:34	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:13	175073

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-007
Client Sample ID: TPZ114
Matrix: GROUNDWATER
Collection Date: 03/22/2021 16:41

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**214**	mg/L	1	03/23/2021 13:53	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 13:53	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**306**	mg/L	1	03/23/2021 15:37	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	10		**19**	mg/L	1	03/24/2021 12:40	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.32**	mg/L	1	03/23/2021 13:13	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**11**	mg/L	1	03/24/2021 12:40	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**0.0169**	mg/L	1	03/24/2021 19:54	175064
Barium	NELAP	0.0025		**0.365**	mg/L	1	03/24/2021 19:54	175064
Beryllium	NELAP	0.0005		**0.0013**	mg/L	1	03/24/2021 19:54	175064
Boron	NELAP	0.0200		**0.177**	mg/L	1	03/25/2021 13:41	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:54	175064
Calcium	NELAP	0.100		**53.1**	mg/L	1	03/24/2021 19:54	175064
Chromium	NELAP	0.0050		**0.0315**	mg/L	1	03/24/2021 19:54	175064
Cobalt	NELAP	0.0050		**0.0074**	mg/L	1	03/24/2021 19:54	175064
Iron	NELAP	0.0400		**19.6**	mg/L	1	03/24/2021 19:54	175064
Lead	NELAP	0.0075		**0.0213**	mg/L	1	03/24/2021 19:54	175064
Lithium	NELAP	0.0050		**0.0352**	mg/L	1	03/24/2021 19:54	175064
Magnesium	NELAP	0.0500		**15.4**	mg/L	1	03/24/2021 19:54	175064
Manganese	NELAP	0.0070		**0.476**	mg/L	1	03/24/2021 19:54	175064
Molybdenum	NELAP	0.010	J	**0.0081**	mg/L	1	03/24/2021 19:54	175064
Potassium	NELAP	0.100		**2.81**	mg/L	1	03/24/2021 19:54	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:54	175064
Sodium	NELAP	0.0500		**30.6**	mg/L	1	03/24/2021 19:54	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010	J	**0.0008**	mg/L	5	03/24/2021 16:52	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 16:52	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:15	175073

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

Lab ID: 21031450-008

Client Sample ID: G112C

Matrix: GROUNDWATER

Collection Date: 03/22/2021 17:25

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**148**	mg/L	1	03/23/2021 14:00	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 14:00	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**1010**	mg/L	1	03/23/2021 15:38	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	200		**532**	mg/L	20	03/24/2021 14:40	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.60**	mg/L	1	03/23/2021 13:15	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**7**	mg/L	1	03/24/2021 12:48	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 19:57	175064
Barium	NELAP	0.0025		**0.0845**	mg/L	1	03/24/2021 19:57	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 19:57	175064
Boron	NELAP	0.0200		**4.25**	mg/L	1	03/25/2021 14:25	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 19:57	175064
Calcium	NELAP	0.100		**165**	mg/L	1	03/24/2021 19:57	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 19:57	175064
Cobalt	NELAP	0.0050		**0.0117**	mg/L	1	03/24/2021 19:57	175064
Iron	NELAP	0.0400		**0.939**	mg/L	1	03/24/2021 19:57	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 19:57	175064
Lithium	NELAP	0.0050		**0.0133**	mg/L	1	03/24/2021 19:57	175064
Magnesium	NELAP	0.0500		**68.2**	mg/L	1	03/24/2021 19:57	175064
Manganese	NELAP	0.0070		**0.398**	mg/L	1	03/24/2021 19:57	175064
Molybdenum	NELAP	0.010	J	**0.0092**	mg/L	1	03/24/2021 19:57	175064
Potassium	NELAP	0.100		**0.159**	mg/L	1	03/24/2021 19:57	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 19:57	175064
Sodium	NELAP	0.0500		**23.9**	mg/L	1	03/24/2021 19:57	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**< 0.0010**	mg/L	5	03/24/2021 17:09	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 17:09	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 13:17	175073

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-009
Client Sample ID: TPZ117
Matrix: GROUNDWATER
Collection Date: 03/22/2021 19:01

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**180**	mg/L	1	03/23/2021 14:05	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 14:05	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**284**	mg/L	1	03/23/2021 15:38	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	10		**32**	mg/L	1	03/24/2021 12:56	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.30**	mg/L	1	03/23/2021 13:17	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	1		**8**	mg/L	1	03/24/2021 12:56	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**0.0198**	mg/L	1	03/24/2021 20:01	175064
Barium	NELAP	0.0025		**0.515**	mg/L	1	03/24/2021 20:01	175064
Beryllium	NELAP	0.0005		**0.0054**	mg/L	1	03/24/2021 20:01	175064
Boron	NELAP	0.0200		**< 0.0200**	mg/L	1	03/25/2021 14:07	175064
Cadmium	NELAP	0.0020	J	**0.0009**	mg/L	1	03/24/2021 20:01	175064
Calcium	NELAP	0.100		**55.4**	mg/L	1	03/24/2021 20:01	175064
Chromium	NELAP	0.0050		**0.0987**	mg/L	1	03/24/2021 20:01	175064
Cobalt	NELAP	0.0050		**0.0381**	mg/L	1	03/24/2021 20:01	175064
Iron	NELAP	0.0400		**71.6**	mg/L	1	03/24/2021 20:01	175064
Lead	NELAP	0.0075		**0.0386**	mg/L	1	03/24/2021 20:01	175064
Lithium	NELAP	0.0050		**0.0219**	mg/L	1	03/24/2021 20:01	175064
Magnesium	NELAP	0.0500		**18.8**	mg/L	1	03/24/2021 20:01	175064
Manganese	NELAP	0.0070		**0.761**	mg/L	1	03/24/2021 20:01	175064
Molybdenum	NELAP	0.010	J	**0.0039**	mg/L	1	03/24/2021 20:01	175064
Potassium	NELAP	0.100		**7.01**	mg/L	1	03/24/2021 20:01	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 20:01	175064
Sodium	NELAP	0.0500		**34.5**	mg/L	1	03/24/2021 20:01	175064
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**0.0051**	mg/L	5	03/24/2021 18:28	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 18:28	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 10:44	175073

Laboratory Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21
Lab ID: 21031450-010
Client Sample ID: TPZ117D
Matrix: GROUNDWATER
Collection Date: 03/22/2021 18:47

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
STANDARD METHODS 2320 B (TOTAL) 1997								
Alkalinity, Bicarbonate (as CaCO3)	NELAP	0		**261**	mg/L	1	03/23/2021 14:11	R288858
STANDARD METHODS 2320 B 1997								
Alkalinity, Carbonate (as CaCO3)	NELAP	0		**0**	mg/L	1	03/23/2021 14:11	R288858
STANDARD METHODS 2540 C (TOTAL) 1997								
Total Dissolved Solids	NELAP	20		**318**	mg/L	1	03/23/2021 15:38	R288890
SW-846 9036 (TOTAL)								
Sulfate	NELAP	50		**187**	mg/L	5	03/24/2021 13:30	R288888
SW-846 9214 (TOTAL)								
Fluoride	NELAP	0.10		**0.27**	mg/L	1	03/23/2021 13:24	R288833
SW-846 9251 (TOTAL)								
Chloride	NELAP	5		**11**	mg/L	5	03/24/2021 13:30	R288889
SW-846 3005A, 6010B, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0100		**< 0.0100**	mg/L	1	03/24/2021 20:05	175064
Barium	NELAP	0.0025		**0.271**	mg/L	1	03/24/2021 20:05	175064
Beryllium	NELAP	0.0005		**< 0.0005**	mg/L	1	03/24/2021 20:05	175064
Boron	NELAP	0.0200		**0.0763**	mg/L	1	03/25/2021 14:13	175064
Cadmium	NELAP	0.0020		**< 0.0020**	mg/L	1	03/24/2021 20:05	175064
Calcium	NELAP	0.100	S	**81.4**	mg/L	1	03/24/2021 20:05	175064
Chromium	NELAP	0.0050		**< 0.0050**	mg/L	1	03/24/2021 20:05	175064
Cobalt	NELAP	0.0050		**0.0052**	mg/L	1	03/24/2021 20:05	175064
Iron	NELAP	0.0400		**0.277**	mg/L	1	03/24/2021 20:05	175064
Lead	NELAP	0.0075		**< 0.0075**	mg/L	1	03/24/2021 20:05	175064
Lithium	NELAP	0.0050		**0.0193**	mg/L	1	03/24/2021 20:05	175064
Magnesium	NELAP	0.0500		**19.3**	mg/L	1	03/24/2021 20:05	175064
Manganese	NELAP	0.0070		**0.922**	mg/L	1	03/24/2021 20:05	175064
Molybdenum	NELAP	0.010	J	**0.0059**	mg/L	1	03/24/2021 20:05	175064
Potassium	NELAP	0.100		**1.41**	mg/L	1	03/24/2021 20:05	175064
Selenium	NELAP	0.0400		**< 0.0400**	mg/L	1	03/24/2021 20:05	175064
Sodium	NELAP	0.0500		**15.8**	mg/L	1	03/24/2021 20:05	175064
Matrix spike control limits for Ca are not applicable due to high sample/spike ratio.								
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Antimony	NELAP	0.0010		**0.0053**	mg/L	5	03/24/2021 18:45	175067
Thallium	NELAP	0.0020		**< 0.0020**	mg/L	5	03/24/2021 18:45	175067
SW-846 7470A (TOTAL)								
Mercury	NELAP	0.00020		**< 0.00020**	mg/L	1	03/24/2021 10:47	175073

Quality Control Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

STANDARD METHODS 2540 C (TOTAL) 1997

Batch **R288890** **SampType:** **MBLK** Units **mg/L**
SampID: MBLK

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Total Dissolved Solids		20		**< 20**	16.00	0	0	-100	100	03/23/2021
Total Dissolved Solids		20	J	**16**	16.00	0	100.0	-100	100	03/22/2021
Total Dissolved Solids		20		**< 20**	16.00	0	0	-100	100	03/22/2021
Total Dissolved Solids		20		**< 20**	16.00	0	0	-100	100	03/22/2021
Total Dissolved Solids		20		**< 20**	16.00	0	0	-100	100	03/23/2021

Batch **R288890** **SampType:** **LCS** Units **mg/L**
SampID: LCS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Total Dissolved Solids		20		**962**	1000	0	96.2	90	110	03/22/2021
Total Dissolved Solids		20		**942**	1000	0	94.2	90	110	03/23/2021
Total Dissolved Solids		20		**950**	1000	0	95.0	90	110	03/22/2021
Total Dissolved Solids		20		**946**	1000	0	94.6	90	110	03/23/2021
Total Dissolved Solids		20		**968**	1000	0	96.8	90	110	03/22/2021

Batch **R288890** **SampType:** **DUP** Units **mg/L** RPD Limit **5**
SampID: 21031450-010ADUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**334**				318.0	4.91	03/23/2021

Batch **R288890** **SampType:** **DUP** Units **mg/L** RPD Limit **5**
SampID: 21030007-002BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**540**				548.0	1.47	03/23/2021

Batch **R288890** **SampType:** **DUP** Units **mg/L** RPD Limit **5**
SampID: 21030010-002BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**508**				506.0	0.39	03/22/2021

Batch **R288890** **SampType:** **DUP** Units **mg/L** RPD Limit **5**
SampID: 21030011-004BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**548**				560.0	2.17	03/22/2021

Client: Ramboll
Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450
Report Date: 01-Apr-21

STANDARD METHODS 2540 C (TOTAL) 1997

Batch R288890 **SampType:** DUP Units **mg/L** RPD Limit **5**
SampID: 21030016-001BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**622**				636.0	2.23	03/22/2021

Batch R288890 **SampType:** DUP Units **mg/L** RPD Limit **5**
SampID: 21031251-011BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**504**				500.0	0.80	03/23/2021

Batch R288890 **SampType:** DUP Units **mg/L** RPD Limit **5**
SampID: 21031337-005BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**1470**				1440	2.20	03/23/2021

Batch R288890 **SampType:** DUP Units **mg/L** RPD Limit **5**
SampID: 21031337-007BDUP

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Total Dissolved Solids		20		**626**				616.0	1.61	03/22/2021

SW-846 9036 (TOTAL)

Batch R288888 **SampType:** MBLK Units **mg/L**
SampID: ICB/MBLK

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		10		**< 10**	6.140	0	0	-100	100	03/24/2021

Batch R288888 **SampType:** LCS Units **mg/L**
SampID: ICV/LCS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		10		**20**	20.00	0	99.8	90	110	03/24/2021

Batch R288888 **SampType:** MS Units **mg/L**
SampID: 21030016-004BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		50		**192**	100.0	95.04	96.7	85	115	03/24/2021

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

SW-846 9036 (TOTAL)

Batch R288888 **SampType:** MSD Units **mg/L** RPD Limit **10**

SampID: 21030016-004BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		50		**192**	100.0	95.04	96.8	191.8	0.05	03/24/2021

Batch R288888 **SampType:** MS Units **mg/L**

SampID: 21030016-009BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		40		**163**	80.00	84.07	99.2	85	115	03/24/2021

Batch R288888 **SampType:** MSD Units **mg/L** RPD Limit **10**

SampID: 21030016-009BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		40		**165**	80.00	84.07	101.7	163.5	1.20	03/24/2021

Batch R288888 **SampType:** MS Units **mg/L**

SampID: 21030017-004BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		50		**192**	100.0	95.04	96.7	85	115	03/24/2021

Batch R288888 **SampType:** MSD Units **mg/L** RPD Limit **10**

SampID: 21030017-004BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		50		**192**	100.0	95.04	96.8	191.8	0.05	03/24/2021

Batch R288888 **SampType:** MS Units **mg/L**

SampID: 21030017-009BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		40		**163**	80.00	84.07	99.2	85	115	03/24/2021

Batch R288888 **SampType:** MSD Units **mg/L** RPD Limit **10**

SampID: 21030017-009BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		40		**165**	80.00	84.07	101.7	163.5	1.20	03/24/2021

Batch R288888 **SampType:** MS Units **mg/L**

SampID: 21031350-001AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		40		**155**	80.00	73.22	102.6	85	115	03/24/2021

Quality Control Results

Client: Ramboll **Work Order:** 21031450

Client Project: Vistra - Joppa West Additional Wells **Report Date:** 01-Apr-21

SW-846 9036 (TOTAL)

Batch R288888 **SampType:** **MSD** Units **mg/L** RPD Limit **10**

SampID: 21031350-001AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		40		**155**	80.00	73.22	101.7	155.3	0.45	03/24/2021

Batch R288888 **SampType:** **MS** Units **mg/L**

SampID: 21031450-010AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		50	E	**288**	100.0	186.7	101.0	85	115	03/24/2021

Batch R288888 **SampType:** **MSD** Units **mg/L** RPD Limit **10**

SampID: 21031450-010AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		50	E	**288**	100.0	186.7	101.4	287.7	0.14	03/24/2021

Batch R288888 **SampType:** **MS** Units **mg/L**

SampID: 21031452-024AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		40		**149**	80.00	70.20	99.0	85	115	03/24/2021

Batch R288888 **SampType:** **MSD** Units **mg/L** RPD Limit **10**

SampID: 21031452-024AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		40		**149**	80.00	70.20	98.6	149.4	0.20	03/24/2021

Batch R288888 **SampType:** **MS** Units **mg/L**

SampID: 21031452-026AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		50		**224**	100.0	126.6	97.2	85	115	03/24/2021

Batch R288888 **SampType:** **MSD** Units **mg/L** RPD Limit **10**

SampID: 21031452-026AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		50		**227**	100.0	126.6	100.6	223.8	1.49	03/24/2021

Batch R288888 **SampType:** **MS** Units **mg/L**

SampID: 21031567-001AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Sulfate		200		**745**	400.0	338.0	101.8	85	115	03/24/2021

SW-846 9036 (TOTAL)

Batch **R288888** **SampType:** **MSD** Units **mg/L** RPD Limit **10**

SampID: 21031567-001AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Sulfate		200		**741**	400.0	338.0	100.8	745.1	0.54	03/24/2021

SW-846 9214 (TOTAL)

Batch **R288833** **SampType:** **MBLK** Units **mg/L**

SampID: MBLK

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**< 0.10**	0.0070	0	0	-100	100	03/22/2021

Batch **R288833** **SampType:** **LCS** Units **mg/L**

SampID: LCS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**1.02**	1.000	0	102.1	90	110	03/22/2021

Batch **R288833** **SampType:** **MS** Units **mg/L**

SampID: 21030007-001BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1130	104.1	75	125	03/22/2021

Batch **R288833** **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030007-001BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1130	104.6	2.195	0.45	03/22/2021

Batch **R288833** **SampType:** **MS** Units **mg/L**

SampID: 21030007-009BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.21**	2.000	0.1610	102.6	75	125	03/22/2021

Batch **R288833** **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030007-009BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.22**	2.000	0.1610	103.0	2.214	0.36	03/22/2021

Client: Ramboll

Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells

Report Date: 01-Apr-21

SW-846 9214 (TOTAL)

Batch R288833 **SampType:** MS Units **mg/L**

SampID: 21030009-003BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1290	103.6	75	125	03/22/2021

Batch R288833 **SampType:** MSD Units **mg/L** RPD Limit **15**

SampID: 21030009-003BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1290	103.6	2.200	0.09	03/22/2021

Batch R288833 **SampType:** MS Units **mg/L**

SampID: 21030010-001BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.12**	2.000	0.1600	98.0	75	125	03/22/2021

Batch R288833 **SampType:** MSD Units **mg/L** RPD Limit **15**

SampID: 21030010-001BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1600	102.0	2.119	3.71	03/22/2021

Batch R288833 **SampType:** MS Units **mg/L**

SampID: 21030011-005BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.18**	2.000	0.1290	102.3	75	125	03/22/2021

Batch R288833 **SampType:** MSD Units **mg/L** RPD Limit **15**

SampID: 21030011-005BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.18**	2.000	0.1290	102.8	2.175	0.46	03/22/2021

Batch R288833 **SampType:** MS Units **mg/L**

SampID: 21030015-005BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.16**	2.000	0.1090	102.6	75	125	03/22/2021

Batch R288833 **SampType:** MSD Units **mg/L** RPD Limit **15**

SampID: 21030015-005BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.16**	2.000	0.1090	102.4	2.160	0.19	03/22/2021

Quality Control Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

SW-846 9214 (TOTAL)

Batch **R288833** **SampType:** **MS** Units **mg/L**
SampID: 21030016-002BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.22**	2.000	0.1600	102.8	75	125	03/22/2021

Batch **R288833** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21030016-002BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.24**	2.000	0.1600	103.8	2.217	0.85	03/22/2021

Batch **R288833** **SampType:** **MS** Units **mg/L**
SampID: 21030016-016BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.19**	2.000	0.1200	103.6	75	125	03/22/2021

Batch **R288833** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21030016-016BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.20**	2.000	0.1200	103.8	2.193	0.14	03/22/2021

Batch **R288833** **SampType:** **MS** Units **mg/L**
SampID: 21031450-010AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Fluoride		0.10		**2.46**	2.000	0.2660	109.8	75	125	03/23/2021

Batch **R288833** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21031450-010AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Fluoride		0.10		**2.38**	2.000	0.2660	105.6	2.461	3.43	03/23/2021

SW-846 9251 (TOTAL)

Batch **R288889** **SampType:** **MBLK** Units **mg/L**
SampID: ICB/MBLK

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		1		**< 1**	0.5000	0	0	-100	100	03/24/2021

Quality Control Results

Client: Ramboll

Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450

Report Date: 01-Apr-21

SW-846 9251 (TOTAL)

Batch **R288889** **SampType:** **LCS** Units **mg/L**

SampID: ICV/LCS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		1		**20**	20.00	0	99.2	90	110	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**

SampID: 21030010-007BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	85	115	03/24/2021

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030010-007BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	985.9	0.00	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**

SampID: 21030011-011BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	85	115	03/24/2021

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030011-011BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	985.9	0.00	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**

SampID: 21030015-007BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	85	115	03/24/2021

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030015-007BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		40		**986**	800.0	278.3	88.4	985.9	0.00	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**

SampID: 21030016-004BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		10		**262**	200.0	90.40	85.7	85	115	03/24/2021

Quality Control Results

Client: Ramboll **Work Order:** 21031450

Client Project: Vistra - Joppa West Additional Wells **Report Date:** 01-Apr-21

SW-846 9251 (TOTAL)

Batch R288889 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030016-004BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		10		**272**	200.0	90.40	91.0	261.9	3.90	03/24/2021

Batch R288889 **SampType:** **MS** Units **mg/L**

SampID: 21030016-009BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		4		**164**	80.00	94.00	87.2	85	115	03/24/2021

Batch R288889 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030016-009BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		4		**163**	80.00	94.00	86.0	163.8	0.56	03/24/2021

Batch R288889 **SampType:** **MS** Units **mg/L**

SampID: 21030017-004BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		10		**262**	200.0	90.40	85.7	85	115	03/24/2021

Batch R288889 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030017-004BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		10		**272**	200.0	90.40	91.0	261.9	3.90	03/24/2021

Batch R288889 **SampType:** **MS** Units **mg/L**

SampID: 21030017-009BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		4		**164**	80.00	94.00	87.2	85	115	03/24/2021

Batch R288889 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21030017-009BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		4		**163**	80.00	94.00	86.0	163.8	0.56	03/24/2021

Batch R288889 **SampType:** **MS** Units **mg/L**

SampID: 21031450-010AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		5		**100**	100.0	10.57	88.9	85	115	03/24/2021

Quality Control Results

Client: Ramboll
Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450
Report Date: 01-Apr-21

SW-846 9251 (TOTAL)

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21031450-010AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		5		**100**	100.0	10.57	89.4	99.51	0.45	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**
SampID: 21031452-024AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		4		**156**	80.00	87.58	86.0	85	115	03/24/2021

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21031452-024AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		4		**157**	80.00	87.58	86.6	156.4	0.29	03/24/2021

Batch **R288889** **SampType:** **MS** Units **mg/L**
SampID: 21031452-026AMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Chloride		5		**179**	100.0	90.65	87.9	85	115	03/24/2021

Batch **R288889** **SampType:** **MSD** Units **mg/L** RPD Limit **15**
SampID: 21031452-026AMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Chloride		5		**178**	100.0	90.65	87.0	178.6	0.55	03/24/2021

Quality Control Results

Client: Ramboll

Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450

Report Date: 01-Apr-21

SW-846 3005A, 6010B, METALS BY ICP (TOTAL)

Batch 175064 **SampType:** MBLK Units **mg/L**

SampID: MBLK-175064

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Arsenic		0.0250		**< 0.0250**	0.0087	0	0	-100	100	03/24/2021
Barium		0.0025		**< 0.0025**	0.0007	0	0	-100	100	03/24/2021
Beryllium		0.0005		**< 0.0005**	0.0002	0	0	-100	100	03/24/2021
Boron		0.0200		**< 0.0200**	0.0090	0	0	-100	100	03/24/2021
Cadmium		0.0020		**< 0.0020**	0.0005	0	0	-100	100	03/24/2021
Calcium		0.100		**< 0.100**	0.0350	0	0	-100	100	03/24/2021
Chromium		0.0050		**< 0.0050**	0.0028	0	0	-100	100	03/24/2021
Cobalt		0.0050		**< 0.0050**	0.0020	0	0	-100	100	03/24/2021
Iron		0.0400		**< 0.0400**	0.0200	0	0	-100	100	03/24/2021
Lead		0.0150		**< 0.0150**	0.0040	0	0	-100	100	03/24/2021
Lithium	*	0.0050		**< 0.0050**	0.0019	0	0	-100	100	03/24/2021
Magnesium		0.0500		**< 0.0500**	0.0055	0	0	-100	100	03/24/2021
Manganese		0.0070		**< 0.0070**	0.0025	0	0	-100	100	03/24/2021
Molybdenum		0.0100		**< 0.0100**	0.0037	0	0	-100	100	03/24/2021
Potassium		0.100		**< 0.100**	0.0400	0	0	-100	100	03/24/2021
Selenium		0.0400		**< 0.0400**	0.0170	0	0	-100	100	03/24/2021
Sodium		0.0500		**< 0.0500**	0.0180	0	0	-100	100	03/24/2021

Quality Control Results

Client: Ramboll
Work Order: 21031450

Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

SW-846 3005A, 6010B, METALS BY ICP (TOTAL)

Batch **175064** **SampType:** **LCS** Units **mg/L**

SampID: LCS-175064

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Arsenic		0.0250		**0.543**	0.5000	0	108.7	85	115	03/24/2021
Barium		0.0025		**2.12**	2.000	0	106.0	85	115	03/24/2021
Beryllium		0.0005		**0.0527**	0.0500	0	105.4	85	115	03/24/2021
Boron		0.0200		**0.525**	0.5000	0	105.1	85	115	03/24/2021
Cadmium		0.0020		**0.0514**	0.0500	0	102.8	85	115	03/24/2021
Calcium		0.100		**2.62**	2.500	0	104.9	85	115	03/24/2021
Chromium		0.0050		**0.206**	0.2000	0	103.2	85	115	03/24/2021
Cobalt		0.0050		**0.510**	0.5000	0	102.0	85	115	03/24/2021
Iron		0.0400		**1.98**	2.000	0	99.2	85	115	03/24/2021
Lead		0.0150		**0.514**	0.5000	0	102.9	85	115	03/24/2021
Lithium	*	0.0050		**0.515**	0.5000	0	103.0	85	115	03/24/2021
Magnesium		0.0500		**2.70**	2.500	0	107.8	85	115	03/24/2021
Manganese		0.0070		**0.517**	0.5000	0	103.4	85	115	03/24/2021
Molybdenum		0.0100		**0.508**	0.5000	0	101.6	85	115	03/24/2021
Potassium		0.100		**2.48**	2.500	0	99.0	85	115	03/24/2021
Selenium		0.0400		**0.513**	0.5000	0	102.5	85	115	03/24/2021
Sodium		0.0500		**2.49**	2.500	0	99.5	85	115	03/24/2021

Quality Control Results

Client: Ramboll
Work Order: 21031450
Client Project: Vistra - Joppa West Additional Wells
Report Date: 01-Apr-21

SW-846 3005A, 6010B, METALS BY ICP (TOTAL)

Batch **175064** **SampType:** **MS** Units **mg/L**

SampID: 21031450-010CMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Arsenic		0.0250		**0.552**	0.5000	0	110.4	75	125	03/24/2021
Barium		0.0025		**2.44**	2.000	0.2714	108.3	75	125	03/24/2021
Beryllium		0.0005		**0.0535**	0.0500	0	107.0	75	125	03/24/2021
Boron		0.0200		**0.638**	0.5000	0.07630	112.4	75	125	03/25/2021
Cadmium		0.0020		**0.0512**	0.0500	0	102.4	75	125	03/24/2021
Calcium		0.100	S	**85.2**	2.500	81.37	154.0	75	125	03/24/2021
Chromium		0.0050		**0.211**	0.2000	0	105.7	75	125	03/24/2021
Cobalt		0.0050		**0.515**	0.5000	0.005200	101.9	75	125	03/24/2021
Iron		0.0400		**2.30**	2.000	0.2773	101.0	75	125	03/24/2021
Lead		0.0150		**0.516**	0.5000	0	103.2	75	125	03/24/2021
Lithium		0.0050		**0.546**	0.5000	0.01930	105.2	75	125	03/24/2021
Magnesium		0.0500		**22.2**	2.500	19.30	114.4	75	125	03/24/2021
Manganese		0.0070		**1.46**	0.5000	0.9216	107.7	75	125	03/24/2021
Molybdenum		0.0100		**0.520**	0.5000	0.005900	102.8	75	125	03/24/2021
Potassium		0.100		**3.97**	2.500	1.411	102.4	75	125	03/24/2021
Selenium		0.0400		**0.513**	0.5000	0	102.6	75	125	03/24/2021
Sodium		0.0500		**18.5**	2.500	15.76	108.0	75	125	03/24/2021

Quality Control Results

Client: Ramboll
Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450
Report Date: 01-Apr-21

SW-846 3005A, 6010B, METALS BY ICP (TOTAL)

Batch **175064** **SampType:** **MSD** Units **mg/L** RPD Limit **20**
SampID: 21031450-010CMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Arsenic		0.0250		**0.541**	0.5000	0	108.3	0.5518	1.92	03/24/2021
Barium		0.0025		**2.40**	2.000	0.2714	106.2	2.437	1.74	03/24/2021
Beryllium		0.0005		**0.0525**	0.0500	0	105.0	0.05350	1.89	03/24/2021
Boron		0.0200		**0.628**	0.5000	0.07630	110.3	0.6383	1.63	03/25/2021
Cadmium		0.0020		**0.0504**	0.0500	0	100.8	0.05120	1.57	03/24/2021
Calcium		0.100		**83.4**	2.500	81.37	81.6	85.22	2.15	03/24/2021
Chromium		0.0050		**0.204**	0.2000	0	102.2	0.2113	3.32	03/24/2021
Cobalt		0.0050		**0.506**	0.5000	0.005200	100.1	0.5149	1.76	03/24/2021
Iron		0.0400		**2.25**	2.000	0.2773	98.5	2.297	2.20	03/24/2021
Lead		0.0150		**0.507**	0.5000	0	101.4	0.5161	1.82	03/24/2021
Lithium		0.0050		**0.534**	0.5000	0.01930	102.9	0.5455	2.15	03/24/2021
Magnesium		0.0500		**21.8**	2.500	19.30	99.6	22.16	1.68	03/24/2021
Manganese		0.0070		**1.43**	0.5000	0.9216	102.5	1.460	1.80	03/24/2021
Molybdenum		0.0100		**0.513**	0.5000	0.005900	101.4	0.5201	1.43	03/24/2021
Potassium		0.100		**3.92**	2.500	1.411	100.2	3.970	1.37	03/24/2021
Selenium		0.0400		**0.509**	0.5000	0	101.8	0.5130	0.80	03/24/2021
Sodium		0.0500		**18.2**	2.500	15.76	98.0	18.46	1.36	03/24/2021

Batch **175064** **SampType:** **MS** Units **mg/L**
SampID: 21031462-002BMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Calcium		0.100	S	**406**	2.500	399.6	264.0	75	125	03/27/2021
Iron		0.0400		**2.10**	2.000	0.1280	98.6	75	125	03/27/2021
Magnesium		0.0500		**90.0**	2.500	87.63	96.4	75	125	03/27/2021
Manganese		0.0070		**0.616**	0.5000	0.1072	101.7	75	125	03/27/2021

Batch **175064** **SampType:** **MSD** Units **mg/L** RPD Limit **20**
SampID: 21031462-002BMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Calcium		0.100	S	**399**	2.500	399.6	-40.0	406.2	1.89	03/27/2021
Iron		0.0400		**2.08**	2.000	0.1280	97.8	2.099	0.72	03/27/2021
Magnesium		0.0500	S	**88.9**	2.500	87.63	52.4	90.04	1.23	03/27/2021
Manganese		0.0070		**0.613**	0.5000	0.1072	101.1	0.6158	0.47	03/27/2021

Client: Ramboll

Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450

Report Date: 01-Apr-21

SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)

Batch 175067 **SampType:** **MBLK** Units **mg/L**

SampID: MBLK-175067

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Antimony		0.0010		**< 0.0010**	0.0004	0	0	-100	100	03/24/2021
Thallium		0.0020		**< 0.0020**	0.0010	0	0	-100	100	03/24/2021

Batch 175067 **SampType:** **LCS** Units **mg/L**

SampID: LCS-175067

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Antimony		0.0010		**0.514**	0.5000	0	102.8	80	120	03/24/2021
Thallium		0.0020		**0.250**	0.2500	0	100.2	80	120	03/24/2021

Batch 175067 **SampType:** **MS** Units **mg/L**

SampID: 21031450-010CMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Antimony		0.0010		**0.605**	0.5000	0.005311	120.0	75	125	03/24/2021
Thallium		0.0020		**0.273**	0.2500	0	109.2	75	125	03/24/2021

Batch 175067 **SampType:** **MSD** Units **mg/L** RPD Limit **20**

SampID: 21031450-010CMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Antimony		0.0010		**0.566**	0.5000	0.005311	112.2	0.6055	6.68	03/24/2021
Thallium		0.0020		**0.274**	0.2500	0	109.5	0.2731	0.20	03/24/2021

SW-846 7470A (TOTAL)

Batch 175073 **SampType:** **MBLK** Units **mg/L**

SampID: MBLK-175073

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Mercury		0.00020		**< 0.00020**	0.0001	0	0	-100	100	03/24/2021

Batch 175073 **SampType:** **LCS** Units **mg/L**

SampID: LCS-175073

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Mercury		0.00020		**0.00527**	0.0050	0	105.3	85	115	03/24/2021

Batch 175073 **SampType:** **MS** Units **mg/L**

SampID: 21031450-010CMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Mercury		0.00020		**0.00507**	0.0050	0	101.4	75	125	03/24/2021

SW-846 7470A (TOTAL)

Batch 175073 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21031450-010CMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Mercury		0.00020		**0.00525**	0.0050	0	105.0	0.005072	3.48	03/24/2021

Batch 175073 **SampType:** **MS** Units **mg/L**

SampID: 21031452-007DMS

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	Low Limit	High Limit	Date Analyzed
Mercury		0.00020		**0.00523**	0.0050	0	104.6	75	125	03/24/2021

Batch 175073 **SampType:** **MSD** Units **mg/L** RPD Limit **15**

SampID: 21031452-007DMSD

Analyses	Cert	RL	Qual	Result	Spike	SPK Ref Val	%REC	RPD Ref Val	%RPD	Date Analyzed
Mercury		0.00020		**0.00527**	0.0050	0	105.4	0.005232	0.72	03/24/2021

Teklab, Inc.
Environmental Laboratory

Receiving Check List

http://www.teklabinc.com/

Client: Ramboll
Client Project: Vistra - Joppa West Additional Wells

Work Order: 21031450
Report Date: 01-Apr-21

Carrier: Nathan Duda

Received By: AH

Completed by:
On:
23-Mar-21
Amanda R. Ham

Reviewed by:
On:
23-Mar-21
Emily Pohlman

Pages to follow: Chain of custody 1 Extra pages included 0

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C 1.4
Type of thermal preservation?	None ☐	Ice ☑	Blue Ice ☐	Dry Ice ☐
Chain of custody present?	Yes ☑	No ☐		
Chain of custody signed when relinquished and received?	Yes ☑	No ☐		
Chain of custody agrees with sample labels?	Yes ☑	No ☐		
Samples in proper container/bottle?	Yes ☑	No ☐		
Sample containers intact?	Yes ☑	No ☐		
Sufficient sample volume for indicated test?	Yes ☑	No ☐		
All samples received within holding time?	Yes ☑	No ☐		
Reported field parameters measured:	Field ☐	Lab ☐	NA ☑	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐		

When thermal preservation is required, samples are compliant with a temperature between 0.1°C - 6.0°C, or when samples are received on ice the same day as collected.

Water – at least one vial per sample has zero headspace?	Yes ☐	No ☐	No VOA vials ☑
Water - TOX containers have zero headspace?	Yes ☐	No ☐	No TOX containers ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	NA ☐
NPDES/CWA TCN interferences checked/treated in the field?	Yes ☐	No ☐	NA ☑

Any No responses must be detailed below or on the COC.

pH strip #75226. - aham - 3/23/2021 10:55:43 AM

COC# 1940100742.001

CHAIN OF CUSTODY

pg. 1 of 1 Work order # 21031450

TEKLAB, INC. 5445 Horseshoe Lake Road - Collinsville, IL 62234 - Phone: (618) 344-1004 - Fax: (618) 344-1005

Client: Ramboll
Address: 300 S. Wacker Drive
City / State / Zip Chicago, IL 60606
Contact: Melissa Marra **Phone:** (312) 270-3612
E-Mail: melissa.marra@ramboll.com **Fax:**

Samples on: ☒ ICE ☐ BLUE ICE ☐ NO ICE 1.4 °C LTG# 3
Preserved in: ☐ LAB ☑ FIELD **FOR LAB USE ONLY**
Lab Notes PHV 75226. PAt 3/23/21

Are these samples known to be involved in litigation? If yes, a surcharge will apply ☐ Yes ☒ No
Are these samples known to be hazardous? ☐ Yes ☒ No
Are there any required reporting limits to be met on the requested analysis?. If yes, please provide limits in the comment section. ☐ Yes ☒ No

Client Comments:

Metals: Li (ICP), Hg, and Sb As Ba Be B Cd Ca Cr Co Fe Pb Mg Mn Mo K Se Na Tl (ICP/MS)

quick TURN 1-2 DAYS

Project Name/Number
Vistra - Joppa West Additional Wells

Sample Collector's Name
Nathan D[illegible] - Ramboll

Results Requested
☐ Standard ☒ 1-2 Day (100% Surcharge)
☐ Other ____ ☐ 3 Day (50% Surcharge)

Billing Instructions

ONE DAY TAT

			# and Type of Containers								MATRIX						INDICATE ANALYSIS REQUESTED														
Lab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	OTHER	Aqueous	Drinking Water	Soil	Sludge	Special Waste	Groundwater	Bicarb/Carb	Chloride/Sulfate	Fluoride	Ra226/228	TDS	Total Metals									
21031450 001	G101	3/22/21 / 1157	1	3												X	X	X	X	X	X	X									
002	TPZ116	3/22/21 / 1304	1	3												X	X	X	X	X	X	X									
003	G113	3/22/21 / 1359	1	3												X	X	X	X	X	X	X									
004	XTPW01	3/22/21 / 1441	1	3												X	X	X	X	X	X	X									
005	QA/QC1	3/22/21 / 1446	1	3												X	X	X	X	X	X	X									
006	G111	3/22/21 / 1600	1	3												X	X	X	X	X	X	X									
007	TPZ114	3/22/21 / 1641	1	3												X	X	X	X	X	X	X									
008	G112C	3/22/21 / 1725	1	3												X	X	X	X	X	X	X									
009	TPZ117	3/22/21 / 190	1	3												X	X	X	X	X	X	X									
010	TPZ117D	3/22/21 / 1847	3	9												X	X	X	X	X	X	X									

Relinquished By	Date/Time	Received By	Date/Time
	3/23/21 / 930		3/23/21 0935

The individual signing this agreement on behalf of the client, acknowledges that he/she has read and understands the terms and conditions of this agreement, and that he/she has the authority to sign on behalf of the client. See www.teklabinc.com for terms and conditions.

BottleOrder: 64383

PAt

ATTACHMENT 6
MANN-KENDALL STATISTICAL REPORT

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
G101	Antimony	mg/L	10	0.001	0.005	0.006	0.0047	0.00134	0.285	FALSE	100	No Trend	0.5	8/17/2010	3/22/2021
G101	Arsenic	mg/L	10	0.01	0.025	0.025	0.0205	0.00725	0.354	FALSE	100	Downward	0.011	8/17/2010	3/22/2021
G101	Barium	mg/L	10	0.0443	0.08295	0.635	0.185	0.225	1.22	FALSE	0	No Trend	0.36	8/17/2010	3/22/2021
G101	Beryllium	mg/L	10	0.0005	0.001	0.001	0.00095	0.000158	0.166	FALSE	100	No Trend	0.082	8/17/2010	3/22/2021
G101	Boron	mg/L	10	0.02	0.02	0.02	0.02	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G101	Cadmium	mg/L	10	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G101	Chloride	mg/L	10	3	5	7	5	1.33	0.266	FALSE	10	No Trend	0.5	8/17/2010	3/22/2021
G101	Chromium	mg/L	10	0.005	0.01	0.01	0.0095	0.00158	0.166	FALSE	100	No Trend	0.082	8/17/2010	3/22/2021
G101	Cobalt	mg/L	10	0.005	0.01	0.01	0.0095	0.00158	0.166	FALSE	100	No Trend	0.082	8/17/2010	3/22/2021
G101	Copper	mg/L	9	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/13/2013
G101	Cyanide	mg/L	9	0.007	0.007	0.007	0.007	0	0	TRUE	100	No Trend	--	8/17/2010	5/13/2013
G101	Depth to groundwater	feet	10	36.28	45.915	49.68	44.9	4.03	0.0898	FALSE	0	No Trend	0.14	8/17/2010	3/22/2021
G101	Fluoride	mg/L	10	0.23	0.28	0.33	0.284	0.031	0.109	FALSE	0	No Trend	0.24	8/17/2010	3/22/2021
G101	Iron	mg/L	10	0.02	0.02	1.34	0.212	0.421	1.99	FALSE	70	No Trend	0.22	8/17/2010	3/22/2021
G101	Lead	mg/L	10	0.002	0.002	0.0075	0.00361	0.00247	0.684	FALSE	90	No Trend	0.051	8/17/2010	3/22/2021
G101	Manganese	mg/L	10	0.005	0.005	0.0556	0.012	0.0165	1.38	FALSE	80	No Trend	0.5	8/17/2010	3/22/2021
G101	Mercury	mg/L	10	0.0002	0.0002	0.0002	0.0002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G101	Nickel	mg/L	9	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/13/2013
G101	Nitrate (as N)	mg/L	9	0.282	1.56	2.12	1.37	0.551	0.402	FALSE	0	No Trend	0.059	8/17/2010	5/13/2013
G101	pH	STD	10	6.63	7.025	7.31	7.01	0.207	0.0295	FALSE	0	No Trend	0.5	8/17/2010	3/22/2021
G101	Selenium	mg/L	10	0.04	0.05	0.05	0.049	0.00316	0.0645	FALSE	100	No Trend	0.082	8/17/2010	3/22/2021
G101	Silver	mg/L	9	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/13/2013
G101	Sulfate	mg/L	10	22	33	39	32.3	4.57	0.141	FALSE	0	No Trend	0.16	8/17/2010	3/22/2021
G101	TDS	mg/L	10	208	270	358	267	53.7	0.201	FALSE	0	No Trend	0.14	8/17/2010	3/22/2021
G101	Thallium	mg/L	10	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G101	Zinc	mg/L	9	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/13/2013

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
G111	Antimony	mg/L	12	0.001	0.005	0.006	0.00475	0.00122	0.257	FALSE	100	No Trend	0.5	8/17/2010	3/22/2021
G111	Arsenic	mg/L	12	0.01	0.025	0.025	0.0213	0.00678	0.318	FALSE	100	Downward	0.0081	8/17/2010	3/22/2021
G111	Barium	mg/L	12	0.149	0.1625	0.207	0.167	0.0162	0.097	FALSE	0	Upward	0.023	8/17/2010	3/22/2021
G111	Beryllium	mg/L	12	0.0005	0.001	0.001	0.000958	0.000144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G111	Boron	mg/L	12	0.02	0.02	0.02	0.02	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G111	Cadmium	mg/L	12	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G111	Chloride	mg/L	12	5	6.5	10	6.75	1.29	0.191	FALSE	0	No Trend	0.41	8/17/2010	3/22/2021
G111	Chromium	mg/L	12	0.005	0.01	0.01	0.00958	0.00144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G111	Cobalt	mg/L	12	0.005	0.01	0.01	0.00958	0.00144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G111	Copper	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G111	Cyanide	mg/L	11	0.007	0.007	0.007	0.007	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G111	Depth to groundwater	feet	12	4.37	5.81	9.77	6.41	1.98	0.309	FALSE	0	Downward	0.05	8/17/2010	3/22/2021
G111	Fluoride	mg/L	12	0.62	0.665	0.71	0.658	0.0319	0.0485	FALSE	0	No Trend	0.2	8/17/2010	3/22/2021
G111	Iron	mg/L	12	0.02	0.02	0.628	0.107	0.206	1.93	FALSE	83.33	No Trend	0.5	8/17/2010	3/22/2021
G111	Lead	mg/L	12	0.002	0.002	0.0075	0.00329	0.00234	0.711	FALSE	100	Upward	0.0052	8/17/2010	3/22/2021
G111	Manganese	mg/L	12	0.005	0.005	0.007	0.00517	0.000577	0.112	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G111	Mercury	mg/L	12	0.0002	0.0002	0.0002	0.0002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G111	Nickel	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G111	Nitrate (as N)	mg/L	11	0.05	0.116	0.719	0.185	0.197	1.06	FALSE	9.09	No Trend	0.18	8/17/2010	5/14/2013
G111	pH	STD	12	6.7	7.105	7.34	7.12	0.17	0.0239	FALSE	0	No Trend	0.25	8/17/2010	3/22/2021
G111	Selenium	mg/L	12	0.04	0.05	0.05	0.0492	0.00289	0.0587	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G111	Silver	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G111	Sulfate	mg/L	12	17	23.5	30	23.2	3.96	0.171	FALSE	0	No Trend	0.15	8/17/2010	3/22/2021
G111	TDS	mg/L	12	322	359	394	356	25.9	0.0728	FALSE	0	No Trend	0.085	8/17/2010	3/22/2021
G111	Thallium	mg/L	12	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G111	Zinc	mg/L	11	0.01	0.01	0.0181	0.011	0.00253	0.23	FALSE	81.82	No Trend	0.08	8/17/2010	5/14/2013
G112C	Antimony	mg/L	4	0.001	0.005	0.006	0.00425	0.00222	0.522	FALSE	100	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Arsenic	mg/L	4	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	3/22/2021
G112C	Barium	mg/L	4	0.0593	0.062	0.0845	0.067	0.0118	0.176	FALSE	0	No Trend (n<8)	0.15	3/7/2013	3/22/2021
G112C	Beryllium	mg/L	4	0.0005	0.001	0.001	0.000875	0.00025	0.286	FALSE	100	No Trend (n<8)	0.19	3/7/2013	3/22/2021
G112C	Boron	mg/L	4	3.09	3.205	4.25	3.44	0.551	0.16	FALSE	0	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Cadmium	mg/L	4	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	3/22/2021
G112C	Chloride	mg/L	4	5	5	7	5.5	1	0.182	FALSE	75	No Trend (n<8)	0.19	3/7/2013	3/22/2021
G112C	Chromium	mg/L	4	0.005	0.01	0.01	0.00875	0.0025	0.286	FALSE	100	No Trend (n<8)	0.19	3/7/2013	3/22/2021
G112C	Cobalt	mg/L	4	0.01	0.01	0.0117	0.0104	0.00085	0.0817	FALSE	75	No Trend (n<8)	0.19	3/7/2013	3/22/2021
G112C	Copper	mg/L	3	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	5/14/2013
G112C	Cyanide	mg/L	3	0.007	0.007	0.007	0.007	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	5/14/2013
G112C	Depth to groundwater	feet	4	2.64	4.825	5.31	4.4	1.24	0.282	FALSE	0	No Trend (n<8)	0.37	3/7/2013	3/22/2021
G112C	Fluoride	mg/L	4	0.6	0.77	0.81	0.738	0.0967	0.131	FALSE	0	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Iron	mg/L	4	0.02	0.04385	0.939	0.262	0.452	1.73	FALSE	25	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Lead	mg/L	4	0.007	0.00725	0.04	0.0154	0.0164	1.06	FALSE	100	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Manganese	mg/L	4	0.151	0.1735	0.398	0.224	0.117	0.522	FALSE	0	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Mercury	mg/L	4	0.0002	0.0002	0.0002	0.0002	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	3/22/2021
G112C	Nickel	mg/L	3	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	5/14/2013
G112C	Nitrate (as N)	mg/L	3	0.05	0.05	0.344	0.148	0.17	1.15	FALSE	66.67	No Trend (n<8)	0.27	3/7/2013	5/14/2013

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
G112C	pH	STD	4	6.73	6.82	6.92	6.82	0.0814	0.0119	FALSE	0	No Trend (n<8)	0.5	3/7/2013	3/22/2021
G112C	Selenium	mg/L	4	0.04	0.05	0.05	0.0475	0.005	0.105	FALSE	100	No Trend (n<8)	0.19	3/7/2013	3/22/2021
G112C	Silver	mg/L	3	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	5/14/2013
G112C	Sulfate	mg/L	4	60	64.5	532	180	235	1.31	FALSE	0	No Trend (n<8)	0.37	3/7/2013	3/22/2021
G112C	TDS	mg/L	4	412	454	1010	582	286	0.491	FALSE	0	No Trend (n<8)	0.15	3/7/2013	3/22/2021
G112C	Thallium	mg/L	4	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	3/22/2021
G112C	Zinc	mg/L	3	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend (n<8)	--	3/7/2013	5/14/2013
G113	Antimony	mg/L	12	0.001	0.005	0.005	0.00467	0.00115	0.246	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G113	Arsenic	mg/L	12	0.01	0.025	0.025	0.0213	0.00678	0.318	FALSE	100	Downward	0.0081	8/17/2010	3/22/2021
G113	Barium	mg/L	12	0.108	0.4795	0.547	0.446	0.121	0.271	FALSE	0	Upward	0.017	8/17/2010	3/22/2021
G113	Beryllium	mg/L	12	0.0005	0.001	0.001	0.000958	0.000144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G113	Boron	mg/L	12	0.02	0.02	0.02	0.02	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G113	Cadmium	mg/L	12	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G113	Chloride	mg/L	12	19	29	34	28.8	3.61	0.125	FALSE	0	No Trend	0.18	8/17/2010	3/22/2021
G113	Chromium	mg/L	12	0.005	0.01	0.01	0.00958	0.00144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G113	Cobalt	mg/L	12	0.005	0.01	0.01	0.00958	0.00144	0.15	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G113	Copper	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G113	Cyanide	mg/L	11	0.007	0.007	0.007	0.007	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G113	Depth to groundwater	feet	12	10.55	13.155	16.65	13.4	1.95	0.146	FALSE	0	No Trend	0.12	8/17/2010	3/22/2021
G113	Fluoride	mg/L	12	0.36	0.425	0.45	0.418	0.0279	0.0667	FALSE	0	No Trend	0.34	8/17/2010	3/22/2021
G113	Iron	mg/L	12	0.02	0.02	0.484	0.0603	0.134	2.22	FALSE	83.33	No Trend	0.5	8/17/2010	3/22/2021
G113	Lead	mg/L	12	0.002	0.002	0.0075	0.00329	0.00234	0.711	FALSE	100	Upward	0.0052	8/17/2010	3/22/2021
G113	Manganese	mg/L	12	0.005	0.005	0.0919	0.0146	0.025	1.71	FALSE	58.33	No Trend	0.18	8/17/2010	3/22/2021
G113	Mercury	mg/L	12	0.0002	0.0002	0.0002	0.0002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G113	Nickel	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G113	Nitrate (as N)	mg/L	11	0.139	0.481	0.838	0.47	0.187	0.398	FALSE	0	No Trend	0.22	8/17/2010	5/14/2013
G113	pH	STD	12	6.44	6.585	6.89	6.64	0.146	0.022	FALSE	0	No Trend	0.34	8/17/2010	3/22/2021
G113	Selenium	mg/L	12	0.04	0.05	0.05	0.0492	0.00289	0.0587	FALSE	100	No Trend	0.074	8/17/2010	3/22/2021
G113	Silver	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013
G113	Sulfate	mg/L	12	30	35	292	58.7	74	1.26	FALSE	0	No Trend	0.34	8/17/2010	3/22/2021
G113	TDS	mg/L	12	524	590	870	618	96	0.155	FALSE	0	Upward	0.00078	8/17/2010	3/22/2021
G113	Thallium	mg/L	12	0.002	0.002	0.002	0.002	0	0	TRUE	100	No Trend	--	8/17/2010	3/22/2021
G113	Zinc	mg/L	11	0.01	0.01	0.01	0.01	0	0	TRUE	100	No Trend	--	8/17/2010	5/14/2013

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
TPZ114	Antimony	mg/L	1	0.001	0.001	0.001	0.001			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Arsenic	mg/L	1	0.0169	0.0169	0.0169	0.0169			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Barium	mg/L	1	0.365	0.365	0.365	0.365			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Beryllium	mg/L	1	0.0013	0.0013	0.0013	0.0013			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Boron	mg/L	1	0.177	0.177	0.177	0.177			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Cadmium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Chloride	mg/L	1	11	11	11	11			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Chromium	mg/L	1	0.0315	0.0315	0.0315	0.0315			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Cobalt	mg/L	1	0.0074	0.0074	0.0074	0.0074			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Depth to groundwater	feet	1	37.23	37.23	37.23	37.2			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Fluoride	mg/L	1	0.32	0.32	0.32	0.32			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Iron	mg/L	1	19.6	19.6	19.6	19.6			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Lead	mg/L	1	0.0213	0.0213	0.0213	0.0213			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Manganese	mg/L	1	0.476	0.476	0.476	0.476			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Mercury	mg/L	1	0.0002	0.0002	0.0002	0.0002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	pH	STD	1	7.42	7.42	7.42	7.42			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Selenium	mg/L	1	0.04	0.04	0.04	0.04			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Sulfate	mg/L	1	19	19	19	19			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	TDS	mg/L	1	306	306	306	306			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ114	Thallium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Antimony	mg/L	1	0.001	0.001	0.001	0.001			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Arsenic	mg/L	1	0.01	0.01	0.01	0.01			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Barium	mg/L	1	0.51	0.51	0.51	0.51			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Beryllium	mg/L	1	0.0006	0.0006	0.0006	0.0006			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Boron	mg/L	1	0.02	0.02	0.02	0.02			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Cadmium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Chloride	mg/L	1	9	9	9	9			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Chromium	mg/L	1	0.0124	0.0124	0.0124	0.0124			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Cobalt	mg/L	1	0.005	0.005	0.005	0.005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Depth to groundwater	feet	1	25.84	25.84	25.84	25.8			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Fluoride	mg/L	1	0.36	0.36	0.36	0.36			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Iron	mg/L	1	4.44	4.44	4.44	4.44			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Lead	mg/L	1	0.0075	0.0075	0.0075	0.0075			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Manganese	mg/L	1	0.0806	0.0806	0.0806	0.0806			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Mercury	mg/L	1	0.0002	0.0002	0.0002	0.0002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	pH	STD	1	6.99	6.99	6.99	6.99			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Selenium	mg/L	1	0.04	0.04	0.04	0.04			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Sulfate	mg/L	1	24	24	24	24			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	TDS	mg/L	1	292	292	292	292			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ116	Thallium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
TPZ117	Antimony	mg/L	1	0.0051	0.0051	0.0051	0.0051			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Arsenic	mg/L	1	0.0198	0.0198	0.0198	0.0198			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Barium	mg/L	1	0.515	0.515	0.515	0.515			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Beryllium	mg/L	1	0.0054	0.0054	0.0054	0.0054			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Boron	mg/L	1	0.02	0.02	0.02	0.02			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Cadmium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Chloride	mg/L	1	8	8	8	8			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Chromium	mg/L	1	0.0987	0.0987	0.0987	0.0987			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Cobalt	mg/L	1	0.0381	0.0381	0.0381	0.0381			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Depth to groundwater	feet	1	31.92	31.92	31.92	31.9			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Fluoride	mg/L	1	0.3	0.3	0.3	0.3			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Iron	mg/L	1	71.6	71.6	71.6	71.6			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Lead	mg/L	1	0.0386	0.0386	0.0386	0.0386			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Manganese	mg/L	1	0.761	0.761	0.761	0.761			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Mercury	mg/L	1	0.0002	0.0002	0.0002	0.0002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	pH	STD	1	6.67	6.67	6.67	6.67			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Selenium	mg/L	1	0.04	0.04	0.04	0.04			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Sulfate	mg/L	1	32	32	32	32			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	TDS	mg/L	1	284	284	284	284			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117	Thallium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Antimony	mg/L	1	0.0053	0.0053	0.0053	0.0053			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Arsenic	mg/L	1	0.01	0.01	0.01	0.01			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Barium	mg/L	1	0.271	0.271	0.271	0.271			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Beryllium	mg/L	1	0.0005	0.0005	0.0005	0.0005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Boron	mg/L	1	0.0763	0.0763	0.0763	0.0763			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Cadmium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Chloride	mg/L	1	11	11	11	11			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Chromium	mg/L	1	0.005	0.005	0.005	0.005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Cobalt	mg/L	1	0.0052	0.0052	0.0052	0.0052			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Depth to groundwater	feet	1	29.73	29.73	29.73	29.7			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Fluoride	mg/L	1	0.27	0.27	0.27	0.27			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Iron	mg/L	1	0.277	0.277	0.277	0.277			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Lead	mg/L	1	0.0075	0.0075	0.0075	0.0075			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Manganese	mg/L	1	0.922	0.922	0.922	0.922			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Mercury	mg/L	1	0.0002	0.0002	0.0002	0.0002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	pH	STD	1	7.09	7.09	7.09	7.09			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Selenium	mg/L	1	0.04	0.04	0.04	0.04			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Sulfate	mg/L	1	187	187	187	187			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	TDS	mg/L	1	318	318	318	318			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
TPZ117D	Thallium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021

ATTACHMENT 5.
MANN-KENDALL REPORT
PART 845 ADJUSTED STANDARD PETITION
JOPPA WEST ASH POND
JOPPA POWER STATION
JOPPA, ILLINOIS

Location	Parameter	Units	Sample Count	Minimum	Median	Maximum	Mean	SD	CV	All Results Same Value?*	Percent Non-Detects	Trend	p value	Start Date	End Date
XTPW01	Antimony	mg/L	1	0.0036	0.0036	0.0036	0.0036			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Arsenic	mg/L	1	0.0298	0.0298	0.0298	0.0298			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Barium	mg/L	1	0.0776	0.0776	0.0776	0.0776			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Beryllium	mg/L	1	0.0005	0.0005	0.0005	0.0005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Boron	mg/L	1	27	27	27	27			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Cadmium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Chloride	mg/L	1	2	2	2	2			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Chromium	mg/L	1	0.005	0.005	0.005	0.005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Cobalt	mg/L	1	0.005	0.005	0.005	0.005			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Depth to groundwater	feet	1	12.77	12.77	12.77	12.8			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Fluoride	mg/L	1	0.1	0.1	0.1	0.1			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Iron	mg/L	1	0.0998	0.0998	0.0998	0.0998			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Lead	mg/L	1	0.0075	0.0075	0.0075	0.0075			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Manganese	mg/L	1	0.007	0.007	0.007	0.007			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Mercury	mg/L	1	0.0002	0.0002	0.0002	0.0002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	pH	STD	1	11.13	11.13	11.13	11.1			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Selenium	mg/L	1	0.0937	0.0937	0.0937	0.0937			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Sulfate	mg/L	1	387	387	387	387			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	TDS	mg/L	1	824	824	824	824			TRUE	0	No Trend (n<8)		3/22/2021	3/22/2021
XTPW01	Thallium	mg/L	1	0.002	0.002	0.002	0.002			TRUE	100	No Trend (n<8)		3/22/2021	3/22/2021

Notes:

1. All minimum, median, maximum, mean, and SD are presented in the units identified.

*In cases where all measured results have the same value (e.g., all were non-detects with identical reporting limits), mean and standard deviation are 0, and a Mann-Kendall trend test p value cannot be calculated.

CV = coefficient of variation
mg/L = milligrams per liter
N = Nitrogen
No Trend (n<8) = no trend was found, however the confidence is lower due to the number of samples collected being less than 8
p value = probability that a trend observed in the data is due to random variation. In this analysis, p<0.05 was considered significant (i.e., that the observed trend was not due to random variation).
SD = standard deviation
STD = standard pH units
TDS = total dissolved solids

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 4

Human Health and Ecological Risk Evaluation and Relative Impact Assessment

Joppa Generating Station – Joppa West

Joppa, Illinois

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May 11, 2021

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Abbreviations

ADI	Acceptable Daily Intake
BCF	Bioconcentration Factor
BGU	Bedrock Groundwater Unit
BMP	Best Management Practice
CBR	Closure by Removal
CCR	Coal Combustion Residual
CEM	Conceptual Exposure Model
CIP	Closure in Place
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COI	Constituent of Interest
COPC	Constituent of Potential Concern
CSM	Conceptual Site Model
CWS	Community Water Supply
EEI	Electric Energy Inc.
EJ	Environmental Justice
EPRI	Electric Power Research Institute
ESV	Ecological Screening Value
FEMA	Federal Emergency Management Agency
ft. amsl	Feet Above Mean Sea Level
GHG	Greenhouse Gas
GWPS	Groundwater Protection Standard
GWQS	Groundwater Quality Standard
HTC	Human Threshold Criteria
IEPA	Illinois Environmental Protection Agency
MCL	Maximum Contaminant Level
N_2O	Nitrous Oxide
NEBA	Net Environmental Benefit Analyses
NO_x	Nitrogen Oxide
NPP	Net Primary Productivity
NRWQC	National Recommended Water Quality Criteria
ORNL	Oak Ridge National Laboratory
PM	Particular Matter
RAIS	Risk Assessment Information System
RfD	Reference Dose
RIA	Relative Impact Assessment
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SI	Surface Impoundment
SWQS	Surface Water Quality Standard
UA	Uppermost Aquifer
UCU	Upper Confining Unit
US	United States

US DOT	United States Department of Transportation
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

Executive Summary

Electric Energy, Inc. (EEI), a subsidiary of Vistra Corp., owns and operates Joppa Generating Station (Joppa Plant or the Site), a coal-fired power generating facility in Joppa, Illinois. The facility began operations in 1955 and is currently in operation. EEI plans to retire the Joppa Plant by September 2022 (Vistra Corp, 2021). The West Ash Pond (Joppa West) was used to store and dispose of coal combustion residuals (CCRs) from 1957 until the 1970s when it ceased to receive CCRs when the East Ash Pond (Joppa East) was brought into service to store and dispose CCRs. This report presents the results of a risk evaluation and a relative impact assessment (RIA) of three closure options (Minimal Disturbance, Closure in Place [CIP], and Closure by Removal [CBR]) at Joppa West.

Key conclusions of the risk evaluation and RIA are highlighted below.

Regarding the Risk Evaluation:

- There are no receptors that could potentially be exposed to constituents present in groundwater underlying or downgradient of Joppa West. Additionally, the Ohio River is not used as a source of drinking water. Thus, residential exposure to potentially impacted groundwater or surface water as a drinking water source is an incomplete pathway and does not pose a risk concern.
- There are no potential ecological receptors exposed to constituents present in groundwater at or adjacent to Joppa West.
- CCR constituents originating at Joppa West may potentially migrate with groundwater and mix with surface water in the Ohio River. Thus, the human health assessment evaluated recreational exposures to swimmers exposed to surface waters of the Ohio River adjacent to the Site and exposures to recreational anglers consuming locally caught fish. The ecological evaluation considered risks for ecological receptors in the Ohio River: aquatic life (including aquatic plants, aquatic invertebrates, and fish) exposed to surface water and avian and mammalian wildlife exposed to bioaccumulative constituents of interest (COIs) in surface water and dietary items.
- There are no unacceptable risks for any human receptor as a result of CCR constituents in groundwater, potentially originating at Joppa West, mixing with surface water in the Ohio River.
- There are no unacceptable risks for any ecological receptor as a result of CCR constituents in groundwater, potentially originating at Joppa West, mixing with surface water in the Ohio River.
- Finally, it should be noted that because current conditions do not present a risk to human health or the environment, there will also be no unacceptable risk to human health or the environment for any future scenario (*i.e.*, different potential closure scenarios), including leaving the unit as is. Furthermore, the time horizon over which Illinois Environmental Protection Agency (IEPA) groundwater water quality standards (GWQSs) are exceeded under the various closure alternatives is immaterial from a risk perspective since no unacceptable risk is associated with exceedances of the GWQSs.

Regarding the Relative Impact Assessment:

- The RIA evaluated and assessed three potential closure scenarios for Joppa West. Closure scenarios included:
  - Minimal Disturbance: This scenario includes monitoring and maintenance of the existing dike and impoundment cover.
  - CIP: This scenario entails removing the existing vegetation and cover atop the former impoundment and then capping the former impoundment with a new cover system.
  - CBR: This scenario entails removing the existing vegetation and cover atop the former impoundment and then excavating all of the CCR and transporting it to an off-Site landfill.
- Closure alternatives were evaluated and compared based on 10 different metrics. Each closure alternative was ranked on a relative scale from A to C for each metric. Metrics that were used to evaluate the different closure scenarios are listed in Table ES.1.
- The Minimal Disturbance closure alternative has the greatest environmental benefit (or least adverse impact) for the majority of the metrics that were evaluated. Specifically, the Minimal Disturbance alternative has the greatest environmental benefit (or least adverse impact) for 8 of the 9 metrics for which scores were quantified (Table ES.1).

Table ES.1 Relative Impact Scores for Each Closure Scenario

Impact Metric[1]	Minimal Disturbance	Closure in Place	Closure by Removal
1) Risks to Human Health/Environment			
a. Risks to groundwater receptors (human)	A	A	A
b. Risks to surface water receptors (human)	A	A	A
c. Risks to ecological receptors	A	A	A
2) Risks of Potential Future CCR Releases			
a. Releases due to dike failure	C	B	A
b. Flood-related releases	C	B	A
3) Groundwater Quality[2]			
a. Upper Confining Unit (UCU)	--	--	--
b. Uppermost aquifer (UA)	--	--	--
4) Surface Water Quality	A	A	A
5) Air Quality	A	B	C
6) Climate Change and Sustainability			
a. GHG emissions (CO_2, NO_x)	A	B	C
b. Energy consumption	A	B	C
7) Worker Safety	A	B	C
8) Community Impacts			
a. Accidents	A	B	C
b. Traffic	A	B	C
c. Noise	A	B	C
d. Environmental justice	A	B	C
9) Habitat Impacts			
a. Habitat availability and biodiversity	A	C	C
b. Threatened and endangered species	A	C	C
c. Net primary productivity	A	C	C
10) Cost	A	B	C

Notes:

CCR = Coal Combustion Residual; CO_2 = Carbon Dioxide; GHG = Greenhouse Gas; GWPS = Groundwater Protection Standard; IEPA = Illinois Environmental Protection Agency; NO_x = Nitrogen Oxide.

1) Rankings based on the following scale:
  A = Highest benefit or lowest adverse impact (shaded green);
  B = Intermediate benefit or adverse impact (shaded yellow);
  C = Lowest benefit or highest adverse impact (shaded red).

2) Relative impact scores were not assigned for groundwater quality because future groundwater concentrations will be affected both by the selected closure approach and potential groundwater corrective actions that may be implemented under an approved groundwater management zone under Part 620 (IEPA, c. 2021) or post-closure care under Part 845 (IEPA, 2020). It is inappropriate to assess the future groundwater impacts and the duration over which GWPSs are exceeded based solely on closure.

1 Introduction

Electric Energy, Inc. (EEI), a subsidiary of Vistra Corp., owns and operates Joppa Generating Station (Joppa Plant or the Site), a coal-fired power generating facility in Joppa, Illinois. The facility began operations in 1955 and is currently in operation. EEI plans to retire the Joppa Plant by September 2022 (Vistra Corp, 2021). The West Ash Pond (Joppa West) was used to store and dispose of coal combustion residuals (CCRs) from 1957 until the 1970s when it ceased to receive CCRs when the East Ash Pond (Joppa East) was brought into service to store and dispose CCRs. This report presents the results of a risk evaluation and a relative impact assessment (RIA) of three closure options (Minimal Disturbance, Closure in Place [CIP], and Closure by Removal [CBR]) at Joppa West.

The risk evaluation characterizes potential risk to human and ecological receptors that may be exposed to Joppa West-related constituents in environmental media. While this report specifically evaluates current risks, it also informs what potential risks may be under the different closure scenarios. Human and ecological risks were evaluated for all constituents analyzed in the groundwater samples. The conceptual site model (CSM) assumed that Site-related constituents of interest (COIs) in groundwater may migrate to the adjacent Ohio River and affect surface water in the vicinity of the Site.

Consistent with United States Environmental Protection Agency (US EPA) guidance (US EPA, 1989), this report used a tiered approach to evaluate potential risks, which included the following steps:

1. Identify complete exposure pathways and develop a conceptual exposure model (CEM).
2. Identify Site-related COIs: Constituents detected in groundwater were considered COIs if the maximum detected concentrations exceeded a health-based benchmark.
3. Screening-Level Risk Analysis: Compare maximum modeled COI concentrations in surface water to conservative, health-protective benchmarks to determine constituents of potential concern (COPCs).
4. Refined Risk Analysis: If COPCs are identified, perform a refined analysis to evaluate potential risks for the COPCs.
5. Formulate risk conclusions and discuss any associated uncertainties.

This assessment relies on a conservative (*i.e.*, health-protective) approach and is consistent with the risk approaches outlined in US EPA guidance. Specifically, we considered evaluation criteria detailed in Illinois Environmental Protection Agency (IEPA) guidance documents (*e.g.*, IEPA, 2019a, 2013), incorporating principles and assumptions consistent with the Federal CCR Rule (US EPA, 2015a) and US EPA's "Human and Ecological Risk Assessment of Coal Combustion Residuals" (US EPA, 2014).

For the RIA, Gradient evaluated all of the benefits and adverse impacts associated with three potential closure scenarios at Joppa West including Minimal Disturbance, CIP, and CBR. The RIA holistically assesses each closure alternative based on a series of metrics. The evaluation approach is similar to comparative assessments that have been performed for other applications, including Net Environmental Benefit Analyses (NEBA) and Electric Power Research Institute's (EPRI) Relative Impact Framework (EPRI, 2016a; Exponent, 2018; TVA, 2015). The Minimal Disturbance scenario includes monitoring and maintenance of the existing dike and impoundment cover, but does not involve removal of the current cap or existing vegetation. The CIP scenario entails removing the existing cover and vegetation and then capping the former impoundment with a new cover system consisting of either a low permeability soil cover or a combination geomembrane/soil cover. The CBR scenario involves excavating the CCR and transporting it to an off-Site landfill for disposal.

2 Qualifications

I am a Principal at Gradient, an environmental consulting firm located in Boston, Massachusetts, and a licensed professional engineer. With over 20 years of professional experience, I have consulted and testified regarding a variety of projects related to the fate and transport of constituents in the environment, hydrogeology, groundwater and surface water modeling, site characterization, and remediation system design. I have a master's degree in environmental engineering from the Massachusetts Institute of Technology and bachelor's degrees in environmental engineering and physics from the University of Michigan. A copy of my *curriculum vitae* is provided in Appendix A.

I have published and presented on a variety of topics, including groundwater and surface water fate and transport modeling of coal ash constituents, assessments of former coal-fired power plants, mass flux and mass discharge of constituents in groundwater, remedial system optimization, and the impact of environmental regulations in the United States (US) and abroad. As a consultant during the past 20+ years, I have applied my knowledge of fate and transport processes to address a range of complex challenges in the electric power, oil and gas, chemical manufacturing, pharmaceutical, mining, agrichemical, and waste disposal sectors. In particular, for the electric power industry, my experience includes projects involving regulatory comment, closure assessments, fate and transport modeling, and risk assessment. Moreover, I have worked on and been involved with projects at approximately 60 CCR surface impoundments (SIs), including risk assessments[1] and relative impacts assessments at numerous CCR disposal facilities.

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[1] My CCR risk assessment experience includes many projects where I have worked closely with toxicologists.

3 Site Overview

3.1 Site Description

The Joppa Generating Station is located in Joppa, Illinois, on the northern bank of the Ohio River, between the confluences with the Tennessee River (approximately 18 miles upstream) and with the Mississippi River (approximately 26 miles downstream). The Site is bounded by industries to the west and north, the village of Joppa to the east, and the Ohio River to the south. A Settling Area, which likely received decanted fluids from the northern portion of Joppa West, is located in the southern portion of the former Joppa West impoundment. The Settling Area is separated by a separator dike from the northern portion of Joppa West (Figure 3.1).

Figure 3.1 Site Location Map. Source: Geosyntec Consultants (2021).

Joppa West, the original ash impoundment for the Joppa Plant, is located northwest of the Joppa Generating Station, approximately 1,500 ft. north of the Ohio River. Joppa West was placed into service in approximately 1957 and was removed from service in the 1970s when Joppa East was constructed to receive CCR. The former impoundment area is 103.5 acres (79 acres for the northern portion of Joppa West, 7.5 acres for the perimeter dike crest, and 17 acres for the Settling Area (Geosyntec Consultants, 2021). Joppa West lies at an elevation ranging from 345 ft. above mean sea level (ft. amsl) along the southern end to 375 ft. amsl along the northern end (Natural Resource Technology, Inc., 2013; Hanson Professional Services Inc., 2010).

The use of Joppa West ended during a time when regulations governing the closure of CCR surface impoundments were non-existent. Currently, there is a clay and silty-clay soil cover over Joppa West ranging from several inches to 15 inches thick (Geosyntec Consultants, 2021). Since the closing of Joppa West, the majority of the former impoundment has become overgrown with a densely vegetated forest including shrubs and large trees (*e.g.*, trunk diameters of more than 18 in.; Figures 3.2 and 3.3). In addition, a network of power lines and a maintained right-of-way also traverse Joppa West (Figure 3.3). The majority of this forested area was identified as a mature bottomland forest located in the northern and southern portions of Joppa West (Geosyntec Consultants, 2021). The remaining areas of Joppa West consist of early successional forests near the roads and power lines and extend away from the maintained right-of-way (Geosyntec Consultants, 2021).

Figure 3.2 Aerial Photograph of Joppa West

Figure 3.3 Recent Photograph of Forest and Power Lines on Joppa West

The geology underlying the Site in the vicinity of Joppa West consists of several distinct hydrostatic layers (Natural Resource Technology, Inc., 2013). Aquifers in the area are either part of the McNairy Formation or associated with the bedrock. There are no surficial aquifers present in the vicinity of Joppa West. However, a groundwater-bearing unit is present between Joppa West and the underlying aquifers (Figure 3.4). Descriptions of the different hydrostatic units are discussed below.

- **Upper Confining Unit (UCU)** – This surficial groundwater-bearing unit underlies Joppa West and is primarily composed of unconsolidated materials of the Equality Formation and Metropolis Formation. The UCU is about 50 ft. thick and consists of silt, clay, and minor amounts of sand and gravel. The hydraulic conductivity of the UCU ranges from 1.1 x 10^{-6} to 7.6 x 10^{-5} cm/s with a geometric mean hydraulic conductivity of 5.9 x 10^{-6} cm/s (Natural Resource Technology, Inc., 2013), which likely does not meet the yield requirements to be considered an aquifer. No known wells use groundwater from this groundwater unit (Natural Resource Technology, Inc., 2013).

  The UCU is considered a Class II general groundwater resource (Natural Resource Technology, Inc., 2012, 2013), a source of water for "agricultural, industrial, recreational or other beneficial uses" (IEPA, c. 2021), but it is not a source of potable water (*i.e.*, not a source of drinking water).

- **Uppermost Aquifer (UA)** – This groundwater unit is part of the McNairy Formation, which consists of sands, silts, and clays. The McNairy Formation is 85 ft. thick and rests on top of bedrock (Natural Resource Technology, Inc., 2013). The UA is more permeable than the UCU and has higher groundwater flow rates (Natural Resource Technology, Inc., 2013). The hydraulic conductivity of the UA is 3.5 x 10^{-3} cm/s (Ramboll US Corp., 2021). However, there is a limited hydraulic connection between Joppa West and the UA. Data suggest that groundwater from the UA travels upward toward the UCU, reducing the likelihood that constituents in the UCU/Joppa West could impact the UA (Ramboll US Corp., 2021). The UA is considered a Class I groundwater unit.

- **Bedrock Groundwater Unit (BGU)** – This groundwater unit is composed of fine-grained, fossiliferous limestone. The uppermost portion of the BGU is Salem Limestone, which has a reported thickness of 200-500 ft. (Natural Resource Technology, Inc., 2013). This unit is considered a Class I groundwater unit.

Hydrogeological data collected at the Site show that groundwater flows north to south from topographically elevated areas at the north end of the Site toward the Ohio River, which is topographically lower than the rest of the Site and a regional discharge point for groundwater (Natural Resource Technology, Inc., 2013). The UA and BGU are more conductive than the UCU and form the primary aquifers at the Site. Vertical hydraulic gradient data indicate that groundwater in the UA is flowing upward into the UCU (Ramboll US Corp., 2021). No known wells in the area utilize the UCU as a potable water supply (Natural Resource Technology, Inc., 2013). There are no known wells downgradient of Joppa West that use groundwater from the UA or the BGU as a potable water source (Natural Resource Technology, Inc., 2013; Ramboll US Corp., 2021). Horizontal flow velocities of 0.44-1.25 ft. per year and average gradients of 0.0097-0.0276 ft./ft. were calculated for groundwater in the UCU (Ramboll US Corp., 2021). Hydraulic head measurements and head gradients in the vicinity of the former impoundment confirm that groundwater flows toward the Ohio River (Natural Resource Technology, Inc., 2013).

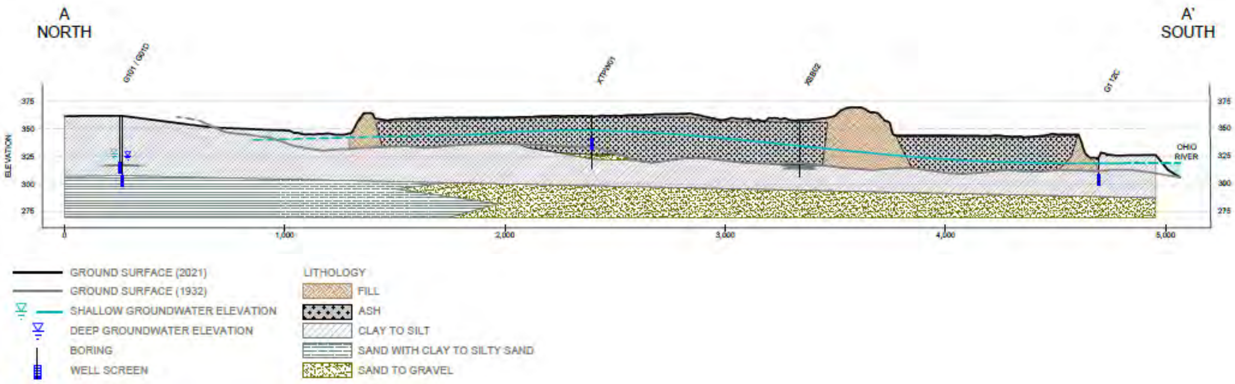

Figure 3.4 Conceptual Site Model for Joppa West. Source: Ramboll US Corp. (2021).

3.2 Conceptual Site Model

A CSM describes the sources of contamination, the hydrogeological units, and the physical processes that control the transport of constituents in and between environmental media. In this case, the CSM described how Joppa West-related constituents may have come into contact with groundwater and migrated off-Site into other media including the adjacent Ohio River. The CSM was developed using available hydrogeological and groundwater quality data (Natural Resource Technology, Inc., 2013), including information on groundwater flow and the characteristics of nearby surface water bodies.

At Joppa West, the downward migration of potential dissolved constituents detected in groundwater is significantly limited due to the presence of a thick, low permeability silty-clay zone (*i.e.*, UCU) (Natural Resource Technology, Inc., 2013). The underlying aquifers are reportedly more permeable (*i.e.*, groundwater flow rates are expected to be higher) than the UCU (Natural Resource Technology, Inc., 2013); however, they have more limited hydraulic connection to Joppa West. Groundwater flow in the UCU is primarily south-southwestward toward the Ohio River[2] (Natural Resource Technology, Inc., 2013). Because the Ohio River is a large regional hydraulic boundary (*i.e.*, serves as a sink for groundwater discharges in the area), any migration of constituents present in groundwater underlying Joppa West underneath or beyond the river is unlikely. Similarly, based on measured groundwater elevations, lateral (*i.e.*, side-gradient or parallel to the Ohio River) flow and transport of these constituents are not expected.

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[2] An intermittent stream that is reportedly the primary drainage near Joppa West runs south-southwest to the Ohio River (Natural Resource Technology, Inc., 2013).

Groundwater underlying Joppa West, both in the UCU and the UA, flows toward the Ohio River and mixes with surface water in the river. It should be noted that many of the constituents detected in groundwater occur naturally in the environment or may come from other sources.

3.3 Groundwater Monitoring

Seven monitoring wells (G101, G111, G112B, G113, G151, G152, and G153) were installed in the UCU in June 2010. In October 2012, two wells (G112B and G152) were abandoned and replaced with wells G112C and G152B because the initial wells were installed within CCR and fill material and are not representative of groundwater conditions in the area (Natural Resource Technology, Inc., 2013). Of the seven wells, three wells (G111, G112C, and G113) are located along the perimeter of Joppa West while one well (G101) is located upgradient of Joppa West. The other three wells (G151, G152B, and G153) are located around the perimeter of Joppa East. Groundwater samples were collected between 2010 and 2013 as part of a groundwater monitoring plan and analyzed for inorganic constituents (as dissolved metals)[3] listed on 35 IAC 620.401 with the exception of perchlorate, vanadium, and radium (Natural Resource Technology, Inc., 2013). In March 2021, four wells (TPZ114, TPZ116, TPZ117, and TPZ117D) were installed downgradient of Joppa West, and one well (XTPW01) was installed in ash pore water within Joppa West. Three wells (TPZ114, TPZ116, and TPZ117) were installed within the UCU, and well TPZ117D was installed in the UA. Groundwater samples from these newer wells were collected and analyzed for the same list of constituents (as total metals). Cyanide, manganese, nickel, silver, and zinc were not analyzed in the 2021 groundwater samples.

The analyses presented in this report relied upon all available data from eight wells downgradient of or adjacent to Joppa West (Table 3.1, Figure 3.5, Appendix Table B.1). We did not use pore water characterization data from well XTPW01 because data from this location are not representative of groundwater quality. A summary of all the groundwater data used in this risk evaluation is presented in Table 3.2.

Table 3.1 Groundwater Monitoring Wells Related to Joppa West

Well ID	Date Constructed	Screened Depth (ft. bgs)	Screened Interval	Sampling Years
G101[a]	6/1/2010	41.7 - 51.7	UCU	2010 - 2013
G111	6/24/2010	31.7 - 41.7	UCU	2010 - 2013
G112C	1/29/2013	15 - 25	UCU	2010 - 2013
G113	6/25/2010	29.7 - 39.7	UCU	2010 - 2013
TPZ114	3/17/2021	30 - 40	UCU	2021
TPZ116	3/17/2021	20 - 30	UCU	2021
TPZ117	3/16/2021	30 - 40	UCU	2021
TPZ117D	3/15/2021	58 - 68	UA	2021

Notes:
ft. bgs = Feet Below Ground Surface; UA = Uppermost Aquifer; UCU = Upper Confining Unit.
(a) G101 is upgradient from Joppa West.
Source: Ramboll US Corp. (2021); Natural Resource Technology, Inc. (2013).

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[3] Samples were analyzed for a more complete list of constituents, which include CCR-related constituents as defined by the Federal and Illinois CCR Rules (US EPA, 2015a; IEPA, 2020). Perchlorate and vanadium were added to the list after the groundwater monitoring plan for the Site was approved (Natural Resource Technology, Inc., 2013). General water quality parameters (nitrogen, nitrate, and alkalinity) and essential nutrients (calcium, magnesium, potassium, and sodium) were also analyzed, but not evaluated in the risk evaluation.

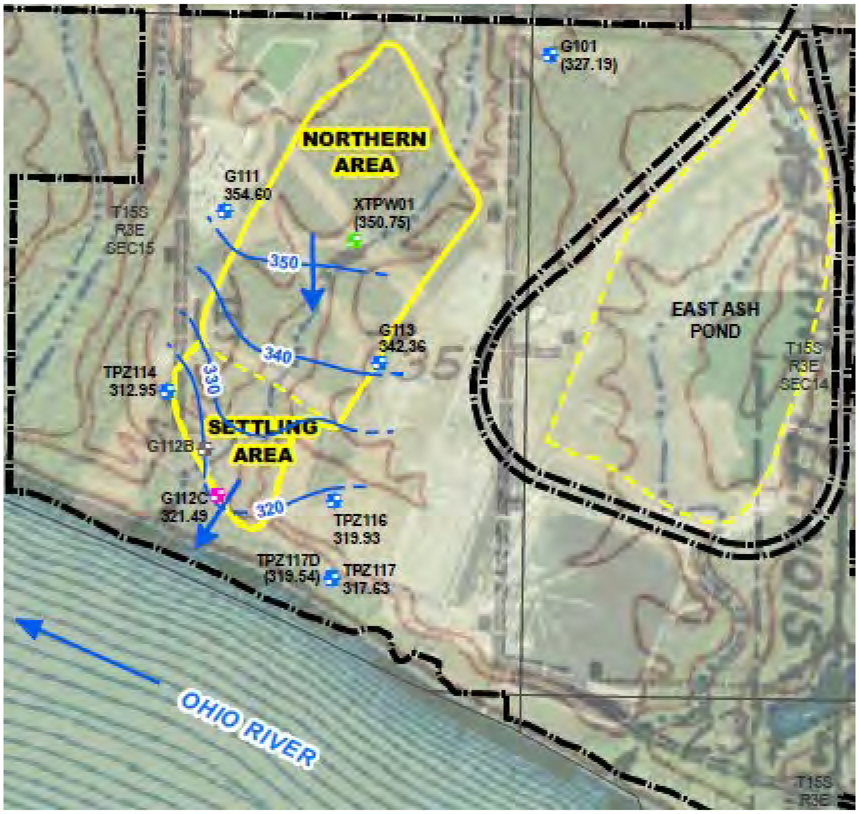

Figure 3.5 Groundwater Monitoring Well Locations. Source: Ramboll US Corp. (2021).

Table 3.2 Groundwater Data Summary (2010-2013, 2021)

Analyte[a]	Samples with Constituent Detected	Samples Collected	Minimum Detect (mg/L)	Maximum Detect (mg/L)	Maximum Detection Limit[b] (mg/L)
Dissolved Metals (mg/L)					
Antimony	0	34			0.0060
Arsenic	0	34			0.025
Barium	34	34	0.044	0.64	
Beryllium	0	34			0.0010
Boron	3	34	3.1	3.3	0.020
Cadmium	0	34			0.0020
Chromium	0	34			0.010
Cobalt	0	34			0.010
Copper	0	34			0.010
Iron	6	34	0.039	1.3	0.020
Lead	1	34	0.0026	0.0026	0.040
Manganese	8	34	0.0064	0.18	0.0050
Mercury	0	34			0.00020
Nickel	0	34			0.010
Selenium	0	34			0.050
Silver	0	34			0.010
Thallium	0	34			0.0020
Zinc	2	34	0.013	0.018	0.010
Total Metals (mg/L)					

Analyte[a]	Samples with Constituent Detected	Samples Collected	Minimum Detect (mg/L)	Maximum Detect (mg/L)	Maximum Detection Limit[b] (mg/L)
Antimony	5	8	0.00050	0.0053	0.0010
Arsenic	2	8	0.017	0.020	0.010
Barium	8	8	0.085	0.52	
Beryllium	3	8	0.00060	0.0054	0.00050
Boron	4	8	0.015	4.3	0.020
Cadmium	1	8	0.00090	0.00090	0.0020
Chromium	3	8	0.012	0.099	0.0050
Cobalt	5	8	0.0031	0.038	0.0050
Cyanide	0	34			0.0070
Iron	8	8	0.27	72	
Lead	2	8	0.021	0.039	0.0075
Lithium	7	8	0.0022	0.035	0.0050
Manganese	8	8	0.0066	0.92	
Mercury	0	8			0.00020
Molybdenum	5	8	0.0039	0.0092	0.010
Selenium	0	8			0.040
Thallium	0	8			0.0020
Other (mg/L, unless otherwise noted)					
Chloride	38	42	3.0	34	5.0
Fluoride	42	42	0.23	0.81	
Nitrogen, Nitrate	31	34	0.052	2.1	0.050
Sulfate	42	42	17	532	
Total Dissolved Solids	43	43	208	1,010	
pH (SU)	34	34	6.4	7.3	

Notes:

Blank = Not Applicable; SU = Standard Unit.

(a) Dissolved metals concentrations, total cyanide, and total fluoride are from samples collected in 2010-2013. Total metal concentrations are from samples collected in 2021.

(b) The maximum detection limit is the highest detection limit reported for all groundwater samples collected from eight wells downgradient of or adjacent to Joppa West from both the upper confining unit and the uppermost aquifer.

Source: Ramboll US Corp. (2021); Natural Resource Technology, Inc. (2013).

4 Risk Evaluation

4.1 Risk Evaluation Process

A risk evaluation was conducted to determine whether constituents present in groundwater underlying and downgradient of Joppa West have the potential to pose adverse health effects to human and ecological receptors. The risk evaluation is consistent with the principles of risk assessment established by US EPA and has considered evaluation criteria detailed in Illinois guidance documents (*e.g.*, IEPA, 2019a, 2013).

The general risk evaluation approach is summarized in Figure 4.1 and discussed below.

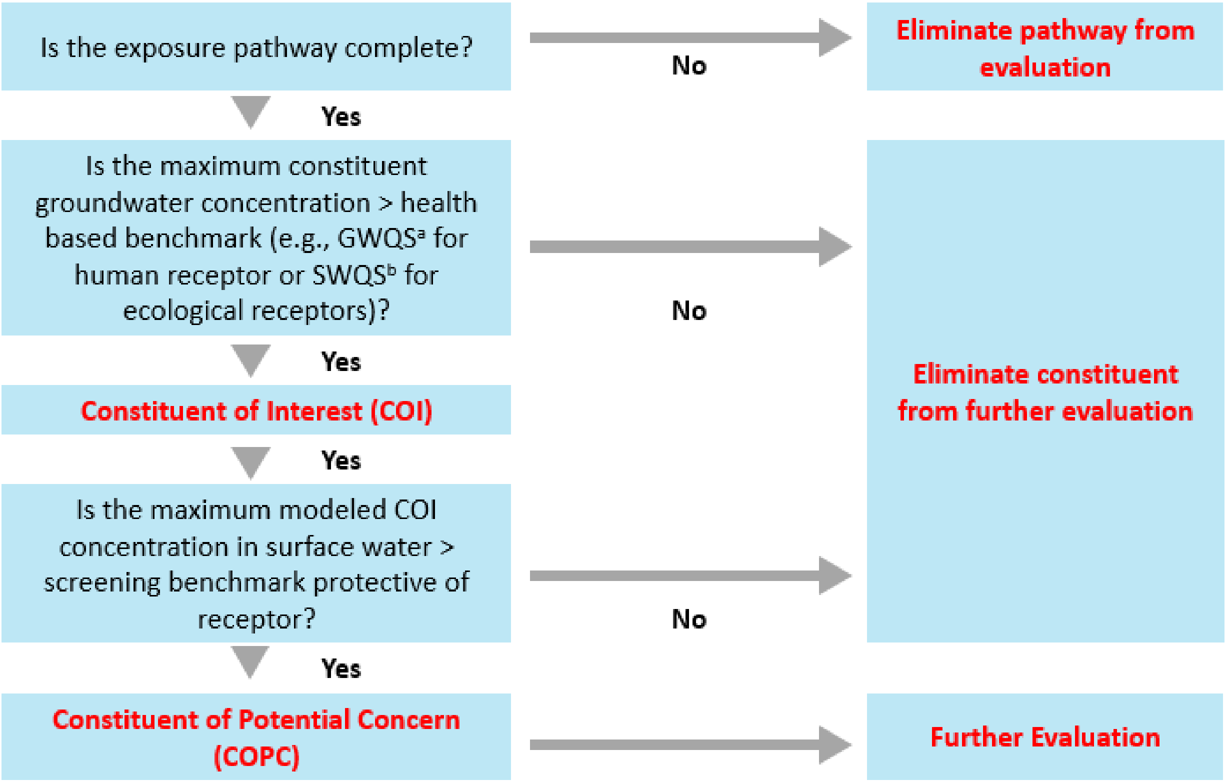

Figure 4.1 Overview of Risk Evaluation Methodology. IEPA = Illinois Environmental Protection Agency; GWQS = IEPA Groundwater Quality Standard; SWQS = IEPA Surface Water Quality Standard; US EPA = United States Environmental Protection Agency.
(a) Although the groundwater at Joppa West is classified as Class II groundwater, we conservatively used Class I GWQS to identify COIs.
(b) IEPA SWQS protective of chronic exposures were used to identify ecological COIs. In the absence of a SWQS, US EPA Region IV ecological screening values were used.

The first step in the risk evaluation was to develop the CEMs and identify complete exposure pathways. All potential receptors and exposure pathways based on groundwater use and surface water use in the vicinity of the Site were considered. Exposure pathways that are incomplete were excluded from the evaluation.

As noted in Section 3.3, groundwater data have been collected from 2010 to 2013 and again in 2021 and were used to identify COIs. COIs were identified as constituents with maximum concentrations in groundwater in excess of a groundwater quality standard (GWQS)[4] for human receptors and a surface water quality standard (SWQS) for ecological receptors (Sections 3.3.1 and 3.2.2). Based on the CSM (Section 3.2), groundwater underlying Joppa West flows from north to south toward the Ohio River. Therefore, Joppa West-related constituents may impact the adjacent surface waters. Because surface water samples have not been collected from the Ohio River adjacent to the Site, Gradient modeled the potential migration of COI concentrations from groundwater to surface water to evaluate potential risks to receptors. Gradient modeled the COI concentrations in the river's surface water based on available groundwater data. Modeled COI concentrations in surface water were compared to conservative, generic risk-based screening benchmarks for human health and ecological receptors. These generic screening benchmarks rely on default assumptions with limited consideration of site-specific characteristics. Human health benchmarks are receptor-specific values calculated for each pathway and environmental medium that are designed to be protective of human health. Ecological benchmarks are medium-specific values designed to be protective of all potential ecological receptors exposed to surface water. Ecological and human health screening benchmarks are inherently conservative because they are intended to screen out chemicals that are of no concern with a high level of confidence. Therefore, a maximum modeled COI concentration exceeding a screening benchmark does not indicate an unacceptable risk, but only that further risk evaluation is warranted. COIs with maximum concentrations exceeding a conservative screening benchmark are identified as COPCs requiring further evaluation.

As described in more detail below, this evaluation relied on the screening assessment to demonstrate that constituents present in groundwater underlying Joppa West do not pose an unacceptable human health or ecological risk. That is, after the screening step, no COPCs were identified and further assessment was not warranted.

4.2 Human and Ecological Conceptual Exposure Model

4.2.1 Human Conceptual Exposure Model

A CEM provides an overview of the receptors and exposure pathways requiring risk evaluation. The CEM describes the source of the contamination, the mechanism that may lead to a release of a constituent, the environmental media to which a receptor may be exposed, the route of exposure (exposure pathway), and the types of receptors that may be exposed to these environmental media.

The human CEM for Joppa West depicts the relationships between the off-Site environmental media potentially impacted by constituents in groundwater and human receptors that could be exposed to these media. Figure 4.2 presents a human CEM for Joppa West. It considers a human receptor who could hypothetically be exposed to COIs from the ash pond groundwater that migrate to surface water and are

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[4] As discussed further in Section 4.3.2 in the report, GWQSs are protective of human health and not necessarily of ecological receptors. While ecological receptors are not exposed to groundwater, groundwater can potentially enter into the adjacent surface water and impact ecological receptors. Therefore, two sets of COIs were identified, one for humans and another for ecological receptors.

taken up by fish. The following human receptors and exposure pathways were evaluated for inclusion in the site-specific CEM.

- Residents – exposure to groundwater or surface water as drinking water;
- Recreators in the river near the Site;
  - Swimmers – exposure to surface water while swimming;
  - Anglers – exposure to surface water and consumption of locally caught fish.

These exposure pathways were considered complete except for residential exposure to groundwater or surface water used as a drinking water source. Section 4.2.1.1 (below) explains why the residential drinking water pathway is incomplete, and Section 4.2.1.2 provides additional descriptions of the recreational exposures.

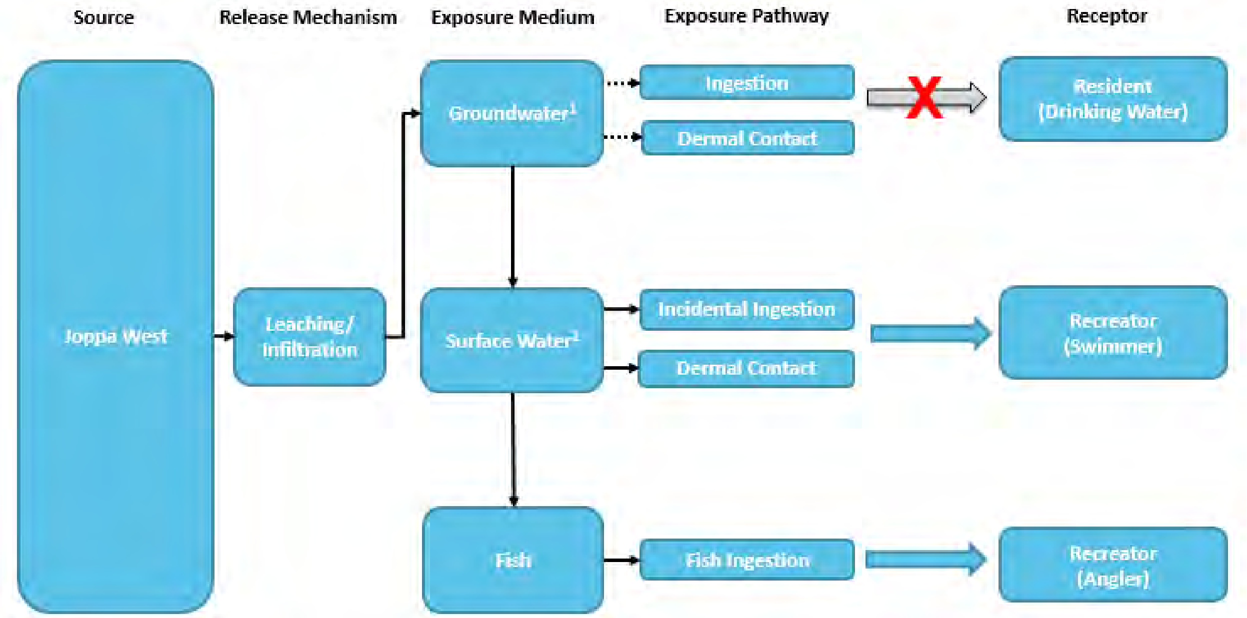

Figure 4.2 Human Conceptual Exposure Model. Dashed line/Red X = Incomplete or insignificant exposure pathway.
(1) Groundwater in the vicinity of the Site is not used as a drinking water or irrigation source.
(2) Surface water is not used as a drinking water source.

4.2.1.1 Groundwater or Surface Water as a Drinking Water/Irrigation Source

Groundwater and surface water potentially impacted by Joppa West are not considered sources of drinking water. Specifically, shallow groundwater from the UCU in the vicinity of Joppa West is not used as a source of drinking water, and no potable water sources are downgradient of Joppa West. Hydrogeological and geochemical evidence indicate that potential Joppa West-related groundwater cannot plausibly impact distant potable wells. Further, the downward migration of the UCU groundwater into the UA is largely restricted due to the presence of a continuous silty-clay unit (Natural Resource Technology, Inc., 2013). A summary of the evidence supporting the conclusion that residential uses of the shallow groundwater and

Ohio River surface water adjacent to Joppa West as sources of drinking water are incomplete exposure pathways is presented below.

- **Shallow groundwater from the UCU is not classified as a potable groundwater source.** The majority of the wells identified within 2,500 ft. of Joppa West in a well survey are screened in one of the two aquifers underlying the UCU (well depths > 50 ft. below ground surface) (Natural Resource Technology, Inc., 2013). According to 35 IAC 620.210(a) (IEPA, 2013), groundwater from the UCU is not classified as a potable Class I groundwater source because (a) Joppa West is not within the minimum setback zone of a well that serves as a drinking water source; (b) the monitoring wells for Joppa West, with the exception of TPZ117D, are screened in silty-clay, instead of sand/gravel, that is ≥ 5 ft. thick and containing ≤ 12% fine particles; and (c) hydraulic conductivity values derived for each of the individual monitoring wells in the UCU and the geometric mean of those values (5.9×10^{-6} cm/s) for the silty clay unit (*i.e.*, UCU) are lower than 1.0×10^{-4} cm/s (Natural Resource Technology, Inc., 2012, 2013). According to 35 IAC 620.210(a), groundwater directly underlying Joppa West within the UCU is classified as Class II general resource groundwater and is a source of water for "agricultural, industrial, recreational or other beneficial uses" but is not a source of potable water (IEPA, c. 2021).
- **No potential groundwater receptors are in the vicinity of Joppa West**. A well survey was conducted for the Site to identify private, semi-private, and non-community water supply wells (non-CWS) within 2,500 ft. of the property; community water supply (CWS) wells and surface water intakes within 1 mile of property; and wellhead protection areas within the property. A total of 46 wells were identified within a 2,500 ft. radius of the Site and 2 CWS wells were identified within 1 mile of the Site (Ramboll US Corp., 2020). Based on this study, there are no wells that use groundwater as a source of drinking water that are downgradient of, and potentially impacted by, Joppa West. IEPA supports this conclusion by noting that no private wells have the potential for impact based on a hydrogeological assessment for the Site (IEPA, 2012). A summary of the well survey findings are as follows:
    - Eight private or semi-private wells were identified on the Joppa Plant property; four of these are owned by the utility and not used for drinking water. The remaining four private wells are either unlikely to still be present or operational (Ramboll US Corp., 2020). Therefore, no groundwater from these wells is being used as a drinking water source.
    - Thirty-eight private or semi-private wells were identified within 2,500 ft. of the Joppa Plant property (Ramboll US Corp., 2020). While 18 of these well were identified as being downgradient of the property, none are downgradient of Joppa West. The remaining 20 wells are located upgradient (north) or side-gradient (east or west) of the property (Ramboll US Corp., 2020). There is no plausible mechanism by which any CCR constituents associated with Joppa West could impact groundwater quality at any of these wells.
    - Two CWS wells were identified within a mile of the Site. One well, formerly used by the Village of Joppa, is abandoned; the other, located northeast of the property and upgradient of Joppa West is an active well used by the Village of Joppa (Ramboll US Corp., 2020). There is no plausible mechanism by which any impacts associated with Joppa West could impact groundwater quality at these wells.
    - No non-CWS wells or surface water intakes were identified within 2,500 ft. of the Site. In addition, the Site is not located in a wellhead protection area (Ramboll US Corp., 2020).
- **UCU is a low-yield groundwater formation**. The UCU is composed of unconsolidated materials of the Equality and Metropolis Formations that have very low permeability. The UCU is about 50 ft. thick and consists of silt, clay, and minor amounts of sand and gravel. The hydraulic conductivity of the UCU ranges from 1.1×10^{-6} to 7.6×10^{-5} cm/s with a geometric mean hydraulic

conductivity of 5.9 x 10^{-6} cm/s (Natural Resource Technology, Inc., 2013). This low permeability water-bearing zone likely does not meet the yield requirements to be considered an aquifer (US EPA, 1986).

- **There is no off-Site migration of Joppa West-related constituents to nearby wells because all shallow groundwater flows into the Ohio River**. The Ohio River is the regional discharge point for groundwater, both within the UCU and the underlying aquifers. Groundwater hydraulic head measurements in three wells (G111, G113, and G112C) screened within the UCU near Joppa West indicate that groundwater flows toward the river (Natural Resource Technology, Inc., 2013). It is expected that groundwater within the UA and the BGU also flow toward and into the Ohio River. Based on groundwater elevation and because the Ohio River is a large regional hydraulic boundary (*i.e.*, serves as a sink for groundwater discharges in the area), constituents present in groundwater underlying Joppa West are not likely to migrate under or laterally to the river.
- **The Ohio River adjacent to the Site is not used as a public water supply.** The Ohio River is designated by the IEPA as a primary contact recreation site and is not designated for public and food processing water supplies (IEPA, 2018). Therefore, surface water adjacent to the Site is not used as a source of drinking water, and this exposure pathway was not evaluated further.
- **Joppa West has a limited hydraulic connection to the underlying aquifers**. The UCU is composed of a 50 ft. thick silty-clay layer of the Equality and Metropolis Formations (Natural Resource Technology, Inc., 2013). A thick, continuous clay forms a hydraulic separation between Joppa West and the UA. Furthermore, hydraulic conductivity of the UCU is low, restricting any downward migration of shallow groundwater originating from Joppa West to the underlying aquifers (Natural Resource Technology, Inc., 2013). Downgradient of Joppa West, vertical hydraulic gradient data indicate that groundwater in the UA is flowing upward into the UCU (Ramboll US Corp., 2021). This reduces the likelihood of Joppa West-related impacts in the UA.

4.2.1.2 Recreational Exposures

The Ohio River flows in a northwest direction past the Site before converging with the Mississippi River approximately 26 miles downstream of the Site. Although the river's width and depth adjacent to the Site were not measured, recent samples (2020-2021) collected at United States Geological Survey (USGS) Station 03612600[5] (Ohio River at Olmsted, Ilinois, located approximately 11 miles downstream of the Site) measured a mean depth of 29 ft. and a mean width of 3,224 ft. (USGS, 2021).

Recreational exposure to surface water may occur while recreating on the river adjacent to the Site (*e.g.*, swimming, boating, canoeing, tubing). Although recreators could be exposed to surface water from various recreational activities, we evaluated risks for a swimmer. Exposure estimates for swimmers provide a health-protective means to evaluate exposure during other recreational activities, given that swimming results in more contact time with water than other recreational activities.

In addition to swimming, recreators have the potential to consume locally caught fish from the Ohio River near the Site, although this is highly unlikely because of the current fish advisory for the Ohio River due to elevated concentrations of constituents unrelated to Joppa West (*i.e.*, organics, such as dioxins and polychlorinated biphenyls, and mercury [IDPH, c. 2021]). Therefore, Gradient conservatively evaluated

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[5] USGS station 03612500 (Ohio River at Dam 53 Near Grand Chain, Illinois) located closer to the Site (approximately 10 miles downstream of the Site) measured a mean depth of 26 ft. and a mean width of 3,833 ft. from samples collected between 1987 and 1992 (USGS, 2021). While USGS Station 03611500 (Ohio River at Metropolis, Illinois) is located 7.5 miles downstream from the Site, stream depth and width information were not recorded at this station (USGS, 2021).

potential risks to recreators exposed to the surface water[6] while swimming in the Ohio River downgradient of the Site and recreators consuming locally caught fish.

4.2.2 Ecological Conceptual Exposure Model

The ecological CEM for Joppa West depicts the relationships between off-Site environmental media (surface water) potentially impacted by COIs in groundwater and ecological receptors that may be exposed to these media. There are no ecological receptors that could potentially be exposed to constituents present in groundwater underlying or downgradient of Joppa West, and thus, there are no completed ecological exposure pathways associated with groundwater. While ecological receptors are not exposed to groundwater, groundwater can potentially migrate into the Ohio River and impact ecological receptors in the river. The ecological risk evaluation considered both direct toxicity as well as secondary toxicity *via* bioaccumulation. Figure 4.3 presents the ecological CEM for Joppa West. The following ecological receptor groups and exposure pathways were considered.

- **Ecological Receptors Exposed to Surface Water:**

  Aquatic life (*e.g.*, aquatic plants, aquatic invertebrates, and fish).

- **Ecological Receptors Exposed to Bioaccumulative COIs:**

  Higher-trophic-level wildlife (avian and mammalian) *via* direct exposures (surface water exposure) and secondary exposures through the consumption of prey (*e.g.*, plants, invertebrates, small mammals, and fish).

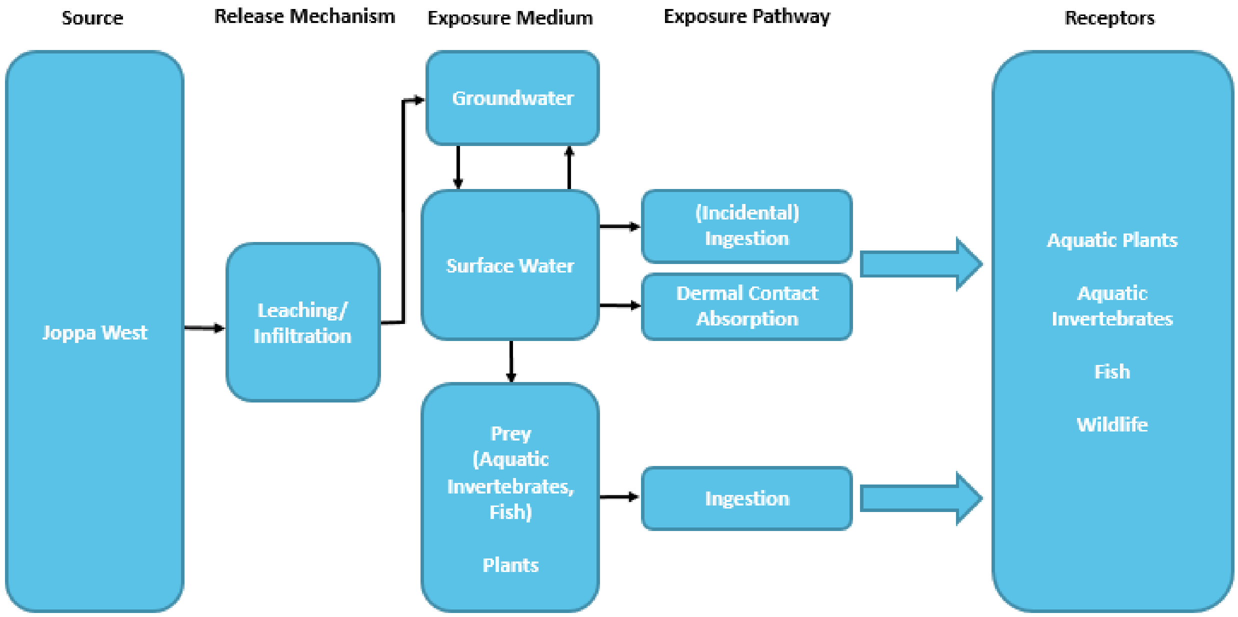

Figure 4.3 Ecological Conceptual Exposure Model

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[6] While swimmers may be exposed to Ohio River sediments, their sediment exposure is limited compared to their surface water exposure. Swimmers do not have a prolonged contact time with sediment and any sediment exposure would be washed off in the surface water. Therefore, sediment exposure was considered an insignificant exposure pathway and not evaluated further for a recreator.

4.3 Identification of Constituents of Interest

Risks were evaluated for COIs. A constituent was considered a COI if the maximum detected constituent concentration in groundwater exceeded a health-based benchmark. According to US EPA Risk Assessment Guidance (US EPA, 1989), this screening step is designed to reduce the number of constituents carried through the risk evaluation that are anticipated to have a minimal contribution to the overall risk. Identified COIs are the constituents that are most likely to pose a risk concern in the surface water adjacent to the Site.

4.3.1 Human Health Constituents of Interest

For the human health risk evaluation, COIs were identified by comparing the maximum constituent concentrations detected in groundwater within either the UCU or the UA to GWQS. Groundwater data from the eight wells (G101, G111, G112C, G113, TPZ114, TPZ116, TPZ117, and TPZ117D) downgradient of or adjacent to Joppa West were used to identify COIs. Although these eight wells represent groundwater data from the UCU and UA, water from both groundwater units flows into the Ohio River.

While the groundwater within the UCU is classified as a Class II groundwater (Natural Resource Technology, Inc., 2013), we conservatively compared the maximum constituent concentrations in groundwater against Class I GWQS (IEPA, 2013). Class I GWQSs are not available for lithium and molybdenum. For these two constituents, we used IEPA's Groundwater Protection Standards (GWPSs). Gradient used the maximum detected constituent concentrations from all wells adjacent and downgradient of Joppa West over all sampling events without considering spatial or temporal representativeness for human exposures in this initial evaluation to identify COIs. Assuming continuous exposure to the maximum concentration of a constituent overestimates potential exposures. Thus, it is important to note that the identification of COIs does not indicate that risks can occur, only that further risk evaluation is warranted. Using this approach, six COIs were identified for the human health risk evaluation *via* a surface water pathway (Table 4.1): arsenic, beryllium, boron, iron, lead, and manganese. The maximum sulfate concentration was detected (532 mg/L) above the Class I GWQS (400 mg/L). Although the basis of IEPA's Class I GWQS is not provided, it is likely based on aesthetic quality as the taste threshold is 300-400 mg/L, and there are no studies available regarding the toxicity of sulfates (US DOE, 1991). Given that sulfate is not likely to pose a human health risk concern in the event of exposure, sulfate was not identified as a COI.

Table 4.1 Human Health Constituents of Interest

Analytes[a]	Maximum Concentration[b]	Class I GWQS[c]	Human Health COI[d]
Dissolved Metals (mg/L)			
Barium	0.64	2.0	No
Boron	3.3	2.0	Yes
Iron	1.3	5.0	No
Lead	0.0026	0.0075	No
Manganese	0.18	0.15	Yes
Zinc	0.018	5.0	No
Total Metals (mg/L)			
Antimony	0.0053	0.0060	No
Arsenic	0.020	0.010	Yes
Barium	0.52	2.0	No
Beryllium	0.0054	0.0040	Yes
Boron	4.3	2.0	Yes
Cadmium	0.00090	0.0050	No
Chromium	0.099	0.10	No
Cobalt	0.038	1.0	No
Iron	72	5	Yes
Lead	0.039	0.0075	Yes
Lithium	0.035	0.15	No
Manganese	0.92	0.15	Yes
Molybdenum	0.0092	0.10	No
Other (mg/L, unless otherwise noted)			
Chloride	34	200	No
Fluoride	0.81	4	No
Nitrogen, Nitrate	2.1	10	No
Sulfate	532	400	No[e]
Total Dissolved Solids	1,010	1,200	No
pH (SU)	7.3	6.5-9.0	No

Notes:

COI = Constituent of Interest; GWQS = Groundwater Quality Standard; SU = Standard Unit; UA = Uppermost Aquifer; UCU = Upper Confining Unit.

Shaded = Compound identified as a COI.

(a) Analytes that were detected in at least one groundwater sample from the eight wells related to Joppa West are presented. Dissolved antimony, dissolved arsenic, dissolved beryllium, dissolved cadmium, dissolved chromium, dissolved cobalt, dissolved copper, dissolved and total mercury, dissolved nickel, dissolved and total selenium, dissolved silver, dissolved and total thallium, and total cyanide were not detected in any of the groundwater samples related to Joppa West.

(b) The maximum concentration is the highest concentration reported for all groundwater samples collected from eight wells downgradient of or adjacent to Joppa West from both the UCU and the UA.

(c) Although groundwater at Joppa West are classified as Class II waters (Natural Resource Technology, Inc., 2013), Class I GWQSs were conservatively used to identify human health COIs. Class I GWQSs are not available for lithium and molybdenum. For these two analytes, IEPA's GWPSs were used.

(d) Analytes with maximum detected concentrations exceeding a Class I groundwater standard are considered COIs.

(e) Sulfate is not likely to pose a human health risk concern due to the absence of studies regarding toxicity to human health. Therefore, sulfate was not considered a COI.

Source: Ramboll US Corp. (2021); Natural Resource Technology, Inc. (2013).

4.3.2 Ecological Constituents of Interest

Class I GWQS, as defined in IEPA's guidance, were developed to protect human health, but not necessarily ecological receptors. While ecological receptors are not exposed to groundwater, groundwater can potentially migrate into the adjacent surface water and impact ecological receptors. Therefore, the maximum concentrations of analytes detected in groundwater were compared to ecological surface water benchmarks protective of aquatic life to identify ecological COIs.

The surface water screening benchmarks for freshwater organisms were obtained from the following hierarchy of sources:

- IEPA (2019a) SWQS. IEPA SWQS are health-protective benchmarks for aquatic life exposed to surface water on a long-term basis (*i.e.*, chronic exposure). The SWQS for several metals are hardness dependent (cadmium, chromium, copper, fluoride, lead, manganese, nickel, and zinc). Screening benchmarks for these constituents were calculated assuming US EPA's (2019a) default hardness[7] of 100 mg/L.
- US EPA Region IV (2018) surface water Ecological Screening Values (ESVs) for hazardous waste sites.

Consistent with the human health risk evaluation, Gradient used the maximum detected constituent concentrations from groundwater samples collected from the UCU and UA from all wells downgradient of or adjacent to Joppa West over all sampling events without considering spatial or temporal representativeness for ecological receptor exposures. The use of the maximum constituent concentrations in this evaluation is designed to conservatively identify COIs that warrant further investigation. Cobalt, iron, and lead were identified as COIs for ecological receptors (Table 4.2).

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[7] While hardness data are not available for the Ohio River adjacent to the Site, a USGS station (03612600) located at Olmstead, Illinois (latitude 37 10'45", longitude 89 03'30" NAD27), approximately 11 miles downstream from the Site, measured hardness concentrations ranging from 91 to 171 mg/L, with a mean hardness of 122 mg/L, from 89 samples collected between 2014 and February 2021. A USGS station (03612500) located at Grand Chain, Illinois (latitude 37 12'11", longitude 89 02'30" NAD27), 10 miles from the Site, measured hardness concentrations ranging from 88 to 155 mg/L from 14 samples collected between 1987 and 1992. The average hardness of these samples is 123 mg/L. US EPA's default hardness of 100 mg/L was conservatively used. Using a higher hardness (123 mg/L) does not change the list of COIs.

Table 4.2 Ecological Constituents of Interest

Analytes[a]	Maximum Concentration[b]	Ecological Benchmark[c]	Basis	Ecological COI[d]
Dissolved Metals (mg/L)				
Barium	0.64	5.0	IEPA SWQS	No
Boron	3.3	7.6	IEPA SWQS	No
Iron	1.3	1.0	EPA R4 ESV	Yes
Lead	0.0026	0.016	IEPA SWQS	No
Manganese	0.18	1.8	IEPA SWQS	No
Zinc	0.018	0.031	IEPA SWQS	No
Total Metals (mg/L)				
Antimony	0.0053	0.19	EPA R4 ESV	No
Arsenic	0.020	0.19	IEPA SWQS	No
Barium	0.52	5.0	IEPA SWQS	No
Beryllium	0.0054	0.064	EPA R4 ESV	No
Boron	4.3	7.6	IEPA SWQS	No
Cadmium	0.00090	0.0011	IEPA SWQS	No
Chromium	0.099	0.21	IEPA SWQS	No
Cobalt	0.038	0.019	EPA R4 ESV	Yes
Iron	72	1	EPA R4 ESV	Yes
Lead	0.039	0.020	IEPA SWQS	Yes
Lithium	0.035	0.44	EPA R4 ESV	No
Manganese	0.92	1.8	IEPA SWQS	
Molybdenum	0.0092	7.2	EPA R4 ESV	No
Other (mg/L, unless otherwise noted)				
Chloride	34	500	IEPA SWQS	No
Fluoride	0.81	4.0	IEPA SWQS	No
Nitrogen, Nitrate	2.1	10	IEPA SWQS	No
Sulfate	532	NA		No
Total Dissolved Solids	1,010	NA		No
pH (SU)	7.3	NA		No

Notes:

COI = Constituent of Interest; EPA R4 ESV = US Environmental Protection Agency Region IV Ecological Screening Value; IEPA SWQS= Illinois Environmental Protection Agency Surface Water Quality Standard; NA = Not Available; SU = Standard Unit; UA = Uppermost Aquifer; UCU = Upper Confining Unit.

Shaded = Compound identified as a COI.

(a) Analytes that were detected in at least one groundwater sample from the eight wells related to the Joppa West are presented. Dissolved antimony, dissolved arsenic, dissolved beryllium, dissolved cadmium, dissolved chromium, dissolved cobalt, dissolved copper, dissolved and total mercury, dissolved nickel, dissolved and total selenium, dissolved silver, dissolved and total thallium, and total cyanide were not detected in any of the groundwater samples related to Joppa West.

(b) The maximum concentration is the highest concentration reported for all groundwater samples collected from eight wells downgradient of or adjacent to Joppa West from both the UCU and the UA.

(c) Ecological benchmarks are from the hierarchy of sources discussed in Section 4.3.2: IEPA SWQS (IEPA, 2019a); US EPA R4 "Ecological Risk Assessment Supplemental Guidance" (US EPA Region IV, 2018).

(d) Analytes with maximum detected concentrations exceeding a benchmark protective of surface water exposure are considered ecological COIs.

Source: Ramboll US Corp. (2021); Natural Resource Technology, Inc. (2013).

4.3.3 Surface Water Modeling Assumptions

Surface water sampling has not been conducted in the Ohio River adjacent to the Site. To estimate potential surface water exposures, Gradient modeled concentrations in river surface waters from groundwater loading to the Ohio River for all detected COIs. This is because the constituents detected in groundwater above a health-based benchmark are most likely to pose a risk concern in the adjacent surface water. Constituents that were not detected were not modeled into surface water, but evaluated separately as part of the uncertainty section (Section 4.6).

Gradient modeled identified human health and ecological COI concentrations in the surface water using a mass balance calculation based on the surface water and groundwater mixing. The model assumes a well-mixed groundwater-surface water location.

The maximum detected concentrations in groundwater (regardless of well location) were conservatively used to model COI concentrations in surface water. For COIs that were measured as both total and dissolved fractions, we used the maximum of the total and dissolved COI concentrations to model surface water concentrations. Maximum detected concentrations for arsenic, beryllium, boron, cobalt, iron, lead, and manganese are based on total concentrations. Modeling surface water concentrations using total metal concentration for these COIs may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow into and mix with surface water.

The volume of groundwater entering the surface water was estimated based on properties of the UCU (Table 4.3). While groundwater from the UA also flows into the Ohio River, the maximum COI concentrations are all from wells sampled in the UCU, with the exception of manganese.[8] This modeling approach does not account for constituent partitioning that may occur between other environmental media (*e.g.*, sediment pore water, sediment, and suspended solids). Moreover, this modeling approach does not account for geochemical transformations that may occur during groundwater mixing with surface water. Gradient assumed that predicted COI surface water concentrations were influenced only by the physical mixing of groundwater as it enters the surface water and were not further influenced by the geochemical reactions in the water and sediment such as precipitation. Given that these factors can reduce the potential COI concentrations in the Ohio River, the modeled surface water concentrations are upper-end estimates of exposure to COI concentrations. Note also that this model only predicts surface water concentrations as a result of the potential migration of COI concentrations in groundwater and does not account for background concentrations in the surface water or concentrations resulting from other sources. Details of the modeling are presented in Appendix C.

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[8] The maximum manganese concentration was observed in well TPZ117D screened in the UA, which has different hydraulic properties than the UCU. Uncertainties associated with modeling the maximum manganese concentration from the UA with UCU hydraulic characteristics are presented in Section 4.6.

Table 4.3 Groundwater and Surface Water Properties Used in Modeling

Parameter	Unit	Value	Notes/Source
Groundwater			
COI Concentration	mg/L	Constituent specific	Maximum detected concentration in groundwater
Cross Section Area for the UCU Layer	m^2	4,637	Estimated using the estimated representative length of 1,584 ft. or 483 m (distance between wells TP114 and TP116) and the representative saturated UCU thickness of 31.5 ft. or 9.6 m (groundwater elevation at 112C minus the elevation of the bottom of the surficial unit) (Ramboll US Corp., 2021)
Aquifer Hydraulic Gradient in the UCU Layer	m/m	0.014	Hydraulic gradient measured in the UCU near Joppa West (Natural Resource Technology, Inc., 2013)
Aquifer Hydraulic Conductivity in the UCU Layer	cm/s	7.4×10^{-6}	Average hydraulic conductivity of UCU based on slug test results in three monitoring wells near Joppa West (Natural Resource Technology, Inc., 2013)
Surface Water			
Surface Water Flow Rate	L/yr	7.2×10^{13}	The 10th percentile of the daily mean flow rates at the Ohio River Grand Chain USGS gauging station[a] (Station ID 03612500) (USGS, 2021)

Notes:
COI = Constituent of Interest; UCU = Upper Confining Unit; USGS = United States Geological Survey.
(a) Nearby USGS gauging stations (Station IDs 03611500 and 03612600) reported 10th percentile of the daily mean flow rates of 6.2×10^{13} L/yr and 9.1×10^{13} L/yr, respectively. Variations in the surface water flow rates did not produce a significant change in the results.

4.3.4 Modeled Surface Water Exposure Estimates

We modeled the contributions to surface water of all identified COIs (human health and ecological) in groundwater. The groundwater COI concentrations used in the modeling as well as the modeled surface water concentrations are presented in Table 4.4. These modeled COI surface water concentrations were used as a conservative upper-end estimate of the COI concentrations from groundwater impacts to which a human or ecological receptor might be exposed. These exposure estimates were used to evaluate risks to the identified receptors in Sections 4.4 and 4.5.

Table 4.4 Surface Water Exposure Estimates

COI[a]	Maximum Groundwater Concentration[b,c]	Modeled Surface Water Concentration[d]
Arsenic	0.020	4.2×10^{-11}
Beryllium	0.0054	1.1×10^{-11}
Boron	4.3	9.2×10^{-9}
Cobalt	0.038	8.0×10^{-11}
Iron	72	1.5×10^{-7}
Lead	0.039	8.1×10^{-11}
Manganese	0.92	1.9×10^{-9}

Notes:
COI = Constituent of Interest; GWQS = Groundwater Quality Standards; UA = Uppermost Aquifer; UCU = Upper Confining Unit.
All concentrations reported in mg/L.

(a) Human Health COIs (arsenic, beryllium, boron, iron, lead, and manganese) were identified by screening maximum constituent concentrations detected in groundwater against Class I GWQS. Ecological COIs (cobalt, iron, and lead) were identified by screening maximum detected constituent concentrations in groundwater against benchmarks protective of aquatic life.
(b) The maximum concentration is the highest concentration reported for all groundwater samples collected from eight wells downgradient of or adjacent to Joppa West from both the UCU and the UA.
(c) Maximum detected concentrations for arsenic, beryllium, boron, cobalt, and lead are based on total concentrations. Modeling surface water concentrations using total metal concentration may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow into and mix with surface water.
(d) Modeled data presented for analytes that were not analyzed in surface water, but detected in groundwater. Surface water was modeled using the maximum total or dissolved COI concentration in groundwater.

4.4 Human Health Risk Evaluation

The section below presents the results of the human health risk evaluation for recreators (swimmers and anglers) along the Ohio River adjacent to the Site. Risks were assessed using the maximum modeled COIs in surface water.

4.4.1 Recreators Near the Site (Swimmers and Anglers)

Screening Exposures: Recreators could be exposed to surface water *via* incidental ingestion and dermal contact while swimming. In addition, anglers could consume fish caught in the Ohio River adjacent to Joppa West. The maximum modeled COI concentrations in surface water were used as conservative upper-end estimates of the COI concentrations to which a recreator might be exposed directly (incidental ingestion of COIs in surface water while swimming) and indirectly (consumption of locally caught fish exposed to COIs in surface water).

Screening Benchmarks: Illinois surface water criteria (IEPA, 2019a) known as the Human Threshold Criteria (HTC) are based on incidental exposure through contact or ingestion of small volumes of water while swimming or during other recreational activities, as well as the consumption of fish. Illinois provides the following equation to calculate HTC values (IEPA, 2019a).

The HTC values (water and fish consumption, incidental water ingestion only, and fish ingestion only) were calculated from the following equation (IEPA, 2019a):

$$\mathrm{HTC} = \frac{\mathrm{ADI}}{\mathrm{W} + (\mathrm{F} \times \mathrm{BCF})}$$

where:

HTC = Human health protection criterion in milligrams per liter (mg/L);
ADI = Acceptable daily intake (mg/day)
W = Water consumption rate (L/day)
F = Fish consumption rate (kg/day)
BCF = Bioconcentration factor (L/kg)

Illinois defines the Acceptable Daily Intake (ADI) as the "maximum amount of a substance which, if ingested daily for a lifetime, results in no adverse effects to humans" (IEPA, 2019a). US EPA defines the chronic reference dose (RfD) as an "estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure for a chronic duration (up to a lifetime) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime" (US EPA, 2011). Illinois lists methods to derive an ADI from the primary literature (IEPA, 2019a). In accordance with Illinois guidance, we derived an ADI by multiplying the maximum contaminant level (MCL) by the default water ingestion rate of 2 L/day (IEPA, 2019a). In the absence of an MCL, we used the RfDs used by US EPA to derive its Regional Screening Levels (RSLs) (US EPA, 2020a) as a conservative estimate of the ADI. The RfDs are given in mg/kg-day, while the ADIs are given in mg/day; thus, we multiplied the RfD by a standard body weight of 70 kg to obtain the ADI in mg/day.

We used bioconcentration factors (BCFs) from a hierarchy of sources. The primary source of BCFs were those that US EPA used to calculate the National Recommended Water Quality Criteria (NRWQC) Human Health Criteria (US EPA, 2002, 2016a). Other sources included BCFs used in the US EPA coal combustion ash risk assessment (US EPA, 2014) and BCFs reported by Oak Ridge National Laboratory's Risk Assessment Information System (ORNL RAIS).[9] Because a BCF was not available for boron, the HTC for fish could not be calculated. Therefore, the HTC for boron is only based on exposure from swimming.

US EPA does not have toxicity values for lead. Lead risks are assessed by comparing predicted blood lead levels to target blood lead levels using US EPA blood lead models. Therefore, calculation of a screening benchmark is not plausible. As a result, the US EPA tap water RSL protective of residential use for lead is based on US EPA's Action Level in water as part of the Lead and Copper Rule (US EPA, 2020b). The lead Action Level is exceeded if 10% of the samples collected from a given source exceeds 15 µg/L (US EPA, 2020c). Although recreator surface water exposures are less frequent and less intense than potential residential drinking water exposures, Gradient conservatively used the US EPA Action Level based on residential exposures as the surface water recreational benchmark (US EPA, 2020c).

Illinois recommends a fish consumption rate of 0.020 kg/day (20 g/day) for an adult weighing 70 kg (IEPA, 2019a). Illinois recommends a water consumption rate of 0.01 L/day for "incidental exposure through contact or ingestion of small volumes of water while swimming or during other recreational activities" (IEPA, 2019a). Appendix Table D.1 presents the calculated HTC for fish and water and HTC for fish consumption only.

Screening Risk Evaluation: The maximum modeled COI concentrations in surface water were compared to the calculated Illinois HTCs (Table 4.5). All surface water concentrations were below their respective benchmarks. Although a benchmark for boron for fish consumption only was not calculated due to the absence of a BCF, boron from fish consumption is not expected to pose a concern for anglers because it does not readily bioaccumulate in the aquatic environment (ECHA, 2020; ATSDR, 2010). The HTCs are protective of recreational exposure *via* water and/or fish ingestion and do not account for dermal exposures to COIs in surface water while swimming. However, given that the modeled COI surface water concentrations are orders of magnitude below HTC protective of water and/or fish ingestion, dermal exposures to COIs are not expected to be a risk concern. Moreover, the dermal uptake of metals is considered to be minimal and only a small proportion of ingestion exposures. Thus, none of the COIs evaluated would be expected to pose an unacceptable risk to recreators exposed to surface water while swimming and anglers consuming fish caught in the Ohio River.

Table 4.5 Risk Evaluation of Recreators (Swimmers and Anglers)

COI	Maximum Modeled Surface Water Concentration[a] (mg/L)	HTC for Water and Fish (mg/L)	HTC for Water Only (mg/L)	HTC for Fish Only (mg/L)	COPC
Arsenic	4.2×10^{-11}	0.022	2	0.023	No
Beryllium	1.1×10^{-11}	0.021	0.8	0.021	No
Boron[b]	9.2×10^{-9}	1,400	1,400	NA	No
Iron	1.5×10^{-7}	126	4,900	129	No
Lead[c]	8.1×10^{-11}	0.015	0.015	0.015	No
Manganese	1.9×10^{-9}	93	168	210	No

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[9] Although recommended by US EPA (2015b), US EPA EpiSuite 4.1 (US EPA, 2019b) was not used as a source of BCFs because inorganic compounds are outside the estimation domain of the program.

Notes:
BCF = Bioconcentration Factor; COI = Constituent of Interest; COPC = Constituent of Potential Concern; CSF = Cancer Slope Factor; HTC = Human Threshold Criteria; NA = Not Available; RfD = Reference Dose; US EPA = United Environmental Protection Agency.
(a) Modeled COI concentrations reflect the potential maximum COI surface water concentrations from groundwater mixing with surface water.
(b) A BCF was not available for boron; therefore, the HTC for fish could not be calculated. In addition, the HTC for fish and water is only based on the water ingestion pathway.
(c) In the absence of a lead toxicity value (RfD or CSF), a benchmark could not be calculated. Therefore, US EPA's lead Action Level was used as the benchmark (US EPA, 2020c).

4.5 Ecological Risk Evaluation

Based on the ecological CEM (Figure 4.3), ecological receptors could be exposed to surface water and dietary items (*i.e.*, prey and plants) potentially impacted by identified COIs (cobalt, iron, and lead).

4.5.1 Ecological Receptors Exposed to Surface Water

Screening Exposures: The ecological evaluation considered aquatic communities in the Ohio River potentially impacted by identified ecological COIs. In the absence of surface water data, the maximum of the total and dissolved COI concentrations detected in groundwater was used to model surface water concentrations. Modeled surface water concentrations were compared to risk-based ecological screening benchmarks.

Screening Benchmarks: Surface water screening benchmarks protective of aquatic life were obtained from the following hierarchy of sources:

- IEPA SWQS (IEPA, 2019a), regulatory standards that are intended to protect aquatic life exposed to surface water on a long-term basis (*i.e.*, chronic exposure). For lead, the surface water benchmark is hardness dependent and calculated using a default hardness of 100 mg/L[10];
- NRWQC – Aquatic Life Criteria Table (US EPA, 2019a); and
- US EPA Region IV (2018) surface water ESVs for hazardous waste sites.

Risk Evaluation: The maximum modeled COI concentrations in surface water were compared to the above hierarchy of benchmarks protective of aquatic life (Table 4.6). All surface water concentrations were below their respective benchmarks. Thus, none of the COIs evaluated are expected to pose an unacceptable risk to aquatic life in the Ohio River.

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[10] While USGS hardness data are available, US EPA's (2019a) default hardness of 100 mg/L was conservatively used. Conservatisms associated with using a default hardness value are discussed in Section 4.4.

Table 4.6 Risk Evaluation of Ecological Receptors Exposed to Surface Water

COI[a]	Maximum Surface Water Concentration (mg/L)	Ecological Freshwater Benchmark (mg/L)	Basis	COPC
Cobalt	8.0×10^{-11}	0.019	US EPA R4 (2018)	No
Iron	1.5×10^{-7}	1.0	IEPA (2015)	No
Lead[b]	8.1×10^{-11}	0.021	IEPA (2015)	No

Notes:

COI = Constituent of Interest; COPC = Constituent of Potential Concern; IEPA = Illinois Environmental Protection Agency; US EPA R4 = United States Environmental Protection Agency Region IV.

(a) Modeled COI concentrations reflect the potential maximum COI surface water concentrations from groundwater mixing with surface water.

(b) A default hardness value of 100 mg/L was used to calculate this hardness-dependent benchmark.

4.5.2 Ecological Receptors Exposed to Bioaccumulative Constituents of Interest

Screening Exposures: COIs with bioaccumulative properties can impact higher-trophic-level wildlife exposed to these COIs *via* direct exposures (surface water and sediment exposure) and secondary exposures through the consumption of dietary items (*e.g.*, plants, invertebrates, small mammals, and fish).

Screening Benchmark: US EPA Region IV guidance (2018) and IEPA's SWQS guidance (IEPA, 2019a were used to identify analytes with potential bioaccumulative effects.

Risk Evaluation: None of the COIs[11] were identified as having potential bioaccumulative effects. Therefore, COIs are not considered to pose an ecological risk *via* bioaccumulation.

4.6 Uncertainties and Conservatisms

A number of uncertainties and their potential impact on the risk evaluation are discussed below. Wherever possible, conservative assumptions were used in an effort to minimize uncertainties and overestimate rather than underestimate risks.

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[11] US EPA Region IV (2018) identifies only mercury (including methyl mercury) and selenium as having potential bioaccumulative effects. IEPA (2019a) identifies mercury as the only metal with bioaccumulative properties. Both mercury and selenium were undetected and were not considered ecological COIs. Although arsenic, cadmium, copper, lead, nickel, silver, and zinc were not identified as bioaccumulative in US EPA Region IV (2018) and IEPA (2019a), they were previously identified as bioaccumulative in US EPA (2000). Lead is the only COI detected in groundwater; however, the maximum modeled lead surface water concentration (8.1×10^{-11} mg/L) is orders of magnitude below the benchmark protective of aquatic life (0.016 mg/L) and, therefore, not expected to be a concern to higher-trophic-level wildlife. While arsenic, cadmium, chromium, and zinc were detected in at least one groundwater sample, they were not identified as an ecological COI and, therefore, not included in the evaluation of risks to higher-trophic-level wildlife. All other analytes were undetected in groundwater.

Exposure Estimates:

- The risk evaluation included all constituents detected in groundwater samples collected from wells downgradient of and adjacent to Joppa West. However, not all constituents are related to Joppa West and not all constituents are associated with CCR. Given that the CCR pore water dataset (XTPW01) is the most representative dataset characterizing CCR constituents in Joppa West, constituents detected in groundwater with maximum concentrations higher than what was detected in the pore water (antimony, barium, beryllium, chromium, cobalt, iron, lead, and manganese) are not likely related to Joppa West.
- The human health and ecological risk characterizations were based on the maximum modeled COI concentrations, rather than on averages. Thus, the variability in exposure concentrations was not considered. Assuming continuous exposure to the maximum concentration overestimates human and ecological exposures given that receptors are mobile and concentrations change over time. For example, US EPA guidance states that risks should be estimated using average exposure concentrations as represented by the 95% upper confidence limit on the mean (US EPA, 1992). Given that exposure estimates based on the maximum concentrations did not exceed risk benchmarks, we have greater confidence that there is no risk concern.
- Only analytes detected in groundwater were used to identify COIs and model COI concentrations in surface water. However, multiple analytes (dissolved antimony, dissolved arsenic, dissolved beryllium, dissolved cadmium, dissolved chromium, dissolved cobalt, dissolved copper, dissolved and total mercury, dissolved nickel, dissolved and total selenium, dissolved silver, dissolved and total thallium, and total cyanide) were not detected (*i.e.*, below detection limits) in any of the groundwater samples related to Joppa West. The detection limits for all these compounds were below the Class 1 GWQS and, thus, do not require further evaluation.
- For ecological COIs, the maximum detection limits for dissolved cadmium, dissolved nickel, dissolved silver, and total cyanide exceeded their respective SWQSs. However, using a maximum detection limit to represent an undetected concentration overestimates potential exposure, because it is the maximum potential concentration that can be used to represent the undetected sample. Furthermore, cadmium would not be considered an ecological COI because the most recent sampling event detected total cadmium[12] at a concentration (0.0009 mg/L) below the screening benchmark (0.0011 mg/L). Nickel, silver, and cyanide would not be considered ecological COIs because they were never detected, and these constituents are not traditionally associated with CCRs (Appendix Table B.1). Therefore, although only constituents detected in groundwater were evaluated, excluding analytes that were not detected does not change our risk conclusions.
- COI concentrations in surface water were modeled using the maximum detected total or dissolved COI concentrations. Maximum detected concentrations for arsenic, beryllium, boron, cobalt, iron, lead, and manganese are based on total concentrations. Modeling surface water concentrations using total metal concentrations for these COIs may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow into and mix with surface water.
- The maximum manganese concentration (0.92 mg/L) collected from the UA (TPZ117D) was used to model surface water concentrations using UCU groundwater properties. As noted in Section 3.1, the UA is more permeable than the UCU, with higher groundwater flow rates. Therefore, relying on the groundwater properties of the UCU for TPZ117D, which is located in the UA, will underestimate the modeled surface water concentrations of manganese. However, the modeled manganese surface water concentration of 1.9×10^{-9} mg/L is orders of magnitude below health-

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[12] While more recent samples were not analyzed for dissolved cadmium, in general, dissolved concentrations are lower than total concentrations.

protective benchmarks. Even with the higher flow rate of the UA, modeled concentrations are expected to be lower than benchmarks and the conclusions of this risk evaluation are not expected to change.

- The COIs identified in this evaluation also occur naturally in the environment. Contributions to exposure from natural or other non-Joppa West-related sources were not considered in the evaluation of modeled concentrations; only exposure contributions potentially attributable to Site groundwater mixing with surface water were evaluated. While not quantified, exposures from potential Joppa West-related groundwater contributions are likely to present only a small fraction of the overall human and ecological exposure to COIs that also have natural or non-Joppa West-related sources.
- Screening benchmarks for human health were developed using exposure inputs based on US EPA's recommended values for reasonable maximum exposure (RME) assessments (Stalcup, 2014). RME is defined as "the highest exposure that is reasonably expected to occur at a site but that is still within the range of possible exposures" (US EPA, 2004). US EPA states, "intent of the RME is to estimate a conservative exposure case (*i.e.*, well above the average case) that is still within the range of possible exposures" (US EPA, 1989). US EPA also notes that this high-end exposure "is the highest dose estimated to be experienced by some individuals, commonly stated as approximately equal to the 90th percentile exposure category for individuals" (US EPA, 2015c). Thus, most individuals will have lower exposures than those presented in this risk assessment.

Toxicity Benchmarks:

- Screening level ecological benchmarks were compiled from US EPA guidance and designed to be protective of the majority of site conditions, leaving the option for site-specific refinement. In some cases, these benchmarks may not be representative of the site-specific conditions or receptors found at the site, or may not accurately reflect concentration-response relationships encountered at the site. For example, the ecological benchmark for lead is hardness dependent. While USGS stations had available hardness data, we relied on US EPA's default hardness of 100 mg/L due to the limitations of the USGS data. USGS data from Olmstead, Illinois, reported hardness ranging from 91 to 171 mg/L, with a mean hardness of 122 mg/L, while USGS data from Grand Chain, Illinois, reported hardness ranging from 87 to 115 mg/L, with a mean hardness of 123 mg/L. Increasing the hardness from 100 to 123 mg/L will increase the total and dissolved lead SWQS from 0.020 to 0.026 mg/L and 0.016 to 0.020 mg/L, respectively, because benchmarks become less stringent with higher levels of hardness. Regardless of the hardness, the maximum modeled lead concentration is orders of magnitude below the SWQS.

  In addition, for the ecological evaluation, we conservatively assumed all constituents to be 100% bioavailable. Modeled COI concentrations in surface water are considered total COI concentrations. US EPA recommends using dissolved metals as a measure of exposure to ecological receptors because it represents the bioavailable fraction of metal in water (US EPA, 1993). Therefore, the modeled surface water COI concentrations may be an overestimation of exposure concentrations to ecological receptors.
- In general, it is important to appreciate that the human health toxicity factors used in this risk evaluation are developed to account for uncertainties, such that safe exposure levels used as benchmarks are often many times lower (even orders of magnitude lower) than the levels that cause effects that have been observed in human or animal studies. For example, toxicity factors incorporate a 10-fold safety factor to protect sensitive subpopulations. This means that a risk exceedance does not necessarily equate to actual harm.

5 Relative Impact Assessment

5.1 Introduction

In order to evaluate all of the benefits and adverse impacts associated with potential closure scenarios at Joppa West, we have performed an RIA comparing selected alternatives. The RIA holistically assesses each closure alternative based on a series of metrics. The three closure scenarios evaluated include Minimal Disturbance, CIP, and CBR. The Minimal Disturbance scenario focuses on monitoring and maintenance of the existing dikes and former impoundment cover, but does not involve removal of the current cap or vegetation. The CIP scenario entails removing the existing cover and vegetation and then capping the former impoundment with a new cover system consisting of either a low permeability soil cover or a geomembrane with a protective soil cover. The CBR scenario involves excavating the CCR from Joppa West and transporting it to an off-Site landfill for disposal.

We based our evaluation of Joppa West on previous comparative assessments of closure alternatives for coal ash surface impoundments, including a NEBA and an application of EPRI's Relative Impact Framework (EPRI, 2016a; Exponent, 2018; TVA, 2015). Both NEBA and EPRI's Relative Impact Framework are systematic frameworks for identifying and comparing the beneficial and adverse impacts associated with different remediation and closure alternatives (ORNL, 2003; EPRI, 2016b). The goal of these frameworks is to serve as a guide to decision-makers during selection of the preferred closure alternative or remedial alternative at a waste management unit or contaminated site (ORNL, 2003; EPRI, 2016b).

For Joppa West, we evaluated each closure alternative with respect to 10 metrics (20 metrics, including sub-categories) commonly applied in evaluations of closure alternatives for coal ash impoundments (Exponent, 2018; TVA, 2015). This list includes many of the factors that must be considered when performing a CCR surface impoundment closure alternatives analysis under IAC 854.710 (IEPA, 2019b):

1. **Risks to Human Health/Environment:** This metric evaluates the impact of each closure scenario on the reduction of risks to human and ecological receptors due to exposure to CCR-associated chemical constituents in groundwater or surface water.
2. **Risks of Potential Future CCR Releases:** This metric evaluates the residual risk of CCR releases occurring under each closure scenario. Sub-categories include CCR releases due to a dike failure event and CCR releases under flood conditions.
3. **Groundwater Quality:** This metric describes the likelihood of groundwater concentration exceedances of relevant regulatory standards under each closure scenario.
4. **Surface Water Quality:** This metric describes the likelihood of surface water concentration exceedances of relevant regulatory standards under each closure scenario.
5. **Air Quality:** This metric describes the air quality impacts of closure activities under each closure scenario, including the generation of fugitive dust and emissions from diesel-powered construction equipment.
6. **Climate Change and Sustainability:** This metric describes sustainability and climate change-related aspects of each closure scenario, including greenhouse gas (GHG) emissions and energy consumption during closure activities.

7. **Worker Safety:** This metric describes potential for worker fatalities and injuries to occur during closure activities, either on-Site or off-Site (*i.e.*, due to haul truck accidents).
8. **Community Impacts:** This metric describes potential for fatalities and injuries to occur in the community due to off-Site haul truck accidents. It also includes the nuisance impacts that may arise from closure activities, including traffic and noise. Finally, this metric includes the possible impacts of closure alternatives on Environmental Justice (EJ) communities.
9. **Habitat:** This metric evaluates the potential impacts of closure activities on habitat availability and biodiversity, threatened and endangered species, and annual net primary productivity (NPP) at the Site.
10. **Cost:** This metric compares the cost of each closure alternative.

Section 5.2 introduces the closure alternatives evaluated as part of this assessment. Section 5.3 presents our analysis of the various closure alternatives with respect to the 10 metrics listed above, and Section 5.4 summarizes our findings.

5.2 Closure Alternatives

We evaluated three closure alternatives for Joppa West: Minimal Disturbance, CIP, and CBR. The details of each alternative are provided below in Sections 5.2.1, 5.2.2, and 5.2.3.

5.2.1 Minimal Disturbance

The Minimal Disturbance scenario focuses on monitoring and maintenance of the existing dikes and former impoundment cover. This scenario includes the following work elements (Geosyntec Consultants, 2021):

- Removal of approximately four acres of vegetation, including trees and shrubs, along dike slopes in order to facilitate regular inspection of the dike slopes and prevent dike slope instability due to root damage and/or eventual tree death.
- Repair of erosion features on the southern perimeter dike of the Settling Area.
- Revegetation of disturbed areas with native grasses.
- On-going monitoring and maintenance, including groundwater monitoring, periodic inspections of the cover and dike slopes, erosion repair and management along dike slopes, and the management of undesirable woody vegetation along dike slopes.

Construction activities under this scenario are expected to be minimal in comparison to the other two closure scenarios. Under this scenario, no soil or CCR will be hauled to or from the Site. A modest amount of vegetation may need to be hauled off-Site as the dike slopes are cleared.

5.2.2 Closure in Place

The CIP scenario entails removing the existing vegetation and cover atop the former impoundment and then capping the former impoundment with a new cover system. This scenario includes the following work elements (Geosyntec Consultants, 2021):

- Removal of existing vegetation from the cover of the former surface impoundment and from dike slopes.

- Grading to promote drainage to low points around the cover. Material for grading will be sourced primarily from the CCR within the former impoundment (*i.e.*, by cutting and filling), rather than being sourced from off-Site.
- Construction of a new cover system, which may consist of a low permeability soil cover or a geomembrane layer topped with 18-36 in. of soil sourced from off-Site. The soil layer would include a 6 in. thick topsoil layer and be revegetated with native grasses.
- Construction of stormwater control structures to convey runoff away from the former impoundment.
- On-going monitoring and maintenance, including groundwater monitoring, periodic inspections of the cover and dike slopes, erosion repair and management along dike slopes, and management of undesirable vegetation on the new cover system and dike slopes.

Special consideration must be given to the power lines and a buried gas pipeline that run through Joppa West during removal of the existing cover system and construction of the new cover system. The human health and environmental impacts of any special procedures associated with the power lines or gas pipeline are not analyzed in this report. However, it is worth noting generally that these procedures will introduce major uncertainties and unique risks to the closure process (Geosyntec Consultants, 2021).

Under the CIP scenario, borrow soil must be brought in from off-Site for the new cover system. Borrow soil will either be sourced from elsewhere on the property or another location near the Site. Because the area surrounding the Joppa property is rural, it should not be difficult to identify a suitable borrow location within 10 miles of the Site. We therefore assumed that the borrow location will lie 10 miles from the Site. Based on the size of the former impoundment (79 acres for the northern portion of Joppa West and 17 acres for the Settling Area, for a total of 96 acres[13]), for the maximum expected depth of the cover system soil layer (3 ft.), we conservatively assume that the CIP scenario will require approximately 465,000 cubic yards of borrow material.

In addition to transporting borrow soil to the Site, it may be necessary to haul vegetation from the Site after clearing it from the existing impoundment cover. The volume of vegetation removed from the Site will likely be substantial, since all of the existing habitat will be cleared from the cover and dike slopes under this scenario (Geosyntec Consultants, 2021). The impacts of hauling this vegetation off-Site (*e.g.*, vehicle emissions from dump trucks, risks of haul truck accidents) are included in our discussion of impacts below (Section 5.3), but were not quantified for this report.

Under the CIP scenario, construction is expected to take approximately two years. Key parameters for the CIP scenario are shown in Table 5.1.

Table 5.1 Key Parameters for the Closure in Place Scenario

Parameter	Value	Notes
Size of former impoundment cover (acres)	96	Source: Geosyntec Consultants (2021)
Volume of borrow material required (yd^3)	465,000	3 ft. depth x 96 acres
Truckloads required for borrow material transport	31,000	Assumes 15 yd^3 capacity per truckload
Length of the haul route from the Site to the borrow area (mi)	10	Assumes borrow soil can be sourced from within 10 miles of the Site
Total vehicle miles traveled to/from the borrow area (mi)	620,000	Truckloads x Length of Haul Route x 2
Duration of construction activities (years)	2	Source: Geosyntec Consultants (2021)

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[13] The total acreage of Joppa West is 103.5 acres, which includes 7.5 acres associated with dike perimeter crest.

5.2.3 Closure by Removal

The CBR scenario entails excavating all of the CCR from the former impoundment and transporting it to an off-Site landfill for disposal. This scenario includes the following work elements (Geosyntec Consultants, 2021):

- Removal of existing vegetation from the cover of the former surface impoundment and from dike slopes.
- Excavation of cover soils. Excavated clay and topsoil will be segregated and set aside for later use during site restoration.
- Excavation of CCR and dewatering to remove free liquids, followed by off-Site disposal.
- Construction of stormwater control structures to convey runoff away from the former impoundment.
- Site restoration, including grading and revegetation. Soil for filling will be taken from perimeter dike soils, stockpiled clay, and topsoil.
- Groundwater monitoring.

CBR-related construction activities, including excavation, are expected to take approximately six years. This timeline does not include any additional time required or work required to address issues and concerns related to the power lines and the buried gas pipeline that run through Joppa West. The human health impacts and environmental impacts associated with such work are not analyzed in this report. However, it is worth noting generally that this work will introduce major uncertainties and unique risks to the closure process (Geosyntec Consultants, 2021). Moreover, this work could extend the overall duration of construction activities at the Site, resulting in a longer duration of adverse impacts occurring during the construction period.

Under the CBR scenario, CCR must be hauled off-Site; however, borrow soil will not need to be hauled on-Site. Soil for grading and revegetating the cover will be sourced from the perimeter dike and the original ash basin cover. For this reason, an off-Site borrow soil location will not be established.

On-Site disposal of CCR is not a viable alternative at this Site, because the landfill is not large enough to accommodate the amount of CCR that would excavated from Joppa West (3.4 million cubic yards). For off-Site disposal, we considered four municipal solid waste landfills within 45 minutes to 1.5 hours of the Joppa Plant (Waste Path Services [Kentucky], West End Disposal Facility [Illinois], Southern Illinois Regional Landfill [Illinois], and Perry Ridge Landfill [Illinois]). These landfills are approximately 40-80 miles from the Site. CCR will be transported to one of these landfills *via* trucks (Geosyntec Consultants, 2021).

In addition to hauling CCR off-Site, it may be necessary to haul vegetation off-Site after clearing it from the existing impoundment cover. As discussed above for the CIP scenario, the volume of vegetation to be removed from the Site would be substantial, consisting of all of the existing habitat atop the former impoundment and dike slopes. The impacts of hauling vegetation off-Site are included in our discussion of impacts below (Section 5.3), but were not quantified for this report.

Key parameters for the CIP scenario are shown in Table 5.2. We estimated the length of the haul route from the Site to the landfill using the three primary routes recommended by Google Maps for each landfill

(Google, 2021).[14] For our analysis, we conservatively assumed that the distance from the Site to the landfill is the longest distance across all of the landfills and haul routes considered in our analysis (the haul route to the Perry Ridge Landfill in Du Quoin *via* I-57N).

Table 5.2 Key Parameters for the Closure by Removal Scenario

Parameter	Value	Notes
Size of former impoundment cover (acres)	96	Source: Geosyntec Consultants (2021)
Volume of CCR in former impoundment (yd^3)	3,400,000	Source: Geosyntec Consultants (2021)
Truckloads required for CCR transport	227,000	Assumes 15 yd^3 capacity per truckload
Length of the haul route from the Site to the landfill (mi)	82 mi	Source: Google (2021)
Total vehicle miles traveled to/from the landfill for CCR disposal (mi)	3.7 x 10^7	Truckloads x Length of Haul Route x 2
Duration of CCR-related construction activities (years)	6	Source: Geosyntec Consultants (2021)

Notes:
CCR = Coal Combustion Residual.

5.3 Analysis of Alternatives

This section of the report evaluates and compares the three closure alternatives described in Section 5.2 with respect to the evaluation metrics listed in Section 5.1. Each closure alternative was ranked from A to C for each metric. A rank of A indicates that the closure alternative either provides the highest environmental/economic benefit or has the lowest environmental/economic adverse impact relative to the other scenarios. A rank of C indicates that the closure alternative either provides the lowest environmental/economic benefit or has the highest environmental/economic adverse impact relative to the other scenarios. In cases where the impacts from one scenario fall between the impacts for the other two scenarios, it was assigned a rank of B. If, instead, there are two low-performing scenarios with a similar magnitude of impacts or two high-performing scenarios with a similar magnitude of impacts (such that there are two scenarios tied for the worst performance or best performance across all scenarios), then both scenarios are assigned a rank of C or A, respectively. For metrics that exhibit no adverse impacts under any closure scenario, all scenarios are assigned a rank of A. If there were any evaluation metrics that had exhibited equal adverse impacts for all closure scenarios, all scenarios would have been assigned a rank of C.

5.3.1 Risks to Human Health/Environment

This metric evaluates the relative impact of each closure alternative on the human and ecological receptors evaluated in Section 4 (Risk Evaluation) due to exposure to CCR-associated constituents in groundwater and/or surface waters. The following subcategories were considered:

- Risks to groundwater receptors (human),
- Risks to surface water receptors (human), and

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[14] Google Maps (Google, 2021) only recommends one route for the landfill located in Kentucky (Waste Path Services near Calvert City).

- Risks to ecological receptors.

Human Health Risks to Groundwater Receptors

Under current conditions, there are no risks to human health associated with groundwater because there are no potential groundwater receptors that could be exposed to CCR-related constituents from Joppa West (see Section 4). Because current conditions do not present a risk to human health, there are no unacceptable risks to human health for any future closure scenarios, and thus, there is no difference between the risk reductions resulting from the different closure alternatives. The time horizon over which GWPSs are exceeded under the various closure alternatives is immaterial from a risk perspective, since there is no unacceptable risk associated with exceedances of the GWPSs. All closure scenarios were assigned a rank of A for this metric (Table 5.3).

Human Health Risks to Surface Water Receptors

Under current conditions, there are no risks to human health associated with recreation on the Ohio River (*i.e*., swimmers, tubers, and fishermen; Section 4). All modeled surface water concentrations resulting from the mixing with potentially impacted groundwater were below the relevant screening benchmarks (Table 4.5). Because current conditions do not present a risk to human health, there are no unacceptable risks to human health for any future closure scenarios, and thus, there is no difference between the risk reductions resulting from the different closure alternatives. All closure scenarios were assigned a rank of A for this metric (Table 5.3).

Risks to Ecological Receptors

Under current conditions, there are no risks to aquatic ecological receptors in the Ohio River (Section 4). All modeled surface water concentrations resulting from the mixing of potentially impacted groundwater were below the relevant screening benchmarks (Table 4.6). Because current conditions do not present a risk to ecological receptors, there are no unacceptable risks for any future closure scenarios, and thus, there is no difference between the risk reductions resulting from the different closure alternatives. All closure scenarios were assigned a rank of A for this metric (Table 5.3).

Table 5.3 Relative Impact Score for Risks to Human Health and the Environment

Impact Metric	**Minimal Disturbance**	**Closure in Place**	**Closure by Removal**
Risks to Human Health/Environment			
a. Risks to groundwater receptors (human)	A	A	A
b. Risks to surface water receptors (human)	A	A	A
c. Risks to ecological receptors	A	A	A

Notes: A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.3.2 Risks of Potential Future CCR Releases

Environmental impacts can occur at coal ash sites due to the sudden release of CCR during infrastructure failures and flooding events. This section evaluates the residual risk of CCR releases occurring under each closure scenario resulting from a dike failure or flood event.

Releases Due to Dike Failure

Current conditions for the Joppa West dike slopes were assessed in March 2021, and no evidence of slope instability was observed (Geosyntec Consultants, 2021). Thus, the current risk of dike failure at Joppa West appears to be low. Moreover, it is expected that, in accordance with an approved groundwater management zone or post-closure care plan under IEPA Part 845, measures will be implemented to reduce the risk of a dike failure event occurring in the future. Under the Minimum Disturbance scenario, undesirable vegetation, including trees and smaller woody vegetation that cause root penetrations, will likely be removed from four acres of the outside dike slopes in order to facilitate inspections and ensure dike slope stability, and erosion gulleys on the southern perimeter dike of the Settling Area will be repaired (Geosyntec Consultants, 2021). The monitoring and maintenance plans for those closure scenarios for which CCR will remain in Joppa West (Minimal Disturbance and CIP) will also likely include periodic inspections of the dike slopes and the impoundment cover, which will further reduce the risk of CCR releases as a result of dike failure.

Joppa West is not located near any active tectonic plate boundaries, but it is in a region that exhibits a moderate level of historical seismicity (AECOM, 2016). There is potential for moderate to large earthquakes particularly from the adjacent New Madrid Seismic Zone and the Wabash Valley Seismic Zone (AECOM, 2016). However, because there is no impounded water within Joppa West (Ramboll US Corp., 2021), there is little risk, for those closure scenarios for which CCR will remain, that a seismic event would result in releases of CCR to downgradient areas.

Under the CIP scenario, a new cover system will be installed, which will include up to three ft. of low permeability soil and new stormwater control structures. Relative to the former impoundment cover, this new cover system may provide better protection against berm and surface erosion, groundwater infiltration, and other adverse effects that could potentially trigger a dike slope failure event. Under the CBR scenario, all of the CCR in the former impoundment will be excavated and relocated, which will completely eliminate the risk of a CCR release occurring under a dike failure event. In summary, the risk of a dike failure occurring under any closure scenario is low. Under the CBR scenario, there is no risk of CCR releases because all CCR will be excavated and relocated to an off-Site landfill. The Minimal Disturbance scenario was assigned a rank of C for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of A (Table 5.4).

Flood-Related Releases

According to the Federal Emergency Management Agency (FEMA), the estimated base flood elevation in the Ohio River near Joppa West (*i.e.*, the estimated water level during a 100-year flood) is 335 ft. amsl (FEMA, 2021). By comparison, the elevation of the Joppa West dike crest is up to 375 ft. amsl in the northern portion of the former impoundment and 345-350 ft. amsl near the Settling Area (Geosyntec Consultants, 2021). Since the crest of the former impoundment is located above the base flood elevation, there is currently minimal risk of the former impoundment being overtopped during a 100-year storm. Moreover, as shown in a FEMA flood map of the Site (FEMA, 1983), Joppa West is located within flood Zone C, which indicates that flooding is unlikely to occur under both 100-year flood and 500-year flood conditions. Since the perimeter dikes are expected to remain in place, the risk of CCR releases occurring due to overtopping of Joppa West dikes during flood conditions is minimal under all closure scenarios. Under the CBR scenario, there is no risk of flood-related CCR releases, because all of the CCR in the former impoundment will be excavated and relocated to an off-Site landfill.

Areas immediately adjacent to Joppa West have been designated Zone A (*e.g.*, area between Joppa West and the Ohio River and area to the west of Joppa West), indicating that they are subject to flooding during a 100-year flood, or Zone B, indicating that they lie between the limits of a 100-year and 500-year flood event (FEMA, 1983, 2021). It is therefore conceivable, albeit unlikely, that flooding could erode or damage portions of the exterior Joppa West dike slopes that are adjacent to the designated zones, leading to CCR releases under the Minimal Disturbance or CIP scenarios. Under the CIP scenario, a new cover system will be installed, which will include up to three feet of low permeability soil and new stormwater control structures. Relative to the Minimal Disturbance scenario, the CIP cover system may provide better protection against flood-induced erosion. The Minimal Disturbance scenario was assigned a rank of C for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of A (Table 5.4).

Table 5.4 Relative Impact Score for Risks of Potential Future CCR Releases

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Risks of Potential Future CCR Releases			
a. Releases due to dike failure	C	B	A
b. Flood-related releases	C	B	A

Notes:
CCR = Coal Combustion Residual. A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.3.3 Groundwater Quality

Currently, there are exceedances of the relevant Class 2 GWQSs in only a single groundwater monitoring well (G112C) located downgradient of Joppa West in the UCU. The time horizon over which GWPSs are exceeded under the various closure alternatives is immaterial from a risk perspective, since there is no unacceptable risk associated with exceedances of a GWPS. Nonetheless, groundwater with CCR-related concentrations exceeding a relevant groundwater protection standard will likely be addressed under an approved groundwater management zone under Part 620 (IEPA, c. 2021) or post-closure care under Part 845 (IEPA, 2020) Since future groundwater concentrations associated with Joppa West will be affected both by the selected former impoundment closure approach and any potential groundwater corrective actions that are implemented, it is inappropriate to assess the future groundwater impacts and the duration over which GWPSs are exceeded based solely on the closure scenarios that are evaluated in this assessment. Thus, no rankings (A to C) were assigned to any of the three closure scenarios for this metric.

5.3.4 Surface Water Quality

All modeled surface water concentrations, based on current conditions, resulting from the mixing of potentially impacted groundwater are below relevant human health and ecological screening benchmarks (Tables 4.5 and 4.6). For all future closure scenarios, groundwater concentrations and surface water concentrations are expected to either decline over time or remain stable. Thus, no future exceedances of any human health or ecological screening benchmarks are anticipated for any of the closure scenarios. All closure scenarios were assigned a rank of A for this metric (Table 5.5).

Table 5.5 Relative Impact Score for Surface Water Quality

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Surface Water Quality	A	A	A

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.3.5 Air Quality

Construction activities can adversely impact air quality. Air pollution due to construction occurs both on-Site and off-Site, *i.e.*, along haul routes. For our analysis of the three Joppa West closure scenarios, two categories of air pollution are of particular concern: equipment emissions and fugitive dust. The equipment emissions of greatest concern are those found in diesel exhaust. Most construction equipment is diesel-powered, including the dump trucks used to haul material to and from the Site. Diesel exhaust contains hundreds of air pollutants, including nitrogen oxides (NO_x), particular matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs; Hesterberg *et al*., 2009; Mauderly and Garshick, 2009). Fugitive dust, another major air pollutant at construction sites, is generated by earthmoving operations and other soil- and CCR-handling activities. Along haul routes, an additional source of fugitive dust is road dust along unpaved dirt roads. Careful planning and the use of Best Management Practices (BMPs) such as wet suppression are used to minimize and control fugitive dust during construction activities; however, it is not possible to prevent dust generation entirely.

The key differences between the three closure alternatives with respect to air pollution are the duration of construction activities and the number of vehicle miles required to haul material to or from the Site. In the Minimal Disturbance scenario, construction activities are expected to be relatively minimal, and no soil or CCR will be hauled to or from the Site. A modest amount of woody vegetation may need to be hauled from the Site after the dike slopes are cleared to ensure dike stability; however, hauling requirements and overall air quality impacts should be minimal in comparison to the other closure scenarios.

In the CIP scenario, air quality impacts are expected to occur over a two-year construction period. No CCR will be hauled off-Site in this scenario; however, a significant volume of vegetation may need to be hauled off-Site. Additionally, approximately 620,000 vehicle miles will be required to haul borrow soil to the Site (Table 5.1). In the CBR scenario, air quality impacts are expected to occur over a six-year construction period. No soil will be hauled in from off-Site in this scenario; however, as in the CIP scenario, a significant volume of vegetation may need to be hauled off-Site. Moreover, approximately 37 million vehicle miles will be required to transport CCR from the Site to a landfill for disposal (Table 5.2). Under both the CIP and CBR scenarios, the CCR in the former impoundment will also be exposed to the open air during the construction period, such that any fugitive dust generated at the Site may contain CCR.

In summary, the Minimal Disturbance scenario will have relatively minimal air quality impacts. The CIP and CBR scenarios, in contrast, may have significant air quality impacts. The duration of construction activities, and hence air quality impacts, is smaller in the CIP scenario (approximately two years) than it is in the CBR scenario (approximately six years). Moreover, 60 times as many vehicle miles will be required to haul soil and CCR on and off of the Site under the CBR scenario than will be required under the CIP scenario. Since diesel emissions scale with vehicle miles traveled, the off-Site air quality impacts of the CBR scenario due to soil or CCR transport are likely to be 60 times greater for the CBR scenario than the CIP scenario. Due to the greater volume of material being hauled on- or off-Site in the CBR scenario relative to the CIP scenario, off-Site impacts will also comprise a larger fraction of the total air quality impacts in the CBR scenario than they will under the CIP scenario, resulting in relatively larger impacts to nearby communities and communities along the haul route. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.6).

Table 5.6 Relative Impact Score for Air Quality

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Air Quality	A	B	C

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B: Intermediate benefit or adverse impact (shaded yellow);
C = Lowest benefit or highest adverse impact (shaded red).

5.3.6 Climate Change and Sustainability

In addition to the air pollutants listed above in Section 5.3.5, construction equipment emits GHGs, including carbon dioxide (CO_2) and possibly nitrous oxide (N_2O). In addition, construction activities have high energy demands. The energy for construction comes from the burning of fossil fuels (*e.g.*, the diesel used to power construction equipment). This section describes the impact of each closure alternative on two metrics related to climate change and sustainable construction: GHG emissions and energy consumption.

GHG Emissions

The potential impact of each closure scenario associated with GHG emissions from construction equipment is similar to the potential impacts associated with the other air pollutants (Section 5.3.5). Because the Minimal Disturbance scenario requires relatively minimal construction activities, GHG emissions under this scenario will be small relative to emissions under other scenarios. GHG emissions under the CIP scenario will also be smaller than those observed under the CBR scenario, both because the duration of construction is shorter (two years under the CIP scenario *versus* six years under the CBR scenario) and because the number of vehicle miles required to haul soil to the Site will be 60 times smaller than the number of vehicle miles required to haul CCR from the Site (Tables 5.1 and 5.2). Since off-Site (*i.e.*, hauling) impacts scale with the number of vehicle miles traveled, the GHG emissions associated with the transport of soil and CCR under each closure scenario is expected to be 60 times greater under the CBR scenario than the CIP scenario. Hauling impacts associated with the removal of vegetation from the Site, in contrast, are expected to be similar under the CIP and CBR scenarios, since both scenarios require complete removal of the vegetation atop the former impoundment.

In summary, GHG emissions under the CBR scenario are expected to be significantly larger than those under the CIP scenario. GHG emissions under the Minimal Disturbance scenario will be significantly smaller than emissions under the other two scenarios. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.7).

Energy Consumption

Energy consumption at a construction site is synonymous with fossil fuel consumption. Fossil fuel demands considered in this analysis include the burning of diesel fuel during on-Site and off-Site construction activities, including hauling, under all three closure scenarios and the fossil fuel demands of manufacturing a geomembrane textile, if one is required, under the CIP scenario. Because the GHG emission impacts and energy consumption impacts under each scenario both arise from the burning of fossil fuels, the trends discussed above with respect to GHG emissions also apply to the evaluation of energy demands: the smallest energy demands are expected under the Minimal Disturbance scenario, and the highest energy demands are expected under the CBR scenario. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.7).

Table 5.7 Relative Impact Score for Climate Change and Sustainability

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Climate Change and Sustainability			
a. GHG emissions (CO_2, NO_x)	A	B	C
b. Energy consumption	A	B	C

Notes:
CO_2 = Carbon Dioxide, GHG = Greenhouse Gas; NO_x.= Nitrous Oxide. A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.3.7 Worker Safety

Best practices will be employed during construction in order to ensure worker safety and comply with all relevant regulations, permit requirements, and safety plans. However, it is impossible to completely eliminate the risk of accidents occurring during construction activities.

Accidents may occur either on-Site or off-Site. On-Site accidents include injuries and deaths arising from the use of heavy equipment and/or earthmoving operations. Off-Site accidents include injuries and deaths due to haul truck accidents. With respect to worker safety, the key differences between the three closure alternatives are once again the duration of construction activities and the number of vehicle miles required to haul material to or from the Site. Compared to the CIP and CBR scenarios, the Minimal Disturbance scenario requires minimal construction and hauling activity. Under this scenario, risks to workers are expected to be small. In contrast, the CIP and CBR scenarios present significant risks to workers.

The duration of risks to workers under the CIP scenario is smaller than the duration of risks under the CBR scenario, because the duration of construction activities is smaller (two years *versus* six years). The risk of injuries and accidents occurring due to haul truck accidents is also much higher under the CBR scenario than it is under the CIP scenario because of the greater number of vehicle miles required to transport soil and CCR to and from the Site (37 million vehicle miles *vs*. 620,000 vehicle miles).

Table 5.8 shows the expected number of accidents and injuries to vehicle occupants (workers) and non-occupants (community members) under each scenario due to the hauling of soil and CCR to and from the Site under the CIP and CBR scenario. Values are zero for the Minimal Disturbance scenario because no soil or CCR will be hauled to or from the Site. For the CIP and CBR scenarios, values in Table 5.8 are based on "per vehicle mile traveled" crash rates reported by United States Department of Transportation (US DOT) for large trucks in the US (US DOT, 2020). As expected based on the number of vehicle miles traveled in each scenario, risks to workers from haul truck accidents due to the transport of soil or CCR are 60 times higher under the CBR scenario than the CIP scenario. Due to the large volume of CCR in Joppa West, the CBR scenario is also associated with a significant risk of injury or death due to haul truck accidents, with as many as five injuries expected for workers during the construction period.

In addition to the potential for haul truck accidents to occur during the transport of soil and CCR to and from the Site, haul truck accidents may also occur during the hauling of vegetation from the Site. These impacts are expected to be relatively minimal under the Minimal Disturbance scenario due to the relatively small amount of vegetation to be removed from the dike slopes. In contrast, impacts may be significant under the CIP and CBR scenario due to the need to remove a large quantity of vegetation from the Site. Accidents and injuries resulting from the hauling of vegetation were not included in Table 5.8.

Table 5.8 Expected Injuries and Fatalities Due to Haul Truck Accidents During CCR and Soil Transport Under Each Closure Scenario

Factor	Minimal Disturbance	Closure in Place	Closure by Removal
Worker Injuries	0	0.079	4.8
Worker Fatalities	0	0.0018	0.11
Community Injuries	0	0.23	14
Community Fatalities	0	0.0083	0.50

Notes:
CCR = Coal Combustion Residual.

The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.9).

Table 5.9 Relative Impact Score for Worker Safety

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Worker Safety	A	B	C

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.3.8 Community Impacts

Closure activities can impact communities near the Site as well as communities located along trucking routes. Community impacts may include air pollution, haul truck accidents, and nuisance impacts from traffic and noise. Community impacts are of particular concern for EJ communities (*e.g.*, communities with a higher-than-average minority, indigenous, and/or low-income populations), which, due to a variety of factors, are especially vulnerable to environmental pollution and other adverse environmental impacts (US EPA, 2016b). Air pollution is the focus of Section 5.3.5. This section of the report focuses on accidents, traffic, noise, and the potential impacts of closure activities on nearby EJ communities.

Accidents

Haul truck accidents have the potential to injure or kill community members as well as workers. Table 5.8 (above) shows the number of community injuries and fatalities that are expected under each scenario due to hauling of soil and CCR to and from the Site. Impacts scale with the number of vehicle miles traveled, such that the risk of injury or death due to the hauling of soil and CCR are 60 times larger under the CBR scenario than they are under the CIP scenario. Moreover, under the CBR scenario, the risks to workers and community members are considerable, with as many as 14 injuries expected to occur during the excavation period due to the large volume of CCR that must be transported from the Site. The totals in Table 5.8 do not include the additional risks that may be posed by the transport of vegetation off-Site. These impacts will be particularly substantial in the CIP and CBR scenarios (for which all of the existing vegetation atop the former impoundment cover will be removed). The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.10).

Traffic

Haul routes are expected to use major arterial roads and highways wherever possible, which will reduce the incidence of traffic. However, heavy use of local roads for construction operations may result in traffic near the Site, the borrow site, and the off-Site landfill. Potential sources of traffic include the mobilization of equipment and materials, the daily arrival and departure of the workforce, and the hauling of borrow soil, CCR, and vegetation to or from the Site (TVA, 2015).

For the Minimal Disturbance scenario, traffic impacts are expected to be relatively limited due to the limited nature of construction activities (including any hauling of vegetation off-Site). For the CIP and CBR scenarios, however, traffic impacts may be significant. Under the CIP scenario, approximately 31,000 truckloads will be required to transport borrow soil to the Site for the new cover system over the span of two years (Table 5.1). Under the CBR scenario, approximately 227,000 truckloads will be required to transport CCR from the Site over the span of six years (Table 5.2). Assuming a 10-hour work day, year-round construction, and 26 working days per month, we estimate that, at a minimum, a truck would pass a given location near the Site once every 6 minutes on average for two years under the CIP scenario. Under the CBR scenario, in contrast, a truck would pass a given location every 2.5 minutes for six years. The traffic demands of the CIP scenario are therefore considerable, and could cause traffic delays on local roads. The traffic demands of the CBR scenario are even more dramatic. Notably, this level of traffic could also damage local roadways. Note that the calculations presented here do not account for the additional traffic requirements associated with hauling vegetation from the Site, which may be significant under the CIP and CBR scenarios. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.10).

Noise

Construction generates a great deal of noise, both in the vicinity of the Site and along haul routes. However, in a similar closure impact analysis performed by TVA (2015), the authors found that "[T]ypical noise levels from construction equipment used for closure are expected to be 85 dBA or less when measured at 50 ft. These types of noise levels would diminish with distance … at a rate of approximately 6 dBA per each doubling of distance and therefore would be expected to attenuate to the recommended EPA noise guideline of 55 dBA at 1,500 ft." Since there are no residences or businesses within 1,500 ft. of Joppa West (Natural Resource Technology, Inc., 2013), we do not anticipate that any communities near the Site will be adversely impacted by noise pollution under any closure scenario.

Haul routes are expected to use major arterial roads and highways wherever possible, which will reduce their impacts on nearby communities. However, local roads near the Site, the borrow site, and the off-Site landfill may experience noise pollution under the CIP scenario and the CBR scenario due to high volumes of truck traffic. As described above ("Traffic"), the construction schedule for the CIP scenario requires trucks to pass by a given location once every 6 minutes on average for ten hours each day over the course of two years. The construction schedule for the CBR scenario requires trucks to pass by a given location every 2.5 minutes on average for ten hours each day over the course of six years. Noise impacts under the CBR scenario, therefore, will be considerably worse than noise impacts along the haul route under the CIP scenario. (Noise impacts under the Minimal Disturbance scenario, in contrast, are expected to be relatively small due to the minimal nature of construction activities.) Notably, dump trucks generate significant noise pollution, with noise levels of approximately 88 decibels or higher expected within a 50 ft. radius of the truck (Exponent, 2018). This noise level is similar to the noise level of a gas-powered lawnmower or leaf blower (CDC, 2019). Decibel levels above 80 can damage hearing after two hours of exposure (CDC, 2019). The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.10).

Environmental Justice Communities

The State of Illinois defines EJ communities to be those communities with a minority population above twice the state average and/or a total population below twice the state poverty rate (IEPA, 2019c). Relative to other communities, EJ communities experience an increased risk of adverse health impacts due to environmental pollution and other factors associated with remediation activities (US EPA, 2016b).

As shown in a map of EJ communities throughout the state (IEPA, 2019c), the nearest EJ community (Metropolis) lies over seven miles from the Site. This suggests that EJ communities will not be impacted by any activities that occur on or near the Site. However, EJ communities located along haul routes may be negatively impacted by the air pollution, noise, traffic, and accidents generated by hauling activities.

For the Minimal Disturbance scenario, no soil or CCR will be hauled to or from the Site. For this reason, impacts to EJ communities along haul routes are expected to be relatively small. For the CIP scenario, impacts to EJ communities are similarly expected to be small because the borrow soil will be sourced from within 10 miles of the Site. Only one EJ community lies within 10 miles of the Site (Metropolis), and we assume that a suitable borrow soil location can be found outside of this community.

The greatest impacts to EJ communities are likely to occur under the CBR scenario due to the hauling of CCR from the Site to a suitable landfill. For this analysis, we evaluated the four municipal solid waste landfills located within approximately 1.5 hours of the Site. For each of the three landfills located in Illinois, we considered the three haul routes recommended by Google Maps (Google, 2021). For the landfill located in Kentucky, Waste Path Services near Calvert City, we evaluated the single haul route recommended by Google Maps (Google, 2021). Results from our analysis may be summarized as follows:

- Waste Path Services (Kentucky): The single route recommended by Google Maps passes through a "Low Income" EJ community in Illinois (Metropolis). We did not evaluate whether additional EJ communities are located along the haul route in Kentucky.
- West End Disposal Landfill (Ilinois): Two of the three suggested haul routes did not pass through any EJ communities. A third route, which is not the primary route recommended by Google Maps, passes through one "Low Income" EJ community (Johnston City).
- Southern Illinois Regional Landfill (Ilinois): The primary route recommended by Google Maps passes through the perimeter of Carbondale, a "Minority Population" and "Low Income" EJ community. A second route passes through two "Low Income" EJ communities, Johnston City and Herrin. A third route does not pass through any EJ communities.
- Perry Ridge Landfill (Ilinois): The primary route recommended by Google Maps passes through two "Low Income" EJ communities, West Frankfort and Johnston City. A second route passes through the center of Carbondale, a "Minority Population" and "Low Income" EJ community. A third route does not pass through any EJ communities.

In summary, for three out of four landfills, at least one haul route was available that did not pass through any EJ communities. However, in all cases, at least one of the haul routes did pass through at least one EJ community. Additionally, at least one EJ community is located along the haul route recommended by Google Maps for Waste Path Services in Kentucky, which is the landfill closest to the Site. Impacts to EJ communities are, therefore, possible in all cases, regardless of which landfill is chosen for the disposal of CCR. Impacts to EJ communities can be avoided if haul routes and landfills are chosen specifically to avoid passing through EJ communities. In selecting the best haul route, however, proximity to EJ communities will have to be balanced against other factors. For example, avoiding a haul route along a major transport corridor in order to avoid impacting an EJ community could increase reliance on local roadways, resulting in a larger number of vehicle miles traveled; worsen overall air quality impacts and GHG emissions; increase noise, traffic, and air pollution in local communities; and increase risks of large truck accidents.

In addition to impacts from hauling soil to the Site (CIP scenario only) and hauling CCR from the Site (CBR scenario only), EJ communities may be impacted by the hauling of vegetation from the Site under all three scenarios. The disposal location for vegetation has not yet been determined, so the potential EJ community impacts of hauling vegetation could not be assessed. However, impacts to EJ communities due to hauling vegetation will be similar under both the CIP and CBR scenarios, since both scenarios require complete removal of the existing vegetation atop the former impoundment. Impacts are expected to be minimal under the Minimal Disturbance scenario due to the minimal nature of the construction activities included in this scenario.

The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.10).

Table 5.10 Relative Impact Score for Community Impacts

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Community Impacts			
a. Accidents	A	B	C
b. Traffic	A	B	C
c. Noise	A	B	C
d. Environmental justice	A	B	C

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow);
C = Lowest benefit or highest adverse impact (shaded red).

5.3.9 Habitat

Land cover is expected to vary greatly across the three closure scenarios during the pre-construction period, the construction period, the post-closure care period, and the period following post-closure care. Variation in land cover across the three closure scenarios and over time has important implications for habitat availability and biodiversity, threatened and endangered species, and annual NPP.

Habitat Availability and Biodiversity

The existing vegetation at the Site provides potential roosting habitat for bats, as well as nesting and foraging sites for birds and other species. Across much of Joppa West, the overall quality of wildlife habitat is low due to the abundance of invasive species such as autumn olive and Amur honeysuckle. However, the existing natural cover atop Joppa West currently includes over 40 acres of bottomland forests with large native trees and a wide diversity of plant species that can serve as habitat for wildlife (Geosyntec Consultants, 2021). Many studies have shown that habitats that contain a diversity of plant species have improved ecosystem functioning, including positive effects on higher-trophic-level wildlife, relative to habitats with a smaller number of plant species (Turnbull *et al*., 2016; Wan *et al*., 2020). In addition to bottomland forests, Joppa West also includes approximately 60 acres of prairies and successional forests.

The expected habitat impacts under each closure scenario may be summarized as follows:

- Under the Minimal Disturbance scenario, the existing land cover atop the former surface impoundment will remain unchanged. The only vegetation that will be removed is what is required to ensure dike stability.
- Under the CIP scenario, all of the habitat covering the former surface impoundment and the dike slopes will be removed (Geosyntec Consultants, 2021). During site restoration, all of the vegetation

currently atop the former impoundment will be replaced with native grasses. Moreover, the CIP scenario may require not only the elimination of any existing habitat atop Joppa West but also the elimination of existing habitat atop the borrow soil location.

- Under the CBR scenario, as with the CIP scenario, all of the habitat covering the former surface impoundment and the dike slopes will be removed and replaced with native grasses (Geosyntec Consultants, 2021).

Overall, the Minimal Disturbance scenario is expected to have a limited impact on habitat availability and biodiversity. In contrast, the CIP and CBR scenarios will have severe impacts. In addition to the direct loss of biodiversity caused by habitat loss, construction activities under the CIP and CBR scenarios may cause alarm and escape behavior for species living near the Site (and, in the case of the CIP scenario, the borrow site). The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of C; and CBR was assigned a rank of C (Table 5.11).

Threatened and Endangered Species

The natural cover atop the former surface impoundment currently includes potential habitat for one federally endangered species, the Indiana bat (*Myotis sodalist*), and one federally threatened species, the northern long-eared bat (*Myotis septentrionalis*; Geosyntec Consultants, 2021). Across Joppa West, approximately 38.8 acres of potential summer roosting habitat is available to bats (Geosyntec Consultants, 2021). During on-Site investigations performed by Geosyntec, one state-listed species, willow oak, was confirmed to be present within the bounds of the Settling Area. Other species may be also present at the Site that were not identified during the habitat survey (Geosyntec Consultants, 2021).

Under the Minimal Disturbance scenario, minimal impacts to threatened and endangered species are anticipated due to the minimal nature of the planned work. Under the CIP and CBR scenario, in contrast, all of the existing habitat atop the former impoundment would be removed, resulting in severe impacts to any threatened or endangered species living within the bounds of Joppa West. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of C; and CBR was assigned a rank of C (Table 5.11).

Annual Net Primary Productivity

Annual NPP is the amount of carbon taken up by plants each year that is converted to biomass rather than released to the atmosphere *via* respiration (McGuire *et al.*, 1992). Functionally, annual NPP is a measure of the ability of a habitat to sequester carbon, which can offset, to some degree, the adverse climate impacts of a closure scenario due to GHG emissions. Moreover, NPP can be used as a proxy for the value of all of the ecological services provided by a habitat (ORNL, 2003).

Highly vegetated areas with dense canopies or shrub layers, such as the early successional forests and bottomland forests that currently overlie much of Joppa West, have a significantly higher annual NPP than grassland. As an example, in one study on carbon and nitrogen dynamics in North American terrestrial ecosystems, the annual NPP of short grassland ecosystems was estimated to range from 132 to 398 g m^{-2} yr^{-1}, whereas the annual NPP of temperate mixed forest ecosystems was estimated to range from 381 to 1,020 g m^{-2} yr^{-1} (McGuire *et al.*, 1992, Table 7). As such, the impacts of each closure scenario on annual NPP will largely be a function of the amount of forest habitat that is removed during construction and replaced with shallow-rooted native grasses.

Overall, minimal impacts to annual NPP are expected under the Minimal Disturbance scenario because the only vegetation that will be removed will be what is required in order to ensure dike stability. Under the

CIP and CBR scenarios, in contrast, the annual NPP of the habitat atop the former impoundment will drop during the construction period due to the complete conversion of the vegetation atop the former impoundment to bare soil. The duration of construction-related impacts will be greater under the CBR scenario than under the CIP scenario (six years *vs*. two years). However, the negative impacts of construction activities on annual NPP will be limited to the former impoundment location under the CBR scenario, whereas negative impacts can occur at both the former impoundment location and the borrow site under the CIP scenario. Under both the CIP and the CBR scenario, the impoundment cover will be revegetated with native grasses during site restoration. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of C; and CBR was assigned a rank of C (Table 5.11).

Table 5.11 Relative Impact Score for Habitat Impacts

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Habitat Impacts			
a. Habitat availability and biodiversity	A	C	C
b. Threatened and endangered species	A	C	C
c. Net primary productivity	A	C	C

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow);
C = Lowest benefit or highest adverse impact (shaded red).

5.3.10 Cost

The Minimal Disturbance option is expected to have substantially lower costs than the other two scenarios due to the minimal nature of planned activities. The CBR scenario is expected to have significantly higher costs than the CIP scenario due to the time and expense associated with moving large volumes of CCR. The Minimal Disturbance scenario was assigned a rank of A for this metric; CIP was assigned a rank of B; and CBR was assigned a rank of C (Table 5.12).

Table 5.12 Relative Impact Score for Cost

Impact Metric	Minimal Disturbance	Closure in Place	Closure by Removal
Cost	A	B	C

Notes:
A = Highest benefit or lowest adverse impact (shaded green); B = Intermediate benefit or adverse impact (shaded yellow); C = Lowest benefit or highest adverse impact (shaded red).

5.4 Summary

Based on the analyses presented in Section 5.3 and summarized in Table 5.13, the Minimal Disturbance closure alternative at Joppa West has the greatest environment benefit (or least adverse impact) for the majority of the metrics that were evaluated. Specifically, the Minimal Disturbance alternative has the greatest environment benefit (or least adverse impact) for 8 of the 9 metrics for which scores were quantified including: risks to human health and the environment, surface water quality, air quality, climate change and sustainability, worker safety, community safety, habitat impact, and cost. The only metric for which the Minimal Disturbance option was ranked as providing the least environmental benefit (or greatest adverse impact) among the potential closure scenarios was for risks of potential future CCR releases. Conversely, CIP was only ranked as providing the greatest environmental benefit (or least adverse impact) for 2 of the 9 metrics that were quantified (risks to human health and the environment and surface water quality), and CBR was only ranked as providing the greatest environmental benefit (or least adverse impact) for 3 of the 9 metrics that were quantified (risks to human health and the environment, risks of potential future CCR releases, and surface water quality).

Table 5.13 Relative Impact Score for Each Closure Scenario

Impact Metric[1]	Minimal Disturbance	Closure in Place	Closure by Removal
1) Risks to Human Health/Environment			
a. Risks to groundwater receptors (human)	A	A	A
b. Risks to surface water receptors (human)	A	A	A
c. Risks to ecological receptors	A	A	A
2) Risks of Potential Future CCR Releases			
a. Releases due to dike failure	C	B	A
b. Flood-related releases	C	B	A
3) Groundwater Quality[2]			
a. Upper confining Unit (UCU)	--	--	--
b. Uppermost aquifer (UA)	--	--	--
4) Surface Water Quality	A	A	A
5) Air Quality	A	B	C
6) Climate Change and Sustainability			
a. GHG emissions (CO_2, NO_x)	A	B	C
b. Energy consumption	A	B	C
7) Worker Safety	A	B	C
8) Community Impacts			
a. Accidents	A	B	C
b. Traffic	A	B	C
c. Noise	A	B	C
d. Environmental justice	A	B	C
9) Habitat Impacts			
a. Habitat availability and biodiversity	A	C	C
b. Threatened and endangered species	A	C	C
c. Net primary productivity	A	C	C
10) Cost	A	B	C

Notes:

CCR = Coal Combustion Residual; CO_2 = Carbon Dioxide, GHG = Greenhouse Gas; GWPS = Groundwater Protection Standard; IEPA = Illinois Environmental Protection Agency; NO_x.= Nitrous Oxide.

(1) Rankings based on the following scale:
  A = Highest benefit or lowest adverse impact (shaded green);
  B = Intermediate benefit or adverse impact (shaded yellow);
  C = Lowest benefit or highest adverse impact (shaded red).

(2) Relative impact scores were not assigned for groundwater quality because future groundwater concentrations will be affected both by the selected closure approach and potential groundwater corrective actions that may be implemented under an approved groundwater management zone under Part 620 (IEPA, c. 2021) or post-closure care under Part 845 (IEPA, 2020). It is inappropriate to assess the future groundwater impacts and the duration over which GWPSs are exceeded based just on closure.

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Appendix A

Curriculum Vitae of Andrew Bittner, M.Eng., P.E.

GRADIENT

Andrew B. Bittner, M.Eng., P.E.

Principal

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Areas of Expertise

Contaminant fate and transport in porous and fractured media, migration of coal ash combustion products in groundwater and surface water, non-aqueous phase liquid (NAPL) transport, surface water and groundwater hydrology, groundwater and surface water modeling, remedial investigation design, remedy evaluation and optimization, cost allocation, South American regulatory compliance and remediation.

Education & Certifications

M.Eng., Environmental Engineering and Water Resources, Massachusetts Institute of Technology, 2000

B.S.E., Environmental Engineering, University of Michigan, 1997

B.S., Physics, University of Michigan, 1997

Licensed Professional Engineer: Idaho, New Hampshire

Professional Experience

2000 – Present GRADIENT, Boston, MA
Environmental Engineer. Specializes in the fate and transport of contaminants in groundwater and surface water, coal combustion products, groundwater hydrology, groundwater flow and contaminant transport modeling, NAPL transport, and remedial investigation and design. Has served as principle-in-charge, testifying expert, and consulting expert on large, multi-disciplinary projects at coal combustion product surface impoundments and landfills, pharmaceutical facilities, automotive facilities, manufacturing plants, dry cleaning facilities, and Superfund sites. Extensive experience in South America and other international sites.

1997 – 1999 PARSONS ENGINEERING SCIENCE, Canton, MA
Environmental Engineer. Specialized in industrial wastewater treatability. On-site supervisor for bioremediation bench scale treatment and laboratory study for a major pharmaceutical company. Built hydraulic models for pharmaceutical wastewater treatment facilities. Designed hazardous waste treatment systems for a major pharmaceutical company. Performed site investigations to delineate NAPL plumes and design remedial recovery plans.

Professional Affiliations

National Ground Water Association; Chi Epsilon – Environmental Engineering Honor Society

9/22/2020

Technical Session Chair:

- World of Coal Ash Conference. Lexington, KY. May 8-11, 2017. Session title: "Groundwater."
- Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds. Palm Springs, CA. May 23-26, 2016. Session title: "Coal Ash Facility Restoration".
- Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds. Monterey, CA. May 21-24, 2012. Session title: "Environmental Remediation in Emerging Markets."
- Defense Research Institute. Panelist for session titled "Groundwater-Surface Water Connectivity and the Clean Water Act." New Orleans, LA. May 13-14, 2019.
- World of Coal Ash Conference. St. Louis, MO. May 13-16, 2019. Session title: "Project-Specific Case Studies."

Projects – *Coal Combustion Products*

Utility Client: Prepared expert report and testified before state pollution control board regarding proposed coal ash disposal regulations.

Electric Power Research Institute: Evaluated the performance of alternative liners, including engineered clay liners, natural clay liners, and geomembrane composite-lined systems at CCP impoundments. Used a probabilistic approach to model the flux of CCP constituents through each liner and the subsequent transport of constituents through the underlying vadose and saturated zone.

Industry Research Group: Developed methodology to evaluate performance equivalency of various surface impoundment liner systems. The methodology, which was submitted to US EPA in order to inform future rulemakings, presented a process to evaluate and compare hydraulic flux and travel times through different liner systems including geocomposite, compacted clay, and natural clay liners.

Confidential Client: Developed a screening level risk assessment for a manufacturing facility beneficially using coal fly ash as a soil stabilizer. The risk assessment compared estimated coal ash constituent exposure concentrations in soil, groundwater, and surface water to relevant benchmarks protective of human health and the environment.

Manufacturing Client: Performed beneficial use risk assessments consistent with US EPA Federal Coal Combustion Residual (CCR) Rule and Secondary Use Guidance for multiple commercial and construction products containing coal ash – including carpet backing, interior and exterior trim, and backer board. Analysis evaluated risks to groundwater, surface water, indoor air, and soil. Evaluation also considered exposure pathways for residents, construction workers, and landfill workers associated with installation of products, active life of the installed products, and post-life disposal in a landfill.

Electric Power Research Institute: Developed framework for creating alternative groundwater standards at CCP storage sites. The framework considers the development of alternative standards for the protection of human health and the environment, current and future uses of groundwater near CCP management units, and potential attenuation that may occur between the current point of compliance and a relevant point of exposure.

Utility Client: Prepared expert report and provided testimony related to the fate and transport of metal constituents in groundwater, including sulfate, boron, and arsenic, from over 30 different coal combustion residual surface impoundments at 15 sites.

Industry Research Group: Prepared technical comments regarding proposal to add boron to list of Appendix IV constituents to the Federal CCR Rule. Evaluated technical practicability and cost implications associated with the potential boron addition.

Industry Research Group: Prepared technical comments regarding portion of Federal CCR Rule that requires the groundwater protection standard (GWPS) of Appendix IV constituents with no MCL to be the background concentration. Evaluated technical practicability, cost implications, and potential benefits associated with the requirement for the four current Appendix IV constituents with no established MCL - cobalt, lithium, molybdenum, and lead.

Confidential Client: Developed a screening level risk assessment for a steel production and recycling facility that is beneficially using coal fly ash as a soil stabilizer. The risk assessment addressed a requirement in the Federal Coal Combustion Residuals (CCR) Disposal Rule for a characterization of risk from unencapsulated beneficial use of CCR. Used the Industrial Waste Evaluation Model (IWEM) to evaluate potential transport of coal ash constituents, including arsenic, in groundwater as a result of the beneficial reuse.

Utility Client: Prepared expert report interpreting data produced during a field investigation performed at a large Midwestern coal ash landfill.

Utility Client: For litigation support, modeled the fate and transport of arsenic and other coal ash related constituents in groundwater and surface water downgradient of a large Midwestern coal ash surface impoundment located in a karst environment. Model simulations compared potential impacts to groundwater and surface water resulting from potential surface impoundment closure scenarios.

Manufacturing Client: Performed beneficial use risk assessments consistent with US EPA Federal Coal Combustion Residual (CCR) Rule and Secondary Use Guidance for multiple commercial and construction products containing coal ash. Analysis evaluated risks to groundwater, surface water, indoor air, worker safety, and residential safety. Evaluation also considered exposure pathways associated with installation of products, active life of the installed products, and post-life disposal in a landfill. Used the Industrial Waste Evaluation Model (IWEM) to evaluate potential transport of coal ash constituents, including arsenic, in groundwater as a result of the beneficial reuse.

Industry Research Group: Developed a groundwater fate and transport model to evaluate the level of groundwater protection provided by various coal ash surface impoundment closure options, including closure in place and closure by removal. Model simulated transport of arsenic (III) and arsenic (V) in groundwater downgradient of coal ash disposal facilities. Model results are being used by utilities in support of closure planning which is required by Federal Coal Combustion Residual Rule.

Confidential Client: Prepared expert report on human health and ecological risks due to a potential spill of barged coal combustion byproducts (CCBs) on a large Midwestern river. Modeled the fate and transport of key CCB constituents, including arsenic, in surface water for a range of spill scenarios and river flow conditions and estimated potential downstream concentrations at drinking water intake locations.

Industry Research Group: Evaluated technical approach used by United States Environmental Protection Agency (US EPA) to simulate the migration of arsenic, selenium, and other metals in groundwater from overlying coal combustion storage units. Model analyses were included in regulatory comments submitted in response to US EPA's 2010 Coal Combustion Product Risk Assessment.

Industry Research Group: Developed relative risk framework to assess impacts to groundwater associated coal combustion product (CCP) surface impoundment closure scenarios. Framework identified potential deterministic and probabilistic modeling approaches to simulate potential migration of CCP constituents, including arsenic, boron, selenium, and molybdenum through the vadose and saturated zones for each closure alternative.

Industry Research Group: Modeled the downward migration of leachate from unlined coal combustion product surface impoundments using a probabilistic framework for a wide range of climatic and site conditions. Model results provided estimated durations for interactions between the impoundment leachate and nearby surface and groundwater.

Industry Research Group: As part of a relative risk framework, performed detailed sensitivity analysis of all factors associated with a coal ash surface impoundment closure that may impact the fate and transport of constituents in groundwater. Factors analyzed included surface impoundment characteristics (*e.g.*, volume, depth, and leachate quality), hydrogeological conditions (*e.g.*, hydraulic conductivity, hydraulic gradient, soil type, depth to groundwater, and surface water proximity), climatic characteristics (*e.g.*, precipitation), and closure details (*e.g.*, closure type and duration).

Projects – *Fate & Transport and Modeling*

Natural Gas Processing Facility: Prepared an expert report evaluating the hydrogeological conditions at and downgradient of a natural gas processing plant and provided assessment of the fate and transport over time of light non-aqueous phase liquids (LNAPLs) released from the plant and associated pipelines.

Confidential Client, Rhode Island: Designed and calibrated a groundwater flow and solute transport model for multiple chlorinated organic constituents at a Northeastern Superfund Site. Used one year long tracer test to calibrate model. Model was used to predict the future effectiveness of various remedial alternatives.

Confidential Client: Designed and calibrated a groundwater flow and solute transport model for a Superfund site that has groundwater impacted with volatile organic compounds including benzene, tetrachloroethylene, trichloroethylene, and vinyl chloride. The model was used successfully to present the case to US EPA for shutting down the source remedy.

Confidential Client, Brazil: Developed 3-D numerical groundwater and solute transport model using MODFLOW and MT3D for volatile organic compounds and pesticides. Used model to evaluate and design remediation alternatives. Managed multiple site investigation and characterization studies. Projects involved calculation of risks to human health from exposure to soils, groundwater, indoor air, and outdoor air.

Savage Well Superfund Site: For a potentially responsible party (PRP) group, managed the development of a 3-D numerical groundwater and solute transport model for tetrachloroethylene (PCE) at a Superfund site in New Hampshire. Calibrated the model using approximately 10 years of data with review and oversight by US EPA and United States Geological Survey (USGS). Designed an optimization algorithm to develop the optimal groundwater pump and treat system.

Confidential Client, Massachusetts: Developed a 2-D contaminant transport model for PCE to demonstrate that contaminant contribution from a dry cleaning operation to the town water supply wells was insignificant compared to contribution from other potential sources. Managed the installation and operation of a pump and treat system at the Site.

Confidential Client, Argentina: Developed a 2-D numerical groundwater and solute transport model using MODFLOW and MT3D. Used the calibrated model to design a hydraulic barrier system to control off-site migration.

Confidential Client: Performed site-specific vapor intrusion modeling using the Johnson-Ettinger model at a pharmaceutical facility. Performed a detailed sensitivity analysis for each model input parameter.

Confidential Client: Performed NAPL transport and travel time calculations through porous media vadose and saturated zones and clay confining layers.

Confidential Client: Wrote critique of US EPA geochemistry model.

Projects – *Remediation*

Confidential Client, Brazil: Designed and implemented nano-scale zero valent iron remedy to prevent off-site arsenic migration. Upon completion of remedy, negotiated site closure with state of Rio de Janeiro environmental agency.

Confidential Client, Brazil: Designed and implemented a pilot scale enhanced *in-situ* bioremediation remedy for groundwater impacted with chlorinated organic compounds at a former agricultural product manufacturing facility.

Confidential Client, New Hampshire: As an independent third party, performed a review of a proposed Electrical Resistive Heating remedy for a chlorinated solvent dense non-aqueous phase liquid (DNAPL) source zone.

Confidential Client, New York: Provided regulatory comments regarding a US EPA Proposed Remedial Action Plan at a Region II Superfund Site on Long Island. Provided support during mediation and during negotiations with US EPA.

Confidential Client, New Jersey: Provided regulatory comments regarding a US EPA Proposed National Priorities List (NPL) listing at a Region II Superfund Site.

Confidential Client, Brazil: Managed multiple conceptual and detailed engineering remedial design projects for a soil vapor extraction system, dual-phase extraction system, and a pump and treat system. Remediation efforts focused on soil and groundwater contamination by pesticides and chlorinated solvents.

Confidential Client, Brazil: Managed site remediation projects to operate and maintain a soil vapor extraction system, dual-phase extraction system, and a hydraulic barrier system.

Confidential Client, Argentina: Managed conceptual and detailed engineering remedial design project for dual-phase extraction system focused on the remediation of volatile organic compounds in soil and groundwater.

Confidential Client: On-site supervisor for bioreactor bench scale study at a pharmaceutical wastewater treatment plant. Performed an in-depth investigation on the bio-inhibitory effects due to the chronic exposure of biomass to manganese. Performed laboratory work required to support the bioreactors including tests for mixed liquor volatile suspended solids (MLVSS), total suspended solids (TSS), chemical oxygen demand (COD), dissolved oxygen (DO), ammonia (NH_3), and respirometry.

Confidential Client: Lead environmental engineer for a belt filter press replacement project for a pharmaceutical company wastewater treatment plant. Designed and sized polymer addition system.

Projects – *Site Characterization*

Confidential Client, Brazil: Provided strategic oversight for a series of environmental investigations, remedial actions, and agency negotiations for an automotive facility located in São Paolo.

Confidential Client: Managed large-scale cost allocation at a Midwestern Superfund site. Forensically evaluated the sources of tar to river sediments considering site industrial operational history, contaminant fate and transport, chemistry, site modification and filling history, and observed contaminant patterns. Calculated the mass of tar present in the environment using both visual observations and analytical data.

Confidential Client, Brazil: Managed large-scale site investigations and human health risk assessment projects at a former pharmaceutical facility located in São Paulo. Key compounds were petroleum hydrocarbons and volatile organic compounds.

Confidential Client, New York: Served as consulting expert for large cost allocation involving over 16 responsible parties and chlorinated organic groundwater plumes extending for nearly 2 miles. Evaluated lateral and vertical groundwater flow direction, chemical usage history, and groundwater chemistry to support a *de minimis* contribution argument for our client.

Confidential Client, Ohio: Served as consulting expert for cost allocation project at a Midwestern landfill. Evaluated differences in toxicity and risk associated with municipal solid waste and industrial hazardous waste. Used data to devise risk-weighted allocation approach for remedy costs.

Confidential Client, Brazil: Managed site investigation to evaluate groundwater responses due to seasonal precipitation events and their effect on potential contaminant fate & transport.

Confidential Client: Managed site investigation project identifying sources of PCE present at a former electrical resistor manufacturing facility. Soil, groundwater, and soil gas data were evaluated and used to identify individual sources of PCE to the subsurface. The impact of each source on remediation costs related to the site was evaluated and successfully used as a tool to mediate between responsible parties. Served as consulting expert during mediation between responsible parties.

Confidential Client, New Jersey: Delineated NAPL plumes and investigated spill history, sewer maps, and gas chromatography fingerprint results at East Coast Superfund Site. Designed French Drain to recover NAPL from subsurface.

City of Pittsfield, Massachusetts: Technical consultant to the city for mediation between General Electric (GE) and governmental agencies. Evaluated reports and clean-up standards, and attended mediation sessions on behalf of the city.

Projects – *Clean Water Act*

Municipal Client, Ohio: Consulting expert for significant nexus evaluation to determine whether wetlands and surface water tributaries are jurisdictional waters of the United States.

Publications/Presentations

Dale, A, Kondziolka, J, de Lassus, C, Bittner, A, Hensel, B. 2020. "Probalistic Modeling of Leaching from Coal Ash Impoundment Liners: A Case Study in Science Informing Policy Development." Presented at the International Society of Exposure Science Virtual Meeting, California, September 21.

Briggs, N; Lewis, AS; Bittner, AB. 2020. "Evaluating Climate Change Impacts on CCP Surface Impoundments and Landfills." Presented at the World of Coal Ash (WOCA) Conference, St. Louis, Missouri, May 16.

Bittner, AB; Lewis, AS. 2020. "Beneficial use assessment of building materials containing CCPs." *Gradient Trends: Risk Science and Application* 77 (Winter):3,5.

Bittner, AB; Spak, MS; Cox, WS. 2019. "Carving out the Contours: The Clean Water Act and the Migration of Affected Groundwater to Waters of the United States." *For the Defense* 61(6):55-59.

Bittner, A. Lewis, A. 2019. "CCP Beneficial Use Risk Assessment: Case Studies for Three Different Applications." Presented at the World of Coal Ash (WOCA) Conference, St. Louis, Missouri, May 14.

Lewis, A. Bittner, A. 2019. "Risk Based Considerations for Establishing Alternative Groundwater Standards at Coal Combustion Product Sites." Presented at the World of Coal Ash (WOCA) Conference, St. Louis, Missouri, May 15.

Lewis, AS; Bittner, A. 2018. "Risk-Based Approaches for Establishing Alternative Standards at Coal Combustion Sites." Presented at the World of Coal Ash (WOCA) Ponded Ash Workshop, Louisville, Kentucky, October 30-31.

Lewis, AS; Bittner, A. 2017. "The Relative Impact Framework for Evaluating Coal Combustion Residual Surface Impoundment Closure Options: Application and Lessons Learned." *Coal Combustion and Gasification Products (CCGP)* 9:1-3.

Lewis, AS; Dube, EM; Bittner, A. 2017. "Key role of leachate data in evaluating CCP beneficial use." *ASH at Work* 1:32-34.

Lewis, AS; Bittner, AB; Lemay, JC. 2017. "Achieving Groundwater Protection Standards for Appendix IV Constituents: The Problem with Using Background Concentrations in the Absence of Maximum Contaminant Levels (MCLs)." Presented at the 2017 World of Coal Ash Conference (WOCA), Lexington, KY, May 8-11.

Bittner, A. 2017. "Evaluation of Groundwater Protectiveness of Potential Surface Impoundment Closure Options." Presented at the American Coal Ash Association's 7th Annual World of Coal Ash Conference, Lexington, KY, May 11.

Lewis, A; Bittner A; Radloff, K; Hensel, B. 2017. "Storage of coal combustion products in the United States: Perspectives on potential human health and environmental risks." In *Coal Combustion Products (CCPs): Characteristics, Utilization and Beneficiation, 1st Edition*. Woodhead Publishing, May 2.

Bittner, AB; Kondziolka, JM; Lewis, A; Hensel, B; Ladwig, K. 2016. "Groundwater Assessment Framework for Evaluating the Relative Impacts of Coal Ash Surface Impoundment Closure Options." Presented at Battelle's Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Palm Springs, CA, May 22-26.

Bittner, AB; Kondziolka, JM; Sharma, M; Nangeroni, P; McGrath, R. 2016. "Using Tracer Test Data to Calibrate a Groundwater Flow and Solute Transport Model." Presented at Battelle's Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Palm Springs, CA, May 22-26.

Bittner, A. 2016. "A Retrospective Look at Remediation in the State of Rio de Janeiro, Brazil: And What Lessons We Can Apply to Remediation Projects in Other Emerging International Markets." Presented at Battelle's Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Palm Springs, CA, May 22-26. 17p.

Bittner, A. 2016. "The Federal CCR Rule and How it is Impacting Coal Ash Disposal." Presented at Battelle's Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Palm Springs, CA, May 22-26. 17p.

Bittner, A. 2016. "Coal Ash Beneficial Reuse Assessment Consistent with Requirements of the 2015 Federal CCR Rule." Presented at EUCI's Sixth Annual Coal Combustion Residuals and Effluent Limitation Guidelines Conference, Charlotte, NC, March 30-31. 30p.

Herman, K; Flewelling, S; Bittner, AB; Tymchak, M; Swamy, M. 2015. "Alternate Endpoints for Remediating NAPL-Impacted Sites." Presented at the EPRI/AWMA Env-Vision Conference, Crystal City, VA, May 14.

Lewis, A; Bittner, AB; Herman, K; Dubé, E; Long, C; Hensel, B; Ladwig, K. 2015. "Framework for Evaluating Relative Impacts for Surface Impoundment Closure Options." Presented at the 2015 World of Coal Ash Conference, Nashville, TN, May 8.

Bittner, AB. Lewis, A; Herman, K; Dubé, E; Long, CM; Kondziolka, K, Hensel, B; Ladwig, K. 2015 "Groundwater Assessment Framework to Evaluate Relative Impacts of Surface Impoundment Closure Options." Presented at the 2015 World of Coal Ash Conference, Nashville, TN, May 7.

Bittner, AB. 2014. "Evolving environmental regulations in Brazil." *Gradient Trends: Risk Science and Application* 59 (Winter):4.

Bittner, AB. 2013. "Modeling Mass Discharge from the Source Zone." Presented at Second International Symposium on Bioremediation and Sustainable Environmental Technologies, Jacksonville, FL, June 11.

Bittner, AB. 2013. "Successful Implementation of a Risk-based Remedial Solution in Brazil." Presented at the 2013 NGWA Groundwater Summit, San Antonio, TX, April 28.

Bittner, AB. 2013. "Evolving methods for evaluating vapor intrusion." *Gradient Trends: Risk Science and Application* 57(Spring): 4.

Esakkiperumal, C; Bittner, A. 2013. "Use of Mass-Flux Based Approach to Optimize the Design of a Hydraulic Containment System." Presented at the 2013 NGWA Groundwater Summit, San Antonio, TX, April 28.

Bittner, A. 2010. "A Weight-of-Evidence Approach to Assess NAPL Mobility." Presented at the 7th International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May 27.

Herman, K; Bittner, A. 2010. "How Much Tar is In the Mud? – Reducing Uncertainty in Characterizing the Distribution and Mass of DNAPL in Sediments." Presented at the EPRI MGP 2010 Symposium, January 28.

Bittner, AB. 2009. "Is your NAPL mobile?" *Gradient Trends: Risk Science & Application* 45(Spring):3.

Herman, K; Bittner, A. 2008. "Reducing Uncertainty in DNAPL Characterization." Presented at the 24th Annual International Conference on Soils, Sediments, and Water, October 23.

Bittner, AB; Baffrey, RN; Esakkiperumal, C. 2006. "Using Sediment Transport Modeling to Support Environmental Forensic PCB Analyses." Presented at Society of Environmental Toxicology and Chemistry Conference, Montreal, Canada, November 8.

Bittner, AB. 2006. "Groundwater and Air Modeling Used to Support Forensic Analyses." Presented at the Gradient Breakfast Seminar Titled: Forensic Chemistry – The Intersection of Science and Law, May 16.

Bittner, AB. 2006. "M&A emerging issues and requirements." *Gradient Trends: Risk Science & Application* 36(Spring):4.

Sharma, M; Saba, T; Bittner, A. 2003. "Optimization of Groundwater Pump and Treat Systems." Presented at the 19th Annual International Conference on Contaminated Soil, Sediments and Water, Amherst, MA, October 23.

Sharma, M; Saba, T; Bittner, A. 2003. "Optimization of Groundwater Pump and Treat Systems Using Numerical Modeling and the Monte Carlo Approach." Presented at the National Ground Water Association Mid-South Focus Conference, Nashville, TN, September 19.

Bittner, AB; Halsey, P; Khayyat, A; Luu, K; Maag, B; Sagara, J; Wolfe, A. 2002. "Drinking water quality assessment and point-of-use treatment in Nepal." *Civil Eng. Practice* 17:5-24.

Bittner, AB. 2000. "Drinking Water Quality Assessment in Nepal: Nitrates and Ammonia [Thesis]." Submitted to Massachusetts Institute of Technology.

Appendix B

Data Summary

Table B.1 Relevant Groundwater Data

		Well[c, d]:	G-101									
Constituents[a]	**Class I GWQS[b]**	**Sample Date:**	**08/17/10**	**03/15/11**	**06/16/11**	**09/13/11**	**11/29/11**	**02/14/12**	**05/15/12**	**03/06/13**	**05/13/13**	**03/22/21**
		Units										
Dissolved Metals												
Antimony	0.006	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.006	
Arsenic	0.01	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01	
Barium	2	mg/L	0.10	0.090	0.64	0.061	0.072	0.58	0.044	0.069	0.076	
Beryllium	0.004	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Boron	2	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Cadmium	0.005	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Chromium	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Cobalt	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Copper	0.65	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Iron	5	mg/L	1.3	0.17	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Lead	0.0075	mg/L	0.0026	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.007	<0.007	
Manganese	0.15	mg/L	0.056	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Mercury	0.002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	
Nickel	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Selenium	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Silver	0.05	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Thallium	0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Zinc	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Total Metals												
Antimony	0.006	mg/L										<0.001
Arsenic	0.01	mg/L										<0.01
Barium	2	mg/L										0.11
Beryllium	0.004	mg/L										<0.0005
Boron	2	mg/L										0.015
Cadmium	0.005	mg/L										<0.002
Chromium	0.1	mg/L										<0.005
Cobalt	1	mg/L										<0.005
Cyanide	0.65	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	
Iron	5	mg/L										0.47
Lead	0.0075	mg/L										<0.0075
Lithium	0.15	mg/L										<0.005
Manganese	0.15	mg/L										0.025
Mercury	0.002	mg/L										<0.0002
Molybdenum	0.10	mg/L										<0.01
Selenium	0.05	mg/L										<0.04
Thallium	0.002	mg/L										<0.002
Other		mg/L										
Chloride	200		7.0	6.0	5.0	3.0	4.0	4.0	4.0	<5	5.0	7.0
Fluoride	4	mg/L	0.26	0.27	0.26	0.32	0.28	0.30	0.31	0.33	0.28	0.23
Nitrogen, Nitrate	10	mg/L	2.1	1.7	1.6	1.6	1.1	0.28	0.82	1.7	1.4	
Sulfate	400	mg/L	32	32	34	28	35	35	22	33	33	39
Total Dissolved Solids	1200	mg/L	344	294	276	222	268	216	208	214	272	358
pH (SU)	6.5-9.0	mg/L	7.1	6.6	7.2	6.9	7.2	6.9	7.3	7.1	6.8	

Notes

Blank = Not Analyzed; <# = Not Detected, detection limit presented; GWQS = Groundwater Quality Standard; IEPA = Illinois Environmental Protection Agency; NA = Not Available; SU = Standard Units.

(a) Constituents analyzed as part of the groundwater monitoring plan.

(b) Class I Groundwater Quality Standards for Potable Resource Groundwater (IEPA, 2013).

BOLD Exceedance of a Class I GWQS

(c) The eight wells related to Joppa West are presented (G-101, G-111, G-112C, G-113, TPZ114, TPZ116, TPZ117, and TPZ117D). Well G-101 is considered an upgradient well. All wells are screened in the surficial groundwater unit, with the exception of well TPZ117D, which is screened in the upper aquifer.

(d) Pore water data from XTPW01 are presented as a comparison. Samples from XTPW01 located in the middle of the former surface impoundment were not included because it represents leachate characterized pore water concentrations from within the WAP rather than groundwater concentrations.

Table B.1 Relevant Groundwater Data

Constituents[a]	Class I GWQS[b]	Well[c, d]:	G-111												G-112C			
		Sample Date: Units	08/17/10	11/05/10	03/15/11	06/16/11	09/13/11	11/29/11	02/14/12	05/15/12	08/07/12	03/07/13	05/14/13	03/22/21	03/07/13	04/17/13	05/14/13	03/22/21
Dissolved Metals																		
Antimony	0.006	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.006		<0.005	<0.005	<0.006	
Arsenic	0.01	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01		<0.01	<0.01	<0.01	
Barium	2	mg/L	0.15	0.15	0.16	0.16	0.18	0.18	0.16	0.17	0.15	0.17	0.17		0.062	0.059	0.062	
Beryllium	0.004	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	
Boron	2	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		**3.3**	**3.1**	**3.1**	
Cadmium	0.005	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	
Chromium	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Cobalt	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Copper	0.65	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Iron	5	mg/L	0.45	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.048	0.039	<0.02	
Lead	0.0075	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.007	<0.007		<0.007	<0.04	<0.007	
Manganese	0.15	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		**0.18**	**0.17**	**0.15**	
Mercury	0.002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	
Nickel	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Selenium	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	
Silver	0.05	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Thallium	0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	
Zinc	5	mg/L	<0.01	0.013	0.018	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	
Total Metals																		
Antimony	0.006	mg/L												0.00050				<0.001
Arsenic	0.01	mg/L												<0.01				<0.01
Barium	2	mg/L												0.21				0.085
Beryllium	0.004	mg/L												<0.0005				<0.0005
Boron	2	mg/L												<0.02				**4.3**
Cadmium	0.005	mg/L												<0.002				<0.002
Chromium	0.1	mg/L												<0.005				<0.005
Cobalt	1	mg/L												<0.005				0.012
Cyanide	0.65	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007	
Iron	5	mg/L												0.63				0.94
Lead	0.0075	mg/L												<0.0075				<0.0075
Lithium	0.15	mg/L												0.0022				0.013
Manganese	0.15	mg/L												0.0066				**0.40**
Mercury	0.002	mg/L												<0.0002				<0.0002
Molybdenum	0.10	mg/L												<0.01				0.0092
Selenium	0.05	mg/L												<0.04				<0.04
Thallium	0.002	mg/L												<0.002				<0.002
Other		mg/L																
Chloride	200		8.0	6.0	7.0	6.0	6.0	6.0	7.0	7.0	5.0	6.0	7.0	10	<5	<5	<5	7.0
Fluoride	4	mg/L	0.62	0.70	0.67	0.63	0.63	0.62	0.67	0.67	0.69	0.63	0.71	0.66	0.74	0.80	0.81	0.60
Nitrogen, Nitrate	10	mg/L	0.092	0.72	0.10	0.17	0.13	0.15	0.093	0.12	0.052	0.37	<0.05		0.34	<0.05	<0.05	
Sulfate	400	mg/L	25	22	23	27	24	19	27	30	26	20	19	17	63	66	60	**532**
Total Dissolved Solids	1200	mg/L	342	330	322	372	330	376	354	324	394	390	374	364	412	476	432	1010
pH (SU)	6.5-9.0	mg/L	7.3	6.7	7.1	7.1	7.1	7.1	7.2	7.1	7.0	7.3	7.1		6.8	6.9	6.7	

Notes

Blank = Not Analyzed; <# = Not Detected, detection limit presented; GWQS = Groundwater Quality Standard; IEPA = Illinois Environmental Protection Agency; NA = Not Available; SU = Standard Units.

(a) Constituents analyzed as part of the groundwater monitoring plan.

(b) Class I Groundwater Quality Standards for Potable Resource Groundwater (IEPA, 2013).

BOLD Exceedance of a Class I GWQS

(c) The eight wells related to Joppa West are presented (G-101, G-111, G-112C, G-113, TPZ114, TPZ116, TPZ117, and TPZ117D). Well G-101 is considered an upgradient well. All wells are screened in the surficial groundwater unit, with the exception of well TPZ117D, which is screened in the upper aquifer.

(d) Pore water data from XTPW01 are presented as a comparison. Samples from XTPW01 located in the middle of the former surface impoundment were not included because it represents leachate characterized pore water concentrations from within the WAP rather than groundwater concentrations.

Table B.1 Relevant Groundwater Data

		Well[c, d]:	G-113												TPZ114	TPZ116	TPZ117	TPZ117D	XTPW01
Constituents[a]	**Class I GWQS**[b]	**Sample Date:** **Units**	**08/17/10**	**11/05/10**	**03/15/11**	**06/16/11**	**09/13/11**	**11/29/11**	**02/14/12**	**05/15/12**	**08/07/12**	**03/07/13**	**05/14/13**	**03/22/21**	**03/22/21**	**03/22/21**	**03/22/21**	**03/22/21**	**03/22/21**
Dissolved Metals																			
Antimony	0.006	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005						
Arsenic	0.01	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01						
Barium	2	mg/L	0.35	0.40	0.46	0.45	0.49	0.51	0.50	0.53	0.47	0.54	0.55						
Beryllium	0.004	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Boron	2	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02						
Cadmium	0.005	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002						
Chromium	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Cobalt	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Copper	0.65	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Iron	5	mg/L	0.040	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02						
Lead	0.0075	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.007	<0.007						
Manganese	0.15	mg/L	0.092	0.025	0.0064	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0076	<0.005						
Mercury	0.002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002						
Nickel	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Selenium	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05						
Silver	0.05	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Thallium	0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002						
Zinc	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Total Metals																			
Antimony	0.006	mg/L												<0.001	0.00080	0.00070	0.0051	0.0053	0.0036
Arsenic	0.01	mg/L												<0.01	**0.017**	<0.01	**0.020**	<0.01	**0.030**
Barium	2	mg/L												0.11	0.37	0.51	0.52	0.27	0.078
Beryllium	0.004	mg/L												<0.0005	0.0013	0.00060	**0.0054**	<0.0005	<0.0005
Boron	2	mg/L												<0.02	0.18	<0.02	<0.02	0.076	**27**
Cadmium	0.005	mg/L												<0.002	<0.002	<0.002	0.00090	<0.002	<0.002
Chromium	0.1	mg/L												<0.005	0.032	0.012	0.099	<0.005	<0.005
Cobalt	1	mg/L												<0.005	0.0074	0.0031	0.038	0.0052	<0.005
Cyanide	0.65	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007						
Iron	5	mg/L												0.48	**20**	4.4	**72**	0.28	0.100
Lead	0.0075	mg/L												<0.0075	**0.021**	<0.0075	**0.039**	<0.0075	<0.0075
Lithium	0.15	mg/L												0.0051	0.035	0.031	0.022	0.019	0.12
Manganese	0.15	mg/L												0.0095	**0.48**	0.081	**0.76**	**0.92**	0.0025
Mercury	0.002	mg/L												<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	0.10	mg/L												<0.01	0.0081	0.0043	0.0039	0.0059	**0.28**
Selenium	0.05	mg/L												<0.04	<0.04	<0.04	<0.04	<0.04	**0.094**
Thallium	0.002	mg/L												<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Other		mg/L																	
Chloride	200		27	29	29	29	29	28	31	34	29	32	30	19	11	9.0	8.0	11	2.0
Fluoride	4	mg/L	0.43	0.45	0.44	0.39	0.40	0.39	0.42	0.43	0.45	0.42	0.44	0.36	0.32	0.36	0.30	0.27	0.050
Nitrogen, Nitrate	10	mg/L	0.84	0.14	0.33	0.35	0.40	0.68	0.48	0.57	0.48	0.53	0.38						
Sulfate	400	mg/L	61	35	36	32	30	34	35	32	30	37	50	292	19	24	32	187	387
Total Dissolved Solids	1200	mg/L	542	524	540	590	554	636	590	586	666	606	706	870	306	292	284	318	824
pH (SU)	6.5-9.0	mg/L	6.9	6.6	6.6	6.6	6.5	6.4	6.6	6.7	6.5	6.8	6.7						

Notes

Blank = Not Analyzed; <# = Not Detected, detection limit presented; GWQS = Groundwater Quality Standard; IEPA = Illinois Environmental Protection Agency; NA = Not Available; SU = Standard Units.

(a) Constituents analyzed as part of the groundwater monitoring plan.

(b) Class I Groundwater Quality Standards for Potable Resource Groundwater (IEPA, 2013).

BOLD Exceedance of a Class I GWQS

(c) The eight wells related to Joppa West are presented (G-101, G-111, G-112C, G-113, TPZ114, TPZ116, TPZ117, and TPZ117D). Well G-101 is considered an upgradient well. All wells are screened in the surficial groundwater unit, with the exception of well TPZ117D, which is screened in the upper aquifer.

(d) Pore water data from XTPW01 are presented as a comparison. Samples from XTPW01 located in the middle of the former surface impoundment were not included because it represents leachate characterized pore water concentrations from within the WAP rather than groundwater concentrations.

Appendix C

Surface Water Modeling

Based on the Conceptual Site Model (CSM), groundwater underlying Joppa Generating Station's West Ash Pond (Joppa West) flows north to south toward the Ohio River. Therefore, coal combustion residual (CCR) constituents related to Joppa West may impact the neighboring surface water. Surface water samples were not collected from the Ohio River adjacent to the Site. To evaluate potential risks to receptors exposed to CCR constituents in surface water near the Joppa Plant, Gradient evaluated the potential mixing of constituents of concern (COIs) in the groundwater with surface water. The COIs for surface water are constituents with maximum concentrations in groundwater in excess of Illinois Environmental Protection Agency (IEPA) groundwater quality standard (GWQS)[1] for human receptors and ecological benchmarks for ecological receptors (Sections 3.2.1 and 3.2.2). As discussed in Section 3.2 of the report, six COIs were identified for human health risk evaluation (arsenic, beryllium, boron, iron, lead, and manganese), and three COIs were identified for ecological receptors (cobalt, iron, and lead).

Gradient estimated the annual groundwater flow rate and the mass loading of COIs in groundwater potentially mixing with surface water. Then, Gradient determined a conservative upper-bound estimate of surface water COI concentrations by dividing the COIs' mass loading rates with annual river flow rate.

C.1 Model Overview

Gradient used a one-dimensional steady-state model to represent groundwater flow into the Ohio River. In this model, potentially impacted groundwater, downgradient of Joppa West, migrates south in the upper confining unit (UCU) toward the Ohio River.[2] Gradient assumed that all the groundwater flowing through the UCU enters into the river. The cross-sectional area where groundwater downgradient of Joppa West flows into the river was estimated by multiplying a representative length parallel to the river by the saturated thickness of the UCU.

The groundwater that flows into the Ohio River mixes with the surface water in the river. Using United States Environmental Protection Agency's (US EPA) indirect exposure assessment methodology (US EPA, 1998), which the agency used in its "Human and Ecological Risk Assessment of Coal Combustion Residuals" (the CCR risk assessment; US EPA, 2014), the model evaluates the potential surface water concentrations of COIs at a location downstream of where the groundwater enters into the river, assuming a well-mixed water column.

The mass loading rates were estimated for each of the COIs (arsenic, beryllium, boron, cobalt, iron, lead, and manganese) from groundwater to the Ohio River. Second, the COI mass loading rates were used to estimate their concentrations in the Ohio River water column.

C.2 Surface Water Modeling Calculations

Groundwater flow in the UCU is governed by the hydraulic conductivity and gradient of the groundwater unit and the cross-sectional area downgradient of Joppa West where groundwater enters the Ohio River. Gradient derived the flow rate of the groundwater entering the river using Darcy's Law (Freeze and Cherry, 1979) and conservatively assumed that the maximum COI concentrations are representative of the entire

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[1] As discussed further in Section 3.2.2 in the report, GWQSs are protective of human health and not necessarily of ecological receptors. While ecological receptors are not exposed to groundwater, groundwater can potentially enter into neighboring surface water and impact ecological receptors. Therefore, two sets of COIs were identified, one for humans and another for ecological receptors.

[2] Groundwater underlying Joppa West, both in the UCU and the uppermost aquifer (UA), flows toward and mixes with surface water in the Ohio River. Surface water modeling was performed only for the UCU because the majority of the COI exceedances were observed in the UCU. While manganese was detected in the UA, the UA contributions to the surface water concentrations were not modeled, but evaluated separately as part of the uncertainty section (See Section 4.6 in the report)

groundwater cross-sectional area (Equation 1). We ignored absorption by subsurface soil, which would decrease the mass loading to the river, and assumed that all the groundwater flowing through the UCU flowed into the river and mixed with surface water.

$$Q = K \times i \times A \qquad \text{Eq. 1}$$

where:

Q = Groundwater flow rate (m^3/s)
K = Hydraulic conductivity (m/s)
i = Hydraulic gradient (m/m)
A = Cross-sectional area of the groundwater entering the river (m^2)

Gradient used an average measured hydraulic conductivity (K) of 7.4 x 10^{-6} cm/s (equivalent to 7.4 x 10^{-8} m/s) and a calculated hydraulic gradient (i) of 0.014 m/m (Natural Resource Technology, Inc., 2013). The cross-sectional area downgradient of Joppa West where groundwater flows into the river was calculated by multiplying a representative length parallel to the river downgradient of Joppa West (1,584 ft. or 483 m, based on the distance between wells G114 and G116) by the estimated saturated UCU thickness (31.5 ft. or 9.6 m, based on the groundwater elevation at well G112C minus the elevation of the bottom of the surficial unit). The total cross-sectional area based on these dimensions is 4,637 m^2 (Ramboll US Corp., 2021). The groundwater flow rate (Q) through this cross-sectional area is 4.80×10^{-6} m^3/s.

Gradient then calculated the potential mass loading rate of each COI into the river using Equation 2.

$$m_c = C_c \times Q \times CF \qquad \text{Eq. 2}$$

where:

m_c = Mass loading rate of COI (mg/year)
C_c = Groundwater concentration of the COI (mg/L)
Q = Groundwater flow rate (4.80×10^{-6} m^3/s)
CF = Unit conversion factors: 1,000 L/m^3; 31,557,600 s/year

Gradient assumed that the groundwater concentrations of the COIs were uniformly equal to the maximum detected concentration of each COI (See Table 4.4 in the report).

To evaluate the potential groundwater mass loading rate of the COIs, Gradient used assumptions that would bias the modeled COI concentrations to be higher than they are likely to be in actuality. Gradient relied on the maximum detected concentration of each COI in groundwater, regardless of the well, location, and time at which they were measured, and did not account for any mixing or dilution that occurs as a result of groundwater migration. Further, Gradient ignored absorption of constituents in groundwater to subsurface soils and sediments, which may overestimate aqueous concentrations. Gradient modeled the potential surface water COI concentrations (See Table 4.3 in the report) using the calculated mass loading rates of the COIs, as follows:

$$C_{Tot} = \frac{m_c}{V_f} \qquad \text{Eq. 3}$$

where:

C_{Tot} = Total concentration of the COI (mg/L)
m_c = Massloading rate of the COI (mg/year)
V_f = Ohio River annual flow (L/year)

To characterize the Ohio River flow rate, we used data from the Ohio River Grand Chain gauging station (ID# 03612500; USGS, 2021), which is one of the nearest United States Geological Survey (USGS) Stations. Based on this, we conservatively assumed a flow rate of 80,620 cubic feet per second (cfs), which is the 10th percentile of the daily mean flow rates.

References

Freeze, RA; Cherry, JA. 1979. *Groundwater.* Prentice-Hall, Inc., Englewood Cliffs, NJ, 604p.

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US EPA. 1998. "Methodology for assessing health risks associated with multiple pathways of exposure to combustor emissions." National Center for Environmental Assessment (NCEA), EPA 600/R-98/137, December. Accessed at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=55525.

US EPA. 2014. "Human and Ecological Risk Assessment of Coal Combustion Residuals (Final)." Office of Solid Waste and Emergency Response (OSWER), Office of Resource Conservation and Recovery, 1237p., December. Accessed at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2009-0640-11993.

US Geological Survey (USGS). 2021. "National Water Information System (NWIS) Web Interface: USGS Water Data for the Nation." Accessed .at https://waterdata.usgs.gov/nwis/

Appendix D

Screening Benchmarks

Table D.1 Calculated Water Quality Standards Protective of Incidental Ingestion and Fish Consumption

Analytes	**Bioconcentration Factor (BCF)**		**Average Daily Intake (ADI)**			**Human Threshold Criteria (HTC)**		
	BCF[a] (L/kg-tissue)	**Basis**	**MCL (mg/L)**	**RfD (mg/kg-d)**	**ADI[b] (mg/day)**	**Water & Fish (mg/L)**	**Water Only (mg/L)**	**Fish Only (mg/L)**
Arsenic	44	NRWQC, 2002	0.010	0.00030	0.020	0.022	2.0	0.023
Beryllium	19	NRWQC, 2002	0.0040	0.0020	0.0080	0.021	0.80	0.021
Boron	NA		NC	0.20	14	1400	1400	NA
Iron	19	US EPA, 2014	NC	0.70	49	126	4900	129
Lead[c]	46	US EPA, 2014	0.015	NC	0.030	0.015	0.015	0.015
Manganese	0.4	US EPA, 2014	NC	0.024	1.7	93	168	210

Notes:

ADI = Average Daily Intake; BCF = Bioconcentration Factor; F = Fish Consumption Rate; HTC = Human Threshold Criteria; IEPA = Illinois Environmental Protection Agency; MCL = Maximum Contaminant Level; NA = BCF not available, therefore, WQC for fish only not calculated; NC = No Criterion Available; NRWQC = National Recommended Water Quality Criteria; ORNL RAIS = Oak Ridge National Laboratory Risk Assessment Information System; RfD = Reference Dose; W = Water Consumption Rate; WQC = Water Quality Criteria; SWQC = Surface Water Quality Criteria; US EPA = United States Environmental Protection Agency.

(a) BCFs from the following hierarchy of sources:

NRWQC (US EPA, 2016a). National Recommended Water Quality Criteria.
NRWQC (US EPA, 2002). National Recommended Water Quality Criteria: 2002. Human Health Criteria Calculation Matrix.
US EPA (2014). Human and Ecological Risk Assessment of Coal Combustion Residuals.
ORNL RAIS (2018). Risk Assessment Information System (RAIS) Toxicity Values and Chemical Parameters.

(b) ADI based on the MCL is calculated as the MCL (mg/L) multiplied by a water ingestion rate of 2 L/day. In the absence of an MCL, the ADI was calculated using an RfD as the RfD (mg/kg-d) multiplied by the body weight (70 kg).

(c) SWQC based on US EPA's action level.

Equations from IEPA (2019a):

Consumption of Water and Fish

$$\text{HTC} = \frac{\text{ADI}}{\text{W} + (\text{F} \times \text{BCF})}$$

Incidental Consumption of Water only

$$\text{HTC} = \frac{\text{ADI}}{\text{F}}$$

Consumption of Fish only

$$\text{HTC} = \frac{\text{ADI}}{\text{F} \times \text{BCF}}$$

Where

Average Daily Intake (ADI) =	Chem. Specific	mg/day
Fish Consumption Rate (F) =	0.02	kg/day
Bioconcentration Factor (BCF) =	Chem. Specific	L/kg-tissue
Water Consumption Rate (W) =	0.01	L/day

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 5

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Springfield, IL 62794-9276

Billing Date	Mon December 16, 2019
Due Date	Tue January 31, 2020
Account Number	W1270100004
Facility Name	Joppa Station

Luminant
Attn: Phil Morris
1500 Eastport Plaza Drive,
Collinsville, IL 62334

Initial Invoice

Pond ID	Pond Description	Amount
W1270100004-01	West Pond 1	75,000.00
W1270100004-02	East Ash Pond 2	75,000.00

Amount Due **$150,000.00**

Other Information/Messages

Questions. Please direct any technical/permit questions to the Permit Section at (217) 782-0610. Questions about the amount of your fee should be emailed to: EPA.AcctsReceivable@illinois.gov

- See Reverse Side for Additional Important Information –

Return bottom portion with a check made payable to Illinois EPA

Payment
Remittance Stub

Account Information

Acct. Number	W1270100004
Facility Name	Joppa Station
IEPA Program	COALIN
Billing Date	Mon December 16, 2019

Amount Due

Tue January 31, 2020	**$150,000.00**
Amount Enclosed	

Please remit payment to:
Illinois Environmental Protection Agency
Fiscal Services #2
P.O. Box 19276
Springfield, IL 62794-9276

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 6

EEI
Electric Energy, Inc.

December 19, 2012

Mr. Bill Buscher
Division of Water Pollution Control
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Subject: EEI Groundwater Monitoring

Dear Mr. Buscher:

On November 7, 2012 we met with you and others on your staff to discuss the results of groundwater monitoring around our active and inactive ash ponds.

In the meeting, we stated that the down gradient wells on both ponds appeared to have been placed in areas that either were in the berm of the pond or were in an area that previously had been filled with ash. We asked for additional time to relocate these wells and collect groundwater data in areas outside of the waste boundary for these ponds.

Attached is a Technical Memorandum prepared by our consultant, Bruce Hensel, Natural Resource Technology, that discusses the groundwater monitoring wells and our plan for relocating the two wells.

As described in the Memorandum, all of the groundwater monitoring wells that were installed around both ash ponds were screened in a zone that we believe meets the definition of Class II groundwater. We request your concurrence that the ash pond groundwater wells should be characterized as Class II groundwater and the Class II standards should apply.

Consistent with this characterization, because the two down gradient wells were placed in areas that had been used for ash fill prior to 1991, Class II standards for certain chemical parameters should not apply per 35 IAC 620.420(a)(3).

The attached Memo also outlines our plan to relocate the down gradient wells on each pond. A monitoring well will be located outside the berm on the west ash pond and outside the rail loop (which served as the original berm) on the east ash pond. With your concurrence we are prepared to install the new wells in early 2013, collect groundwater data in the 1st and 2nd quarters, and review this data with you in July 2013.

Please contact Bruce Parker, Senior Engineer at (618) 543-3458 if you have any questions on the enclosed information.

Sincerely,

Mike Pullen

Michael T. Pullen
Director, Operations

Enclosure

CERTIFIED MAIL: 7007 3020 0002 0392 0935

NATURAL
RESOURCE
TECHNOLOGY

TECHNICAL MEMORANDUM

No. 1

Date: December 7, 2012
To: Bruce Parker, Electric Energy, Inc.
From: Bruce Hensel
Subject: Class II Groundwater Designation and Replacement Wells, Joppa Ash Ponds

---

Background

Electric Energy Inc. (EEI) at IEPA's request voluntarily installed seven groundwater monitoring wells in July 2010 around the east and west ash ponds at the Joppa Power Station, near Joppa, Illinois. Monitoring well details are listed in Table 1. Nine rounds of quarterly groundwater samples were collected from the third quarter of 2010 through the third quarter of 2012 and reported to IEPA on a regular basis, with exceedances flagged based on Class I groundwater quality standards. Two of the wells, G112B and G152, have had repeated exceedances of certain monitored constituents relative to the Class I standards.

This technical memorandum addresses two items related to the groundwater monitoring:

- The hydrostratigraphic unit in which G112B and G152, as well as the other monitoring wells on site, are screened does not meet the criteria for Class I groundwater.
- In the November 7, 2012 meeting with IEPA, EEI proposed relocation of G112B and G152 because they were installed beneath fill materials that may be impacting analytical results.

Proposal for Class II Groundwater Designation

Groundwater quality data collected at the site were previously compared to Class I groundwater quality standards. However, per 35 IAC 620.210(a), the groundwater monitored at these wells does not qualify as Class I groundwater because:

- The ash ponds are not within the minimum setback zone of a well which serves as a potable water supply.
- The monitoring wells are screened in a clay unit, rather than unconsolidated sand, gravel, or sand and gravel which is 5 feet or more in thickness and that contains 12 percent or less of fines.
- The monitoring wells are not screened in a sandstone which is 10 feet or more in thickness, nor are they screened in fractured carbonate which is 15 feet or more in thickness.

- The individual well and geometric mean hydraulic conductivity values for the clay unit, based on site-specific slug tests, is lower than 1 x 10^{-4} cm/s (Table 2).

Since groundwater within the clay unit also does not meet the criteria for Class III or Class IV groundwater, we propose that it be characterized as Class II groundwater, and that the Class II groundwater quality standards be applicable.

Table 3 lists groundwater analytical results previously reported to IEPA, compared to Class II groundwater quality standards. This revised table indicates exceedances of Class II groundwater quality standards for pH at G113 and G151, boron at G151, and iron at G151 and G153.

- The boron and iron exceedances are anomalous, only occurring in the initial sample from the monitoring wells. Six subsequent samples (the wells were dry on two occasions) had lower concentrations with no exceedances, little variability, and no trend. The consistency of the six subsequent samples indicates that they represent groundwater quality at these wells and that the initial samples are anomalous.
- The pH exceedances are not associated with a release from the impoundments and may be naturally occurring. This conclusion is based on the observation that the coal ash indicator constituents, boron and sulfate, have low concentration in these wells, and that the pH of coal ash leachate tends to be alkaline.

Furthermore and as discussed below, G112B and G152 are screened beneath fill which suggests that the Class II standards for barium, pH, boron, chloride, copper, iron, manganese, nickel, selenium, TDS, sulfate, and zinc are not applicable at those locations per 35 IAC 620.420(a)(3).

Proposal for Replacement Monitoring Wells

G112B

G112B was drilled on top of the south berm of the west ash pond (Figure 1). G112B is the only monitoring well drilled on a berm, and is also the only monitoring well drilled through berm fill materials. Based on visual observation from the top of the berm to base grade at the toe of the berm, the upper 20 to 30 feet of material that this boring was advanced through is fill. The lithologic descriptions on the boring log for G112B are brief and do not provide detailed information of the materials encountered. Fill is not identified on the log, although it does note the presence of "coal" at a depth of 18 feet (Attachment 1). Given the sparse lithologic descriptions, and the observation of coal, the fill may contain coal and/or coal ash that was not recognized and recorded on the boring logs.

Furthermore, per 35 IAC 620.420(a)(3), the Class II standards for barium, pH, boron, chloride, copper, iron, manganese, nickel, selenium, TDS, sulfate, and zinc do not apply if the groundwater is within fill or within 10 feet of the base of fill when the fill was placed prior to 1991 or placement was ongoing as of 1991. G112B appears to meet these criteria because:

- The west ash pond was constructed in 1957.
- While the depth of fill is not noted on the G112B boring log, it can be inferred by the depth where clay consistency changes from "stiff to very stiff" (i.e., compacted fill placed to construct a berm) to "soft to medium stiff" (i.e., native sediments). This change occurs at a depth of 32 feet and the well is screened from 32 to 42 feet; therefore, G112B appears to be monitoring groundwater within 10 feet of the base of fill.

Since this monitoring well was drilled through berm fill materials, which contained coal and may have contained coal ash, there is potential for drag-down of fill materials into the screened interval (a clay unit), causing the well to be unreliable for monitoring groundwater quality, and precluding its use for monitoring coal ash indicator constituents (specifically boron and sulfate). Therefore, EEI proposes a replacement monitoring well located outside (south), and within 25 feet of the berm as indicated on Figure 1. This replacement location will be 350 to 500 feet southeast of the original location, depending on access, to minimize tree clearing.

G152

G152 was installed immediately south of the east ash pond, inside the railroad loop (Figure 1). After this monitoring well was installed, it was determined that this area was used for sluiced coal ash disposal from 1954 until the west ash pond was constructed in 1957. Similar to G112B, no coal ash is noted on the boring log for G152; however, other data suggest that coal ash is likely present in this area. Figure 2 shows the current ash pond configuration superimposed on an aerial photo from 1968—taken prior to construction of the east ash pond. Soil borings were drilled in 1973 during the site investigation for the east ash pond and for a foundation investigation for a transmission line that traverses the area. Boring locations and the depth to the base of ash deposits are listed on Figure 2. An ash delta is visible on the 1968 air photo, and there is a drainage channel that surrounds the area of ash deposits. All of the borings inside the 1968 drainage channel had coal ash extending from 2 to 23 feet below the ground surface. No borings outside of this drainage channel encountered coal ash. G152 is located within the area of coal ash deposits, suggesting that coal ash may have been encountered when G152 was drilled, but not recognized and logged.

Furthermore, per 35 IAC 620.420(a)(3), the Class II standards for barium, pH, boron, chloride, copper, iron, manganese, nickel, selenium, TDS, sulfate, and zinc do not apply if the groundwater is within fill or within 10 feet of the base of fill if the fill was placed prior to 1991 or placement was ongoing as of 1991. G152 appears to meet these criteria because:

- The location surrounding G152 was filled in 1954.
- G152 is relatively shallow, with a screened depth of 15 to 25 feet. Other borings in the area indicate fill to a depth of as much as 23 feet. Given the relatively shallow depth of this well screen,

if the fill material at G152 only extends to a depth of 5 to 10 feet, then the upper portion of the well screen is within 10 feet of the base of fill.

Since there is evidence that this monitoring well was drilled through coal ash fill, there is potential for drag-down of fill in the screened interval (a clay unit), causing the well to be unreliable for monitoring groundwater quality, and precluding its use for monitoring coal ash indicator constituents (specifically boron and sulfate). Therefore, EEI proposes a replacement monitoring well located outside (south), and within 25 feet of the railroad loop, which served as the berm for the 1954 sluiced ash disposal area. The proposed location is indicated on Figure 1. This replacement location is 750 feet southeast of the original location to avoid drilling through fill materials associated with the coal yard, and across the raised railroad embankment/berm from the thickest ash deposits within the railroad loop.

Proposed Monitoring Well Construction

Boreholes for the replacement monitoring wells will be drilled to a depth of 15 feet or seven feet below the water table, whichever is greater. Clay soils are expected, and water recovery in the boreholes is expected to be slow, so water level in each borehole will be allowed to stabilize overnight prior to setting the monitoring well. Monitoring wells will be constructed from 2-inch diameter, flush-threaded PVC, with 10-foot screens. The annulus around the screen will be filled with sand, and the annulus above the screen will be sealed to prevent vertical migration through the annulus.

Schedule

- The replacement monitoring wells will be installed as soon as practical after approval of this plan by IEPA. Assuming a December approval, installation in January 2013 is anticipated.
- G112B and G152 will be abandoned in January 2013 on the same mobilization, and immediately following, installation of replacement wells G112C and G152B.
- The replacement monitoring wells will be developed and allowed to chemically stabilize for one month.
- The replacement monitoring wells will be scheduled for initial sampling in the first quarter of 2013, with a second sample in the second quarter.

This schedule will enable two rounds of sample collection from the replacement wells prior to delivery of a hydrogeologic assessment report to IEPA within six months after IEPA approves the relocation of these wells.

Tables

Figures

Attachments

Attachments

Table 1
Monitoring Well Construction Details
Technical Memorandum 1
Electric Energy Inc. Joppa Power Station

Monitoring Well Number	Date Installed	Ground Elevation	Bottom of Boring		Screen Elevation		Top of Well Riser	Screened Formation
			Depth	Elevation	From	To		
G-101	06/01/10	361.12	49.68	311.44	314.32	324.32	363.69	Silty Clay
G-111	06/24/10	356.63	45.00	311.63	314.50	324.50	359.17	Silty Clay
G-112b	06/20/10	345.16	45.20	299.96	302.75	312.75	347.62	Silty Clay
G-113	06/25/10	350.46	43.60	306.86	309.77	319.77	353.04	Silty/Sandy Clay
G-151	06/19/10	360.90	45.00	315.90	318.93	328.93	363.60	Silty/Sandy Clay
G-152	06/21/10	348.55	26.90	321.65	324.61	334.61	351.18	Silty Clay
G-153	06/18/10	351.73	43.60	308.13	311.38	321.38	354.65	Silty/Sandy Clay & Silt

1. Depths are measured in feet below land surface
2. Elevations are referenced to a site datum

Table 2
Hydraulic Conductivity Values
Technical Memorandum 1
Electric Energy Inc. Joppa Power Station

Well	Hydraulic Conductivity	
	ft/min	cm/s
G-101	1.1E-05	5.6E-06
G-111	2.9E-05	1.5E-05
G-112B	2.1E-06	1.1E-06
G-113	1.2E-05	6.1E-06
G-151	6.2E-06	3.1E-06
G-152	1.5E-04	7.6E-05
G-153	3.8E-06	1.9E-06
Geometric Mean	**1.2E-05**	**5.9E-06**

Table 3
Groundwater Quality Results
Technical Memorandum 1
Electric Energy Inc. Joppa Power Station

Monitoring Well	Date	Depth to GW (ft)	35 IAC 620 Standard	pH (SU)	TDS	NO3	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Mn	Ni	Se	Ag	Zn	Sb	Pb	Tl	Hg	CN	SO4	F	Cl
			Class I	6.5 - 9.0	1200	10	0.050	2.0	0.004	2.0	0.005	0.10	1.0	0.65	5.0	0.15	0.10	0.050	0.050	5	0.006	0.0075	0.002	0.002	0.20	400	4.0	200
			Class II	6.5 - 9.0	1200	100	0.20	2.0	0.50	2.0	0.050	1.0	1.0	0.65	5.0	10	2.0	0.050	ns	10	0.024	0.10	0.020	0.010	0.60	400	4.0	200
G-101	8/17/2010	45.29		7.13	344	2.12	<0.0250	0.103	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	1.34	0.0556	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	0.0026	<0.0020	<0.00020	<0.007	32	0.28	7
G-101	11/5/2010	dry		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G-101	03/15/11	44.86		6.53	294	1.72	<0.0250	0.09	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	0.172	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	32	0.27	6
G-101	06/16/11	39.84		7.16	276	1.56	<0.0250	0.635	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.020	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	34	0.28	5
G-101	09/13/11	46.24		6.88	222	1.9	<0.0250	0.0814	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.020	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	28	0.32	3
G-101	11/29/11	45.32		7.19	268	1.14	<0.0250	0.0719	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.020	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	35	0.28	4
G-101	02/14/12	48.12		6.86	215	0.282	<0.0250	0.582	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.020	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	35	0.3	4
G-101	05/15/12	45.59		7.31	208	0.816	<0.0250	0.0443	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.020	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	22	0.31	4
G-101	08/07/12	dry		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G-111	8/17/2010	8		7.35	342	0.092	<0.0250	0.153	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	0.453	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	25	0.62	8
G-111	11/5/2010	9.77		6.70	330	0.719	<0.0250	0.149	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	0.0132	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	22	0.7	8
G-111	03/15/11	4.9		7.07	322	0.104	<0.0250	0.157	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	0.0161	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	23	0.67	7
G-111	06/16/11	6.42		7.11	372	0.164	<0.0250	0.159	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	27	0.63	6
G-111	09/13/11	8.45		7.10	330	0.127	<0.0250	0.181	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	24	0.63	6
G-111	11/29/11	4.66		7.05	376	0.147	<0.0250	0.178	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	19	0.62	6
G-111	02/14/12	4.55		7.23	354	0.093	<0.0250	0.16	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	27	0.87	7
G-111	05/15/12	6.66		7.14	324	0.116	<0.0250	0.167	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	30	0.87	7
G-111	08/07/12	9.22		7.02	394	0.052	<0.0250	0.162	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	28	0.89	5
G-113	8/17/2010	15.4		6.89	542	0.838	<0.0250	0.354	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	0.04	0.0919	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	61	0.43	27
G-113	11/5/2010	15.8		6.57	524	0.139	<0.0250	0.393	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	<0.0200	0.0253	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	39	0.49	26
G-113	03/15/11	11.8		6.97	840	0.33	<0.0250	0.461	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0064	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	36	0.44	29
G-113	06/16/11	13.66		6.60	590	0.348	<0.0250	0.454	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	32	0.39	29
G-113	09/13/11	14.9		6.64	554	0.395	<0.0250	0.49	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	30	0.4	29
G-113	11/29/11	11.5		6.44	638	0.88	<0.0250	0.507	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	34	0.39	28
G-113	02/14/12	12.05		6.58	590	0.481	<0.0250	0.504	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	35	0.42	31
G-113	05/15/12	14.25		6.71	586	0.672	<0.0250	0.527	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	32	0.43	34
G-113	08/07/12	16.65		6.50	668	0.482	<0.0250	0.469	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	30	0.45	29
G-151	8/17/2010	42.7		6.70	348	1.04	<0.0250	0.516	0.0025	8.27	<0.00200	0.0233	0.0331	0.0275	17.7	0.471	0.0205	<0.0500	<0.0100	0.0813	<0.0050	0.0274	<0.0020	<0.00020	<0.007	93	0.17	18
G-151	11/5/2010	dry			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G-151	03/16/11	38.1		5.89	236	1.07	<0.0250	0.196	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0634	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	100	<0.10	6
G-151	06/17/11	36.63		6.13	242	1.06	<0.0250	0.788	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	0.0378	0.0361	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	100	<0.10	5
G-151	09/13/11	41.45		5.98	228	1.2	<0.0250	0.0655	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0316	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	100	0.1	5
G-151	11/29/11	42.2		6.20	256	1.11	<0.0250	0.281	<0.0010	0.0522	<0.0020	<0.0100	<0.0100	0.0114	1.77	0.0454	<0.0100	<0.0500	<0.0100	0.0165	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	88	0.85	5
G-151	02/14/12	37.8		6.03	284	0.517	<0.0250	0.0737	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0217	<0.0100	<0.0500	<0.0100	0.0165	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	110	<0.10	5
G-151	05/15/12	41.82		6.00	232	0.825	<0.0250	0.0812	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	0.0668	0.0111	<0.0100	<0.0500	<0.0100	0.0137	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	111	<0.10	5
G-151	08/07/12	dry		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G-153	8/17/2010	38.13		6.90	462	0.301	<0.0250	0.629	0.0074	0.0338	<0.00200	0.0254	0.0249	0.0167	12.8	0.215	0.0116	<0.0500	<0.0100	0.0247	<0.0050	0.0161	<0.0020	<0.00020	<0.007	102	0.84	18
G-153	11/5/2010	dry			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G-153	03/16/11	37.82		6.70	434	0.458	<0.0250	0.308	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.005	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	110	0.82	20
G-153	06/17/11	32.67		6.84	484	0.373	<0.0250	0.289	<0.0010	0.0467	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.005	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	104	0.76	20
G-153	09/13/11	39.55		6.91	406	0.305	<0.0250	0.278	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	0.0285	<0.005	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	104	0.75	20
G-153	11/29/11	40.17		6.92	432	0.267	<0.0250	0.242	<0.0010	0.0549	<0.0020	<0.0100	<0.0100	<0.0100	0.0285	0.0583	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	107	0.77	20
G-153	02/14/12	32.9		6.92	434	0.288	<0.0250	0.243	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	99	0.82	22
G-153	05/15/12	36.92		6.95	406	0.211	<0.0250	0.207	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	111	0.87	24
G-153	08/07/12	dry		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monitoring Well	Date	Depth to GW (ft)	35 IAC 620 Standard	pH (SU)	TDS	NO3	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Mn	Ni	Se	Ag	Zn	Sb	Pb	Tl	Hg	CN	SO4	F	Cl
			Class I	6.5 - 9.0	1200	10	0.050	2.0	0.004	2.0	0.005	0.10	1.0	0.65	5.0	0.15	0.10	0.050	0.050	5	0.006	0.0075	0.002	0.002	0.20	400	4.0	200
			Class II	ns*	ns*	100	0.20	ns*	0.50	ns*	0.05	1.0	1.0	ns*	ns*	ns*	ns*	ns*	ns	ns*	0.024	0.10	0.020	0.010	0.60	ns*	4.0	200
G-112B	8/17/2010	26.42		6.05	744	0.948	<0.0250	0.068	<0.0010	3.45	<0.00200	<0.0100	0.0653	<0.0100	13.1	4.25	0.0351	<0.0500	<0.0100	0.0546	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	298	0.29	56
G-112B	11/5/2010	26.16		6.33	754	<0.050	<0.0250	0.116	<0.0010	1.63	<0.00200	<0.0100	0.0323	<0.0100	22.4	4.1	0.0204	<0.0500	<0.0100	0.0149	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	129	0.49	49
G-112B	03/15/11	15.5		6.80	858	0.055	0.0387	0.0623	<0.0010	4.35	<0.0020	<0.0100	0.0613	<0.0100	53.1	5.48	0.0432	<0.0500	<0.0100	0.0432	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	352	0.29	56
G-112B	06/16/11	22.03		6.80	778	0.118	<0.0250	0.104	<0.0010	3.48	<0.0020	<0.0100	0.0674	<0.0100	44.7	5.13	0.0368	<0.0500	<0.0100	0.0219	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	302	0.28	55
G-112B	09/13/11	26.05		6.51	778	0.154	0.0581	0.204	<0.0010	0.435	<0.0020	<0.0100	0.0195	<0.0100	74.9	4.58	0.0132	<0.0500	<0.0100	0.0219	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	37	0.53	40
G-112B	11/29/11	20.8		6.35	804	<0.05	0.0536	0.165	<0.0010	1.98	<0.0020	<0.0100	0.0374	<0.0100	67.6	4.32	0.0238	<0.0500	<0.0100	0.0138	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	178	0.48	58
G-112B	02/14/12	9.72		6.33	890	<0.05	0.0575	0.169	<0.0010	1.61	<0.0020	<0.0100	0.0418	<0.0100	71.3	4.73	0.0247	<0.0500	<0.0100	0.0195	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	147	0.82	60
G-112B	05/15/12	24.01		6.64	778	<0.05	0.0655	0.209	<0.0010	0.35	<0.0020	<0.0100	0.0158	<0.0100	76.7	4.51	<0.010	<0.0500	<0.0100	0.0195	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	21	0.78	52
G-112B	08/07/12	28.45		6.50	860	<0.05	0.0604	0.198	<0.001	0.051	<0.0020	<0.0100	0.0103	<0.0100	81.5	4.19	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	15	0.83	67
G-152	8/17/2010	6.21		6.41	1110	0.823	<0.0250	0.019	<0.0010	11.8	<0.00200	<0.0100	<0.0100	<0.0100	0.0454	0.185	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	768	0.12	21
G-152	11/5/2010	5.42		6.03	1090	0.07	<0.0250	0.017	<0.0010	12.3	<0.00200	<0.0100	<0.0100	<0.0100	<0.0200	0.174	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	692	0.16	22
G-152	03/16/11	2.2		5.96	1080	<0.050	<0.0250	0.0145	<0.0010	11.4	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.005	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	731	0.12	22
G-152	06/17/11	3.82		6.87	1020	<0.050	<0.0250	0.0121	<0.0010	11.1	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0068	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	593	0.11	21
G-152	09/13/11	9.34		5.91	922	<0.050	<0.0250	0.0134	<0.0010	11.8	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.014	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	570	0.14	21
G-152	11/29/11	22.5		6.04	910	0.1	<0.0250	0.0156	<0.0010	11.4	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0083	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	565	0.12	20
G-152	02/14/12	18.2		6.25	878	<0.050	<0.0250	0.012	<0.0010	11.2	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	605	0.14	24
G-152	05/15/12	5.07		6.03	866	0.139	<0.0250	0.0118	<0.0010	11.1	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	<0.0050	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	572	0.13	25
G-152	08/07/12	6.03		5.91	956	<0.050	<0.0250	0.0105	<0.0010	11.2	<0.0020	<0.0100	<0.0100	<0.0100	<0.0200	0.0138	<0.0100	<0.0500	<0.0100	<0.0100	<0.0050	<0.0020	<0.0020	<0.00020	<0.007	451	0.15	21

Unless otherwise noted, all results in parts per million (ppm)
Yellow highlighted cells represent results exceeding 35 IAC 620.420 Groundwater Quality Standards for Class II General Resource Groundwater
Green highlighted cells represent results higher than 35 IAC 620.410 Groundwater Quality Standards for Class I Potable Resource Groundwater in effect at the time of sampling, and lower than Class II standards
ns indicates no standard
ns* indicates no standard for monitored points meeting criteria of 35 IAC 620.420(a)(3) (applies to G112B and G152)

Figures

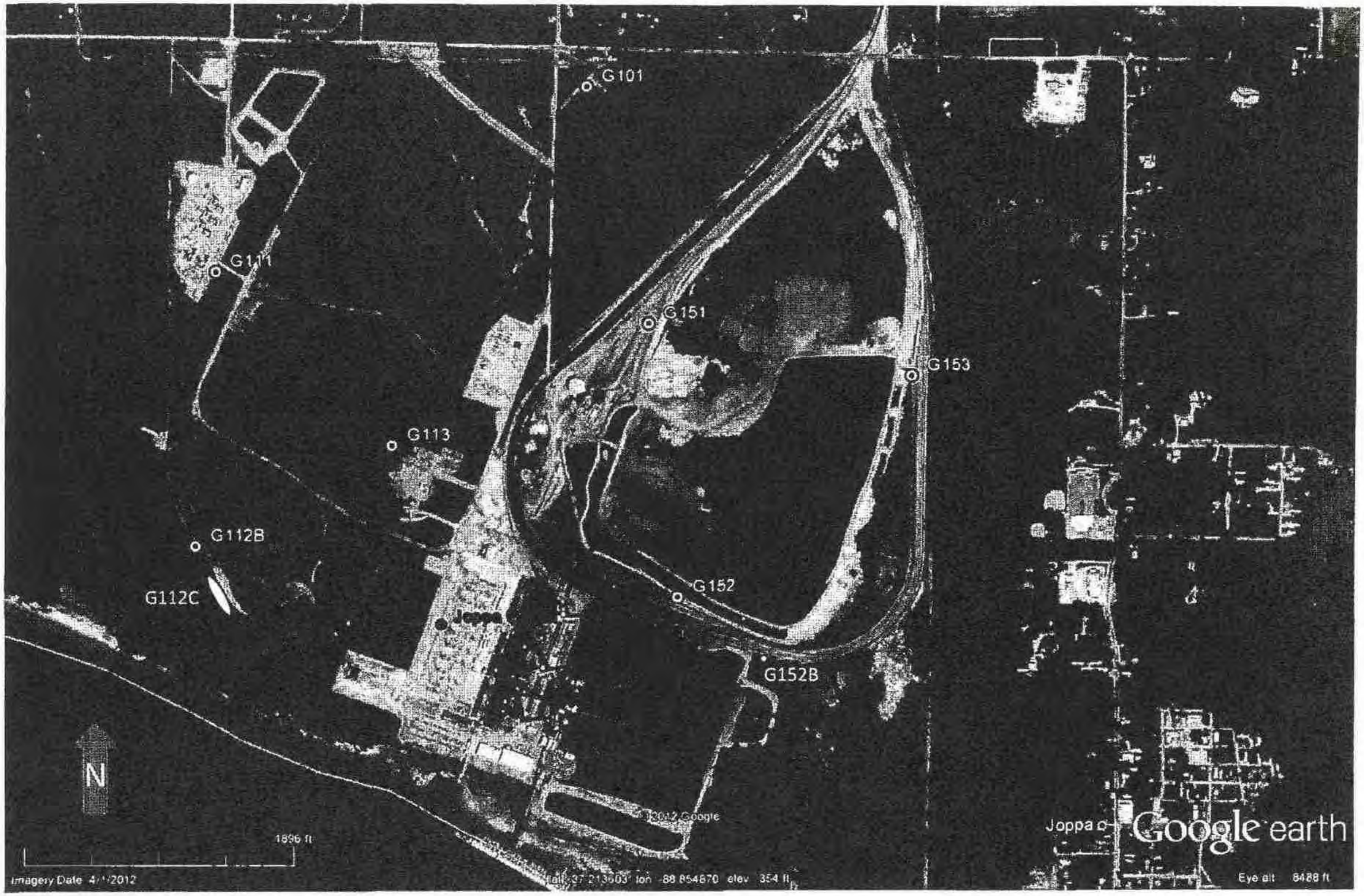


Figure 1. Existing (yellow) and Proposed (white) Monitoring Well Locations

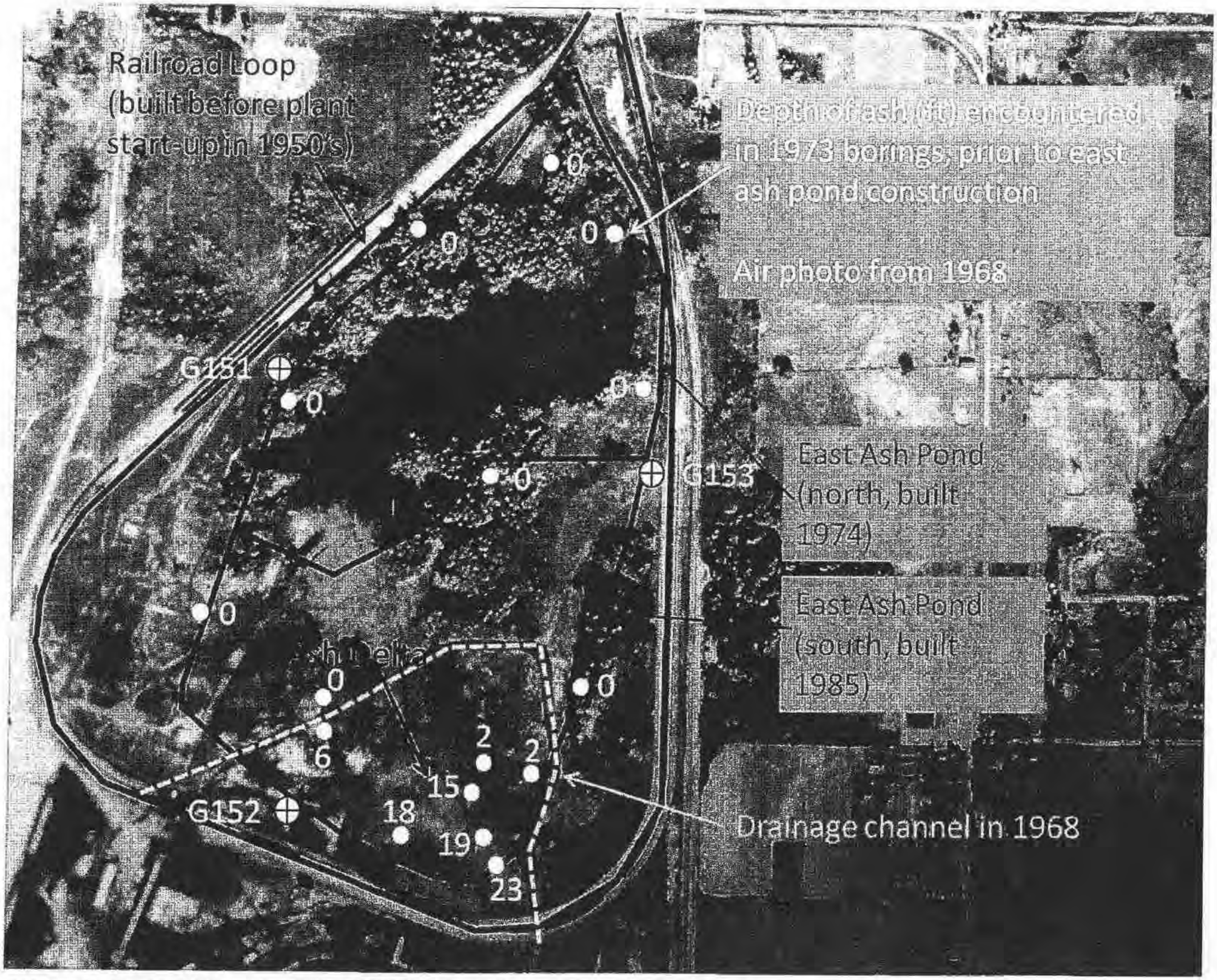


Figure 2. Depth of Coal Ash Filled Within The Railroad Loop Prior to Construction of the East Ash Pond

Attachments

Surface Elevation: 361.12

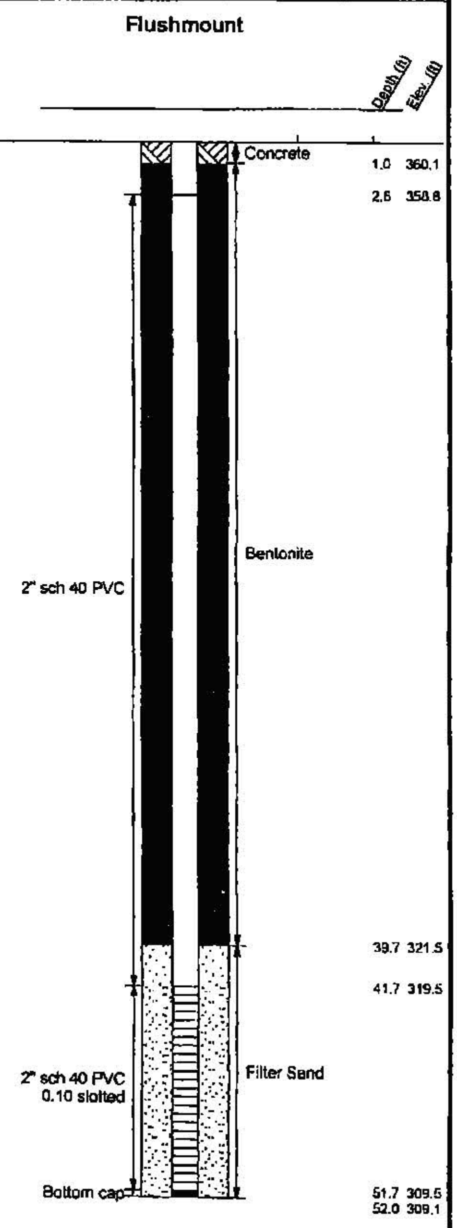
Datum msl

Completion Date: ______

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to stiff, brown and gray, silty CLAY - (CL)		2-4-4-5	SS1
	k = 2.8 x 10^{-9}cm/s		2-2-3-4	SS2
5			2-3-4-5	SS3
			5-4-5-6	SS4
			3-5-6-7	SS5
10			3-5-7-9	SS6
			3-4-4-5	SS7
15			2-2-4-5	SS8
			2-4-5-5	SS9
			2-4-6-7	SS10
20			2-4-7-5	SS11
			2-3-4-4	SS12
25	trace sand		3-4-6-6	SS13
			2-4-5-8	SS14
			2-3-4-6	SS15
30	trace gravel and weathered limestone		2-4-8-18	SS16
	Weathered LIMESTONE with silty clay		15-18-22-22	SS17
35	Stiff, brown and gray, silty CLAY with sand - CL		7-7-6-6	SS18
	Medium stiff, brown and gray, silty CLAY, trace sand - CL		2-3-4-4	SS19
			3-3-4-4	SS20
40	soft		1-2-2-1	SS21
			1-4-6-7	SS22
45	very stiff, with weathered limestone		4-10-12-6	SS23
		▽	3-4-4-4	SS24
			1-2-3-3	SS25
50			2-3-4-6	SS26
	Boring terminated at 52 feet.			

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

WELL DIAGRAM



GROUNDWATER DATA

ENCOUNTERED AT 48 FEET ▽

DRILLING DATA

__ AUGER __ HOLLOW STEM
WASHBORING FROM __ FEET
PH DRILLER BGF LOGGER
__ DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA
Date: 7/14/10
Checked by: ROP
Date: 9/20/10
App'vd. by: BGF
Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-101

Project No. J017150.02

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0838301.GPJ 9/22/10

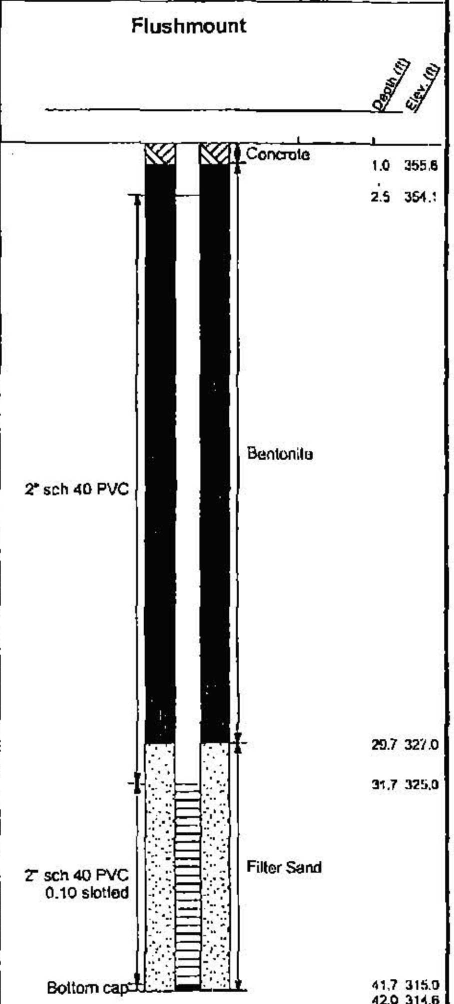
Surface Elevation: 356.63

Datum msl

Completion Date: 6/24/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to stiff, brown, silty CLAY - (CL)	▨	2-2-3-4	SS1
		▨	2-3-4-5	SS2
5		▨	1-3-4-5	SS3
		▨	1-3-4-4	SS4
10		▨	1-4-4-4	SS5
		▨	2-3-5-6	SS6
		▨	2-3-5-7	SS7
15		▨	2-4-4-4	SS8
		▨	3-6-7-9	SS9
20		▨	5-6-7-8	SS10
		▨	1-5-5-10	SS11
		▨	3-5-6-8	SS12
25	k = 4.6 x 10^{-9}cm/s	▨	3-5-7-9	SS13
	brown and gray	▨	2-4-6-6	SS14
30		▨	3-6-10-11	SS15
		▨	3-4-7-8	SS16
	Stiff, brown and gray, silty CLAY, trace sand - CL	▨	2-3-6-7	SS17
35		▨	6-5-5-8	SS18
		▨	3-5-6-7	SS19
40		▨	1-3-5-6	SS20
		▨	3-4-5-7	SS21
	Boring terminated at 42 feet.			
45				
50				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: Kgr	App'vd. by: KOr
Date: 7/14/10	Date: 9/22/10	Date: 9/21/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

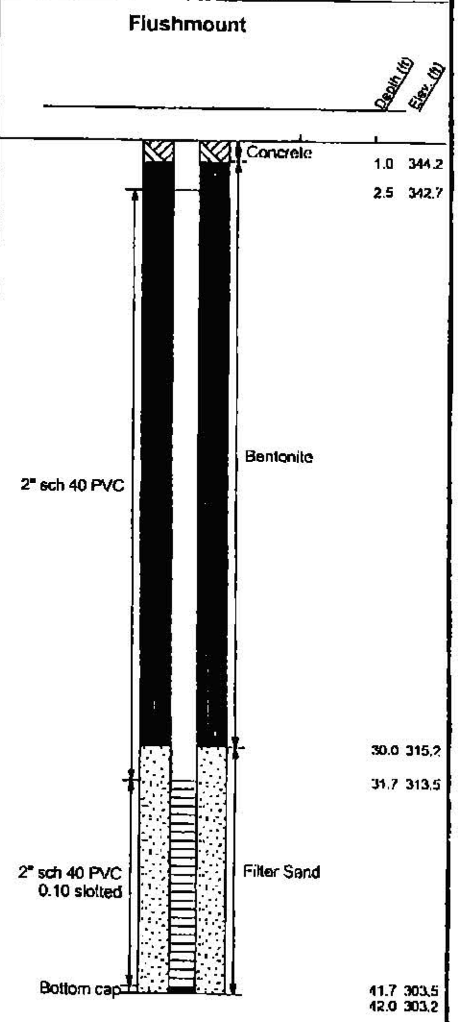
LOG OF BORING: G-111

Project No. J017150.02

Surface Elevation: 345.16
Datum msl
Completion Date: 6/20/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very stiff, brown silty CLAY - (CL)	▨	2-3-5-6	SS1
		▨	3-5-9-11	SS2
5		▨	3-6-11-11	SS3
		▨	4-11-14 -15	SS4
10		▨	6-8-9-10	SS5
		▨	2-5-5-6	SS6
		▨	2-5-5-7	SS7
15		▨	2-5-6-7	SS8
	$k = 9.2 \times 10^{-9}$cm/s	▨	2-3-4-5	SS9
20	with coal	▨	2-4-5-4	SS10
		▨	2-3-4-4	SS11
		▨	1-2-3-4	SS12
25		▨	1-3-4-4	SS13
		▨	1-3-4-5	SS14
30		▨	1-2-3-4	SS15
		▨	2-3-4-5	SS16
	Soft to medium stiff, brown silty CLAY - CL	▨	1-2-2-4	SS17
35		▨	2-2-4-5	SS18
		▨	0-1-1-2	SS19
40		▨	2-2-2-2	SS20
		▨	2-4-4-8	SS21
	Boring terminated at 42 feet.			
45				
50				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150 02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM
WASHBORING FROM __ FEET
PH DRILLER JPC LOGGER
__ DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RBP	App'vd. by: RBY
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-112b

Project No. J017150.02

Surface Elevation: 350.46

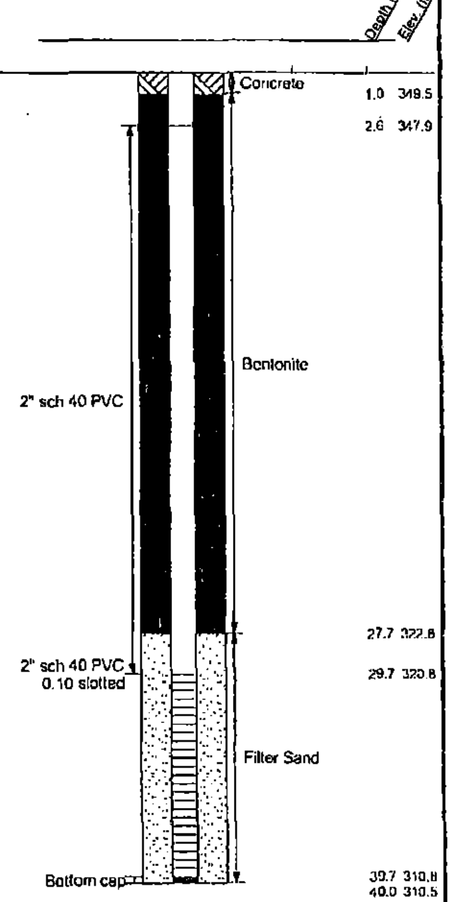
Datum msl

Completion Date: 6/25/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL		2-2-3-4	SS1
	Medium stiff to stiff, brown CLAY - CH		2-5-6-7	SS2
5			2-2-4-3	SS3
	Soft, brown to brown and gray CLAY - CH		2-1-2-3	SS4
			1-1-1-3	SS5
10	Medium stiff to stiff, brown and gray CLAY - CH		3-3-4-5	SS6
			2-3-4-6	SS7
15			2-3-4-5	SS8
			2-2-4-5	SS9
20			4-5-7-8	SS10
			4-5-7-7	SS11
			2-5-6-10	SS12
25			2-8-10-10	SS13
	Stiff, gray and brown, silty CLAY - CL k = 3.7 x 10⁻⁹cm/s		3-6-8-9	SS14
30			4-6-8-11	SS15
			4-4-7-19	SS16
	Hard to very stiff, gray and brown, sandy CLAY - CL		8-17-16-20	SS17
35			6-8-9-9	SS18
	Stiff, brown and gray, silty CLAY, trace sand - (CL)		3-4-6-8	SS19
40	Boring terminated at 40 feet.		4-4-6-9	SS20
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KOP	App'vd. by: KOP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-113

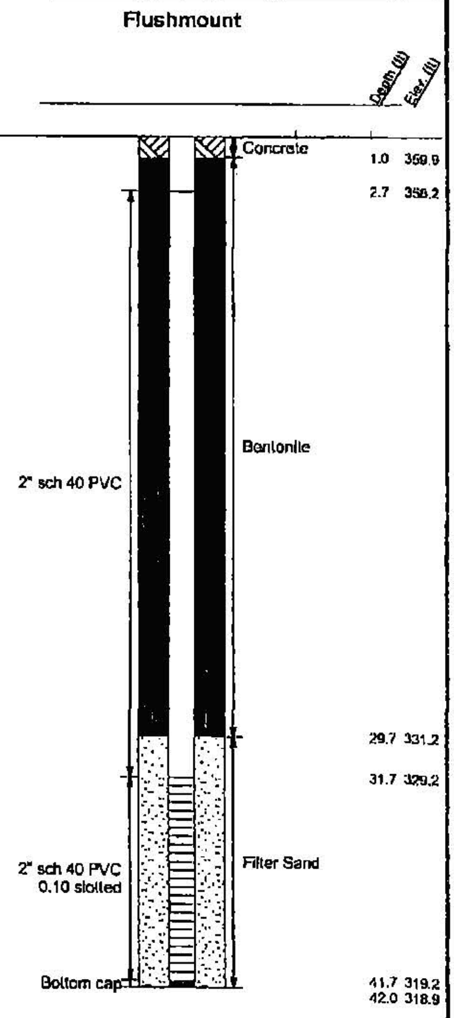
Project No. J017150.02

Surface Elevation: 360.9
Datum msl
Completion Date: 6/19/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	GRAVEL	●		SS1
	Medium stiff to stiff, brown and gray, silty CLAY - (CL)	▨	3-4-4-5	SS2
5		▨	2-3-3-5	SS3
		▨	3-3-4-4	SS4
10	k = 1.6 x 10^{-8}cm/s	▨	1-2-3-5	SS5
		▨	3-5-5-6	SS6
		▨	2-4-5-6	SS7
15		▨	2-3-4-5	SS8
	Medium stiff to stiff, brown and gray, silty CLAY, trace sand - CL	▨	3-4-6-7	SS9
20		▨	3-4-6-6	SS10
		▨	3-5-7-8	SS11
		▨	3-5-7-9	SS12
25		▨	2-3-5-6	SS13
		▨	3-5-7-6	SS14
30		▨	3-5-8-8	SS15
		▨	4-7-9-4	SS16
		▨	4-4-6-7	SS17
35		▨	2-4-3-5	SS18
	Medium stiff to very stiff, brown and gray, sandy CLAY with silt - CL	▨	5-5-7-14	SS19
40		▨	13-13-10-8	SS20
		▨	2-4-6-7	SS21
	Boring terminated at 42 feet.			
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM
WASHBORING FROM __ FEET
PH DRILLER BGF LOGGER
__ DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJP	App'vd. by: RJP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-151

Project No. J017150.02

Surface Elevation: 348.56

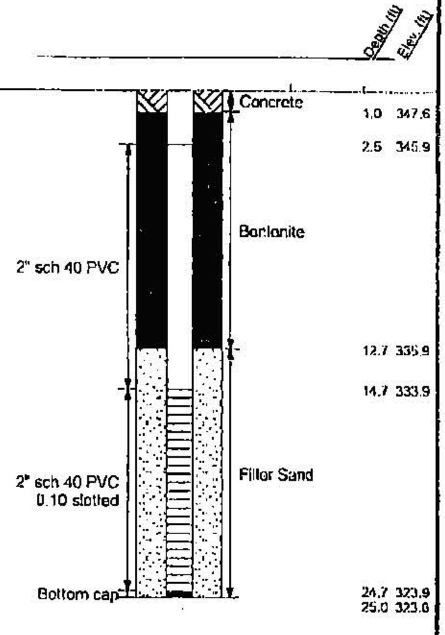
Datum msl

Completion Date: __________

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown CLAY with organics - CH		2-3-3-4	SS1
	Medium stiff, brown and gray, silty CLAY - (CL)		1-1-2-3	SS2
5			1-2-3-5	SS3
			2-3-4-5	SS4
10			1-3-4-4	SS5
	becoming stiff		2-3-5-5	SS6
			2-5-8-9	SS7
15			2-5-3-6	SS8
	trace sand to 25 feet		3-5-5-7	SS9
20	k = 1.1 x 10^{-8}cm/s	∇	3-4-7-6	SS10
			3-6-10-9	SS11
			2-4-5-5	SS12
25	Boring terminated at 25 feet.			
30				
35				
40				
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638391.GPJ 9/22/10

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ∇

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KSP	App'vd. by: KDP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-152

Project No. J017150.02

Surface Elevation: 351.73

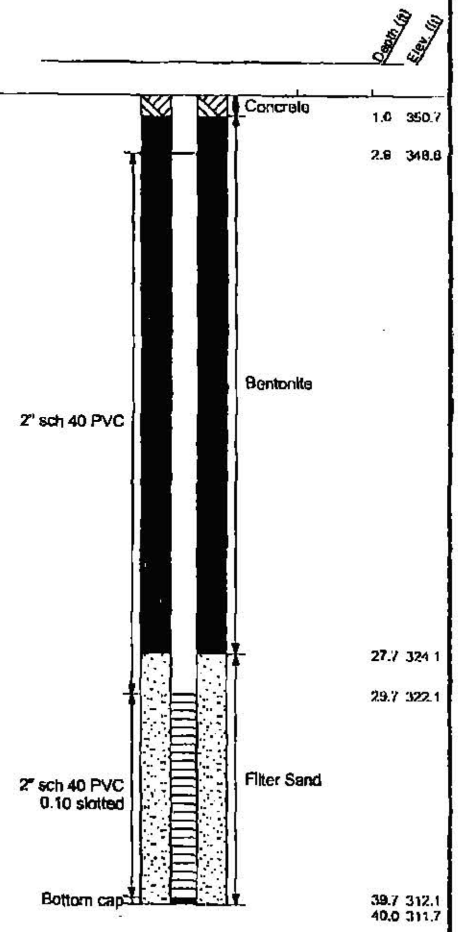
Datum msl

Completion Date: 6/18/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/ROD	SAMPLES
	Medium stiff, brown and gray CLAY - CH	▨	2-2-3-4	SS1
	Soft, brown and gray CLAY - CH	▨	1-1-2-1	SS2
5	Medium stiff to stiff, brown, silty CLAY, trace sand - (CL)	▨	1-2-4-4	SS3
		▨	2-4-4-5	SS4
10		▨	2-3-6-6	SS5
		▨	3-5-5-6	SS6
		▨	1-4-4-8	SS7
15	k = 1.2 x 10^{-8}cm/s	▨	2-4-5-8	SS8
		▨	2-6-6-7	SS9
20		▨	3-5-7-7	SS10
		▨	2-5-7-8	SS11
		▨	3-5-6-7	SS12
25		▨	4-4-6-6	SS13
	Very stiff to stiff, brown, silty CLAY - CL	▨	4-6-8-11	SS14
30		▨	3-4-7-9	SS15
		▨	4-6-8-10	SS16
	Stiff, brown, sandy CLAY with silt - CL	▨	5-6-6-8	SS17
35		▨	3-4-6-8	SS18
		▨	5-5-7-7	SS19
40	Stiff, brown clayey SILT - ML Boring terminated at 40 feet.	▥	2-3-6-7	SS20
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KOP	App'vd. by: KOP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-153

Project No. J017150.02

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 7

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
) R 2020-019
STANDARDS FOR THE DISPOSAL)
OF COAL COMBUSTION RESIDUALS) (Rulemaking - Water)
IN SURFACE IMPOUNDMENTS:)
PROPOSED NEW 35 ILL. ADM.)
CODE 845)

ILLINOIS EPA'S PRE-FILED ANSWERS

NOW COMES the Illinois Environmental Protection Agency (Illinois EPA or Agency), by and through one if its attorneys, and submits the following information with respect to its pre-filed answers.

1. On March 30, 2020, the Illinois EPA filed a rulemaking, proposing new rules at 35 Ill. Adm. Code 845 concerning coal combustion residual surface impoundments at power generating facilities in the State.

2. Public Act 101-171, effective July 30, 2019, amended the Illinois Environmental Protection Act, by among other things, adding a new Section 22.59 (415 ILCS 5/22.59). Public Act 101-171 includes a rulemaking mandate in Section 22.59(g) which directs the Board to adopt rules "establishing construction permit requirements, operating permit requirements, design standards, reporting, financial assurance, and closure and post-closure care requirements for CCR surface impoundments." 415 ICLS 5/22.59(g). The Board is required is adopt new rules for 35 Ill. Adm. Code part 845 by March 30, 2021.

3. The Agency timely filed pre-filed testimony for eight witnesses.

4. Based on the pre-filed testimony, Illinois EPA received over 1000 questions counting subparts.

5. On June 30, 2020, the Agency asked that it be granted until August 3, 2020 to respond to the pre-filed questions.

5. **How does Illinois EPA distinguish between "inactive CCR surface impoundments at active and inactive electric utilities or independent power producers" and landfills that contain CCR at these same facilities? See: Proposed Sections 845.lOO(c) and 845. 100(h).**

   Response: CCR surface impoundments, by definition, are designed to hold liquids and CCR, landfills are not.

6. **Does the Coal Ash Pollution Prevention Act include the same exclusion for " landfills that receive CCR" that is in Illinois EPA's proposed Section 845.100(h)? If not, what is Illinois EPA's legal authority for this exclusion?**

   Response: Section 22.59 of the Act is titled "CCR surface impoundments", contains requirements to which CCR surface impoundments are subject and makes no mention of landfills that receive CCR. Section 845.100(h) is a clarification that the Board rules mandated by Section 22.59 of the Act also pertain only to CCR surface impoundments.

7. **Do Illinois EPA's Proposed Regulations apply to all natural topographical depressions and man-made excavations where coal combustion residual has been disposed at power generating facilities?**

   Response: No, Part 845 applies to CCR surface impoundments at electric utilities and independent power producers.

8. **Is Illinois EPA aware of any CCR surface impoundments not located at the 23 power generating facilities identified on pages 37 and 38 of its Statement of Reasons? If so, where are these off-site surface impoundments?**

   Response: There are 10 CCR surface impoundments of which the Agency is aware that are off-site from the power generating facility they serve. These CCR surface impoundments are off-site from the Joliet 9 Station, south of Joliet, City Water Light and Power in Springfield and Southern Illinois Power Cooperative, south of Marion, by Lake of Egypt.

9. **If a CCR surface impoundment is outside of the property boundaries of a power generating facility (for example, on an adjacent or nearby property), will Illinois EPA's Proposed Regulations apply to this off-site surface impoundment?**

   Response: If the hypothetical CCR surface impoundment is owned or operated by an electric utility or an independent power producer, Part 845 would be applicable.

   a. **If not, how is this exclusion consistent with the statutory mandate that "environmental laws should be supplemented to ensure consistent, responsible regulation of <u>all</u> existing CCR surface impoundments (415 ILCS 5/22.59(a)(4), emphasis added)?**

      Response: Not applicable. Please see Response 9.

   b. **What steps has Illinois EPA taken to identify CCR surface impoundments that are not located at the 23 power generating facilities identified on pages 37 and 38 of its Statement of Reasons?**

Response: The Agency has not taken steps to identify CCR surface impoundments at facilities which are not utilities or independent power producers. According to USEPA in its Federal Registry entry for Part 257, located at 80 Fed. Reg. 21340, (Apr. 17, 2015), industries using coal to generate electricity and heat for their own use, consumed less than one percent of the coal burned. Hence, these industries would produce less than one percent of the CCR generated.

Section 22.59(a)(3) of the Act states, as a finding of the General Assembly, that the electrical generating industry has caused groundwater contamination at active and inactive plants throughout Illinois. Further, Section 22.59(g)(1) of the Act requires that the rules adopted pursuant to Section 22.59(g), be as protective and comprehensive as Subpart D of 40 CFR 257 governing CCR surface impoundments. It is the Agency's position that the same universe of CCR surface impoundments is intended to be regulated by Part 845. Based on this information, as drafted, Part 845 would regulate approximately 99% of the CCR generated and is consistent with the General Assembly's findings.

10. **How will Illinois EPA identify the CCR surface impoundments with the highest risk to public health and the environment, as required by 415 ILCS 5/22.59(g)(9)? Is this process set forth in the Proposed Regulations?**

Response: The required closure or retrofit of CCR surface impoundments is generally addressed in Section 845.700, with the specific prioritization in Section 845.700(g).

11. **Why are decisions about implementing interim measures delegated to owners and operators? Proposed Section 845.680(a)(3). Why isn't this an Illinois EPA authority and responsibility?**

Response: The Agency is responsible for reviewing and approving an overall corrective action plan. The interim measures being described here are actions expected of owners and operators to mitigate a situation prior to the completion of the formal approval process. For example: if an active CCR surface impoundment received damage to a liner system. The owner or operator could begin dewatering the impoundment prior to approval of the corrective action plan and permitting process to reduce the amount of leachate that could potentially impact groundwater.

12. **415 ILCS 5/22.59(b)(l) prohibits the discharge of any contaminants from CCR surface impoundments into the environment"... so as to cause, directly or indirectly, a violation of this Section or any regulations or standards adopted by the Board under this Section, either alone or in combination with contaminants from other sources." Dust control is specifically mandated by 415 ILCS 5/22.59(g)(10).**

a. **Under Illinois EPA's Proposed Regulations, does this provision apply to dust that originates from CCR surface impoundments in combination with other on-site and off- site sources that are also discharging dust?**

Response: No. CCR surface impoundments are separate from the other particles released to the air by surrounding facilities or other sources where the CCR surface impoundment

a. Does the Agency consider existing groundwater quality standards under 35 Ill. Adm. Code pt. 620 to be "applicable state…water quality standard[s]?"

Response: Yes

b. Does the Agency consider existing groundwater protection standards under 40 C.F.R. Part 257 to be "applicable. . . federal water quality standard[s]?"

Response: Yes

c. Could you please identify all standards that the Agency considers to be "applicable state or federal water quality standard[s]?"

Response: The Owner/Operator must comply with Sections 307 and 404 of the Clean Water Act, the Interagency Wetlands Policy Act of 1989, and the Rivers, Lakes, and Streams Act, 35 IAC Part 302 and 303, Part 620 and 40 CFR Part 257, as applicable. (Agency Response)

d. Will the Agency take into account existing groundwater monitoring data from CCR surface impoundments covered by the Federal CCR Rule in determining whether "the construction and operation" of the impoundment "will not cause or contribute to any violation of any applicable state or federal water quality standard?"

Response: Existing groundwater quality data would be taken into account for determining if a CCR surface impoundment already at that location meets the requirements of Section 845.310. For the construction of a new CCR surface impoundment, which is compliant with the proposed requirements of Part 845, Subpart D, existing groundwater water quality may not be relevant, because the design of the new CCR surface impoundment may be significantly different than a CCR surface impoundment not designed pursuant to Part 845, Subpart D. (Agency Response)

i. If so, what monitoring results would lead the Agency to determine that operation of the impoundment "will not cause or contribute to any violation of any applicable state or federal water quality standard?

Response: Monitoring results of water quality will determine whether operation will not cause or contribute to any violation to an applicable standard. (Agency Response)

e. Will the Agency take into account existing groundwater monitoring data from CCR surface impoundments not covered by the Federal CCR Rule in determining whether "the construction and operation" of the impoundment "will not cause or contribute to any violation of any applicable state or federal water quality standard?"

Response: CCR surface impoundments not subject to Part 257, are not subject to the requirements of Part 845. (Agency Response)

i. If so, what monitoring results would lead the Agency to determine that operation of the impoundment "will not cause or contribute to any violation of any applicable state or federal water quality standard?"

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 8

ENVIRONMENTAL PROTECTION AGENCY

WATER POLLUTION CONTROL PERMIT

PERMIT NUMBER: 1973-EA-1458

DATE ISSUED: July 11, 1973

PROJECT LOG NUMBERS: 2343-73

SUBJECT: ELECTRIC ENERGY, INC. (JOPPA) - Ash Pond

TO CONSTRUCT AND OPERATE: Electric Energy, Inc.
P. O. Box 165
Joppa,Illinois 62953

Permit is hereby granted to the above designated permittee to construct and/or operate water pollution control facilities described as follows:

An ash pond for settling with pH control with an average flow rate of 7,000,000 GPD with discharge to the Ohio River.

The final plans, specifications and supporting documents approved by this permit were prepared by Dr. Harry W. Gehm, R.P.E. and are identified in the records of the Illinois Environmental Protection Agency, Division of Water Pollution Control, Permit Section, by the log numbers designated in the subject heading above. This permit expires July 11, 1976.

The Standard Conditions of issuance of this permit are itemized below.

READ ALL CONDITIONS CAREFULLY:

STANDARD CONDITIONS

Pertaining to both construction and operation permits.

1. If any statement or representation is found to be incorrect, this permit may be revoked and the permittee thereupon waives all rights thereunder.

2. During or after the construction or the installation of the sewage works, any agent duly authorized by the Environmental Protection Agency shall have the right to inspect such work and its operation.

3. The issuance of this permit (a) shall not be considered as in any manner affecting the title of the premises upon which the sewage works are to be located (b) does not release the permittee from any liability for damage to person or property caused by or resulting from the installation, maintenance or operation of the proposed sewage works. (c) does not take into consideration the structural stability of any units or parts or the project, and (d) does not release the permittee from compliance with other applicable statutes of the State of Illinois, or with applicable local laws, regulations or ordinances.

4. Treatment works will be operated or supervised by a duly qualified sewage works operator certified under the Regulations of the Environmental Protection Agency.

5. The treatment works or wastewater source covered by this permit shall be constructed and operated in compliance with the provision of the Environmental Protection Act and Chapter 3 of the Rules and Regulations as adopted by the Illinois Pollution Control Board.

6. Plans, specifications and other documentation submitted shall constitute a part of the application and when approved shall constitute part of the permit.

7. This Permit may not be assigned or transferred without a new permit from the Illinois Environmental Protection Agency.

Pertaining only to construction permits.

1. There shall be no deviations from the approved plans and specifications unless revised plans, specifications, and application shall first have been submitted to the Environmental Protection Agency and a supplemental written permit issued.

2. The installation shall be made under the supervision of an inspector, who is familiar with the approved plans and specifications provided by and approved by the owner, and said inspector shall require that construction to compliance with the plans and specifications approved by this Agency.

3. Unless otherwise stated by Special Condition, construction must be completed in three years for treatment works and two years for sewers and wastewater sources.

4. Unless otherwise stated by Special Condition, the issuance of this permit shall be a joint construction and operation permit provided that

   a) All standard and Special Conditions, are compiled with.

   b) This Agency is notified within ten (10) days, respectively, of the start of construction and the date of testing and start-up of full operation.

   c) The submission of operating reports of the treatment works covered under this permit shall be at a frequency specified by this Agency.

   d) The operation permit shall expire one year from the date of start-up of operation.

   e) At least 90 days prior to the expiration date of the operation permit, the permittee shall apply for a renewal of the operation permit.

This permit is issued in accordance with the Illinois Environmental Protection Act of 1970 and the Chapter III Water Pollution Regulations adopted by the Illinois Pollution Control Board in March of 1972.

TRW/REB/cj

cc: -EPA-Champaign Surveillance
-Dr. Harry W. Gehm
-Massac County Health Dept.
-Standards Section
-Grant & Tax Certification
-Div. Water Resource Management

DIVISION OF WATER POLLUTION CONTROL

Ward L Akers P.E.

Ward L. Akers, Acting
Manager, Permit Section

MEMORANDUM

SUBJECT: NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

TO: New Dischargers of Wastewater to the Waters of Illinois

DATE: May 11, 1973

FROM: William H. Busch, P.E.
Manager, Permit Section
Division of Water Pollution Control

Enclosed is your Illinois Environmental Protection Agency permit to construct and operate new wastewater treatment facilities with discharge to the waters of Illinois. We wish to be sure that you are aware of new Federal requirements which specify that a National Pollutant Discharge Elimination System permit (NPDES) must have been applied for prior to the commencement of discharge for any new discharge source. This requirement is specified in the proposed regulations of 40 CFR 125.12, paragraph (d), which were issued January 5, 1973 under the Federal Water Quality Act Amendments of 1972. These proposed regulations require that new dischargers must apply at least 180 days prior to the date on which the discharge will commence.

For further information and necessary NPDES application forms, applicants should contact Region V of the United States Environmental Protection Agency at 1 North Wacker, Chicago, Illinois 60606.

William H. Busch

William H. Busch P.E.
Manager, Permit Section
Division of Water Pollution Control

WHB/cj

cc: -USEPA - Region V
-Consulting Engineer
-Surveillance Office

In accordance with the Conditions under which the attached Permit was issued, please submit this form within ten days of start of construction.

Name of Project

Address

County

Permit Number

Project Completion Schedule Certification Number

Construction was started for this project

on ______________________.
date

Signature of Applicant

In accordance with the Conditions under which the attached Permit was issued, please submit this form within ten days after start up of operation.

Name of Project

Address

County

Permit Number

Project Completion Schedule Certification Number

Construction was completed for this project

on ______________________.
date

Signature of Applicant

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
WATER POLLUTION CONTROL PERMIT

PERMIT NO.: 1973-EA-1458-1
DATE ISSUED: July 19, 1979

FINAL PLANS, SPECIFICATIONS, APPLICATION
D SUPPORTING DOCUMENTS
EPARED BY: Electric Energy, Inc.
LOG NUMBERS: 5041-79 (2343-73)

SUBJECT: ELECTRIC ENERGY, INC. - (Joppa Generating Station)
Ash Pond

PERMITTEE TO CONSTRUCT AND OWN
Electric Energy, Inc.
Post Office Box 165
Joppa, Illinois 62953

Supplemental permit is hereby granted to the above designated permittee(s) to construct and/or operate water pollution control facilities, which were previously approved under Permit #1973-EA-1458 dated July 11, 1973. These facilities have been revised as follows:

Addition of air pre-heater wash waste to the pond for treatment. Increase the design average flow to 10.4 million gallons per day with a design maximum flow of 12 million gallons per day.

All Special Conditions on the original permit issued are also applicable to this permit unless specifically deleted or revised in this permit.

THE STANDARD CONDITIONS OF ISSUANCE INDICATED ON THE ATTACHED PAGES 1a AND 1b MUST BE COMPLIED WITH IN FULL. READ ALL CONDITIONS CAREFULLY.

TGM:DR:jb/9084/13
cc: EPA - Region 7

DIVISION OF WATER POLLUTION CONTROL

Thomas G. McSwiggin, P.E.
Manager, Permit Section

WPC-146 (Rev. 1-77)

STANDARD CONDITIONS

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) grants the Environmental Protection Agency authority to impose conditions on permits which it issues.

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year after date of issuance unless construction or development on this project has started on or prior to that date. In any event, construction must be completed in three years for treatment works and two years for sewers and wastewater sources, unless otherwise stated by special condition.

2. The construction or development of facilities covered by this permit shall be done in compliance with applicable provisions of Federal laws and regulations, the Illinois Environmental Protection Act, and Rules and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification of the project, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

4. The permittee shall allow any agent duly authorized by the Agency upon the presentation of credentials:

   a. to enter at reasonable times the permittee's premises where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit.

   b. to have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit.

   c. to inspect at reasonable times, including during any hours of operation of equipment constructed or operated under this permit, such equipment or monitoring methodology or equipment required to be kept, used, operated, calibrated and maintained under this permit.

   d. to obtain and remove at reasonable times samples of any discharge or emission of pollutants.

   e. to enter at reasonable times and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

The issuance of this permit:

a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located;

b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities;

c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations;

d. does not take into consideration or attest to the structural stability of any units or parts of the project;

e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. Unless a joint construction/operation permit has been issued, a permit for operating shall be obtained from the Agency before the facility or equipment covered by this permit is placed into operation.

7. These standard conditions shall prevail unless modified by special conditions.

8. The Agency may file a complaint with the Board for suspension or revocation of a permit:

   a. upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed; or

   b. upon finding that any standard or special conditions have been violated; or

   c. upon any violation of the Environmental Protection Act or any Rule or Regulation effective thereunder as a result of the construction or development authorized by this permit.

TGM:JG:bs/sp/9332/1-2

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 9

EEI
Electric Energy, Inc.

July 24, 2013

Mr. Bill Buscher
Division of Water Pollution Control
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Dear Mr. Buscher:

Enclosed is the Electric Energy, Inc. (EEI) Hydrogeologic Assessment Report for the coal combustion product impoundments at the Joppa Generating Station. This report completes the Ash Pond Hydrogeologic Assessment Plan submitted to IEPA in 2009 and approved by IEPA in 2010. This report also complies with item 3 of IEPA's January 25, 2013 letter requiring a hydrogeologic assessment report be submitted to IEPA within six months of the revised monitoring well location plan approval.

With IEPA's approval in January 2013, EEI relocated two groundwater monitoring wells which we had determined were placed in areas that had been used for ash fill prior to 1991. Following is a summary of the groundwater monitoring at each ash pond.

Active Ash Pond
Monitoring well G152, which was located just inside the rail road loop, was relocated to just outside the rail loop. Both the first and second quarter 2013 samples taken from this well met the Class II Groundwater Standards. Wells G151 and G153, located in the west and east sides of the active ash pond respectively, met the Class II groundwater standards for all metals for the last 10 quarters sampled. Based on the groundwater sampling performed around the active ash pond, there are no exceedances attributed to coal combustion products in the east ash pond. Exceedances of the Class II standard for pH were observed in well G151, but those exceedances are not related to the ash pond operation.

Inactive Ash Pond
Monitoring well G112B was relocated from being in the levee of the inactive ash pond to just outside the levee. Samples taken from this well in the first and second quarters of 2013 met all Class II groundwater standards with the exception that Boron was 3 ppm, while the standard is

2 ppm. Wells G111 and G113, located in the west and east sides of the inactive ash pond respectively, met the Class II groundwater standards for the last 10 quarters sampled, with the exception of one pH exceedance at G113 that is not related to ash pond operation.

EEI and its consultant performed a search of water well records on file with various Illinois agencies, met with both local water district personnel, and had discussions with neighboring industries. Two water districts supply potable water to nearly everyone bordering the Joppa Plant. There are no wells used for potable water within 2500 feet downgradient of either of the ash ponds. It is unlikely there are any wells used for potable water within 2500 feet side gradient of the active ash pond. There is one industrial site that is at the edge of the 2500 foot radius side gradient to the inactive ash pond that has wells for potable water use. However, the groundwater monitoring well located between the inactive ash pond and the industrial site has met the Class II groundwater standard for the last 11 calendar quarters.

As the attached Hydrogeologic Assessment Report shows, there are 50 or more feet of clay rich deposits with a low hydraulic conductivity directly below both of the impoundments. This clay layer restricts migration of leachate from the impoundment to surrounding groundwater.

In summary, the groundwater monitoring wells around the active ash pond do not show any exceedances attributable to the ash pond. One well at the inactive ash pond exceeded the Class II groundwater standard for boron by 1 ppm. There are no potable water sources downgradient of this pond.

We are available to meet with you to discuss the results of our ash pond hydrogeologic assessment. Please contact Bruce Parker, Senior Engineer at (618) 543-3458 if you have any questions on the enclosed information or to schedule a follow up meeting.

Sincerely,

Michael T. Pullen
Director, Operations

Enclosure
CERTIFIED MAIL: 7009 0820 0002 2445 6795

SMARTER SOLUTIONS

EXCEPTIONAL SERVICE

VALUE

Phase I Hydrogeological Assessment Report

Coal Combustion Product Impoundments
Joppa Generating Station
Joppa, Illinois

Project No: 2126

July 23, 2013

NATURAL
RESOURCE
TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

NATURAL
RESOURCE
TECHNOLOGY
ENVIRONMENTAL CONSULTANTS

234 W FLORIDA ST.
MILWAUKEE, WI 53204
(P) 414.837.3607
(F) 414.837.3608

PHASE 1 HYDROGEOLOGICAL ASSESSMENT REPORT

COAL COMBUSTION PRODUCT IMPOUNDMENTS
JOPPA GENERATING STATION
JOPPA, ILLINOIS

Project No. 2126

Prepared For:

ELECTRIC ENERGY INC
and
AMEREN ENERGY GENERATING COMPANY

Prepared By:

Natural Resource Technology, Inc.
234 W Florida St
Milwaukee, WI 53204

July 23, 2013

Bruce R. Hensel, PG
Principal Hydrogeologist

EXECUTIVE SUMMARY

Background and Objectives

Electric Energy Incorporated (EEI) and Ameren Energy Generating Company own and operate the Joppa Generating Station in Joppa, Illinois. The coal-fired power station currently operates one impoundment for coal combustion product (CCP) management purposes, and has another impoundment that is no longer in service. To assess the potential for constituent migration from the impoundments as requested by the Agency in their correspondence dated April 10, 2009 and a follow-up letter on January 25, 2013, EEI commissioned a hydrogeologic study, water well survey, development of a groundwater monitoring plan, and an initial groundwater quality assessment. This report reviews hydrogeologic data pertinent to the site, groundwater quality data, the potential for off-site migration in the event of a release from one of the impoundments, and whether or not there are potential groundwater receptors in the event of a release.

Hydrogeology

Site-specific data were supplemented with geologic data from EEI's nearby landfill facility and published regional data to develop a conceptual model of geology and groundwater flow at the CCP impoundments. Site specific data were collected at seven monitoring wells (G101, G111, G112B, G113, G151, G152, and G153) installed in June 2010. Groundwater samples were collected from these monitoring wells for nine consecutive quarters from August 2010 through August 2012 to establish a statistical baseline for groundwater quality. Monitoring wells G112B and G153 were subsequently determined to be returning groundwater samples that were not representative of the uppermost water bearing formation beneath the CCP impoundments, and were abandoned and replaced with G112C and G152B in January 2013. Two additional quarters of groundwater quality samples were collected from the remaining original and new replacement monitoring wells in March and May 2013.

Three hydrostratigraphic units have been identified in the vicinity of the CCP impoundments:

- The uppermost hydrostratigraphic unit is approximately 50 or more feet thick and is composed of the Equality Formation and the underlying Metropolis Formation. These units consist of predominantly clay and silty clay with some minor intervals of sandy clay. This surficial groundwater unit extends downward to the McNairy Formation, which was not intercepted by any of the borings advanced around the CCP impoundments. The geometric mean hydraulic conductivity of this hydrostratigraphic unit is 5.9×10^{-6} cm/s, suggesting that it is a confining unit.

- The McNairy Formation is the lowest unlithified unit identified in the vicinity of the CCP impoundments and rests on top bedrock. Based on regional data, the McNairy Formation is typically more permeable than the overlying Equality and Metropolis Formations owing to the larger amount of sand and gravel in that unit. This hydrostratigraphic unit is approximately 85 feet thick in the vicinity of the CCP impoundments.

- The third hydrostratigraphic unit is defined by the uppermost bedrock unit, the Salem Limestone, which is the uppermost bedrock unit underlying the Station, and has a reported thickness of 200 to 500 feet.

Groundwater occurs within the uppermost hydrostratigraphic unit at depths of 2.6 to 42.7 feet, depending on monitoring well location. Groundwater flow beneath the CCP impoundments is conceptually south toward the Ohio River, a regional groundwater sink. The CCP impoundments, particularly the east impoundment, are close to the Station property boundary and given expected east-west variations in groundwater flow direction, there may be potential for off-site migration in the event of a release.

Potential for Groundwater Receptors

A search of water well records on file with the Illinois State Geological Survey, Illinois State Water Survey, and Illinois Environmental Protection Agency identified 25 water well records within 2,500 feet of the CCP impoundments. Locations were field verified and no buildings or other evidence of water wells were identified at six of these locations, one location on property recently purchased by EEI where the well will soon be abandoned, and nine wells that are not used for potable water supply, leaving nine wells within the search radius that are may be active and used for potable water supply. In addition, the Ft. Massac and Joppa Water Districts were consulted to verify areas surrounding the impoundments serviced by municipal water; LaFarge Corporation, which owns the water wells west of the impoundments, was consulted to identify the location of potable wells on their property; and Trunkline Gas Pumping Station was consulted to verify the status of wells on their property.

The well search identified no potable water supply wells within 2,500 feet of either CCP impoundment in a position likely to be downgradient. The closest active water supply wells to the CCP impoundments are non-potable, belong to EEI, and are used for plant process water. The closest community water supply well is in the village of Joppa, approximately 3,000 feet to the southeast. Water quality data for this well shows no evidence of impacts from the CCP impoundments.

Groundwater Chemistry

Groundwater monitored in the uppermost hydrostratigraphic unit at the CCP impoundments is classified as Class II because these materials are composed of silt and clay with hydraulic conductivity lower than 1×10^{-4} cm/s. Excluding the August 2010 sample event, which was bailed and produced anomalous samples that were not representative of groundwater quality as indicated by all subsequent samples, exceedances of Class II groundwater quality standards were identified for two constituents at three monitoring wells:

- pH: G113 (1 of 10 samples) and G151 (8 of 8 samples)
- Boron: G112C (3 of 3 samples)

The only Class II groundwater quality standard exceedance potentially related to the CCP impoundments is boron. Boron had three exceedances at well G112C, which is downgradient of the inactive west impoundment, with concentrations of 3.1 to 3.3 mg/L versus a Class II groundwater quality standard of 2 mg/L. In addition, manganese at G112C was high relative to background, although lower than its Class II groundwater quality standard, and may be associated with coal ash leachate. No other constituent at G112C had a concentration that was high relative to background.

The pH values lower than the 6.5 SU standard are not associated with coal ash leachate, which tends to be alkaline. Additionally, boron concentrations at these monitoring wells were at background concentrations (relative to G101), indicating no correlation between pH and the primary coal ash indicator parameter, boron.

Conclusions

The primary conclusion from voluntary monitoring of groundwater at the Joppa Generating Station CCP impoundments is that past operation of the west ash pond has caused a localized exceedance of Class II groundwater quality standards for boron. The west ash pond is no longer in service. There are no exceedances attributed to the east ash pond, which is currently in service. Exceedances of the Class II standard for pH were also observed, but those exceedances are not related to CCP impoundment operation. Furthermore:

- The impoundments are underlain by more than 50 feet of clay-rich deposits. These clays restrict migration of leachate from the impoundment to surrounding groundwater.
- Groundwater beneath the impoundments is conceptually interpreted to flow south toward the Ohio River.
- The exceedances attributed to former operation of the west ash pond were only observed in monitoring well G112C, immediately south and downgradient of the impoundment.
- Manganese concentrations in G112C are elevated relative to background, although less than 2 percent of the Class II groundwater quality standard, and while these concentrations may be naturally occurring due to a reduced hydrogeologic environment, the west ash pond cannot be ruled out as a source of this manganese.
- A search of water well records indicates that there are no potential receptors downgradient, and potential receptors are unlikely within 2,500 feet sidegradient of the east impoundment. Drinking water in this area is provided by the Joppa and Ft. Massac Water Districts.
- There are no potential receptors directly downgradient of the west impoundment. There are active potable wells sidegradient, and within 2,500 feet of the west impoundment. These wells are used for sinks and showers, but not drinking water supply. The property owner brings in bottled drinking water.
- The Station’s non-potable water supply wells are the closest water wells downgradient of the CCP impoundments. Water quality data for the Station wells and the closest community water supply well (3,000 feet sidegradient of the east impoundment) indicate very low boron and sulfate concentrations, indicating no evidence of impacts from the CCP impoundments after more than 50 years of service.

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APPENDICES

1 INTRODUCTION

1.1 Purpose

Electric Energy Incorporated (EEI) and Ameren Energy Generating Company own and operate the Joppa Generating Station in Joppa, Illinois (Figure 1). The coal-fired plant currently operates one impoundment for coal combustion product (CCP) management purposes, and has another impoundment that is no longer in service. To assess the potential for constituent migration from the impoundments as requested by the Agency in their correspondence dated April 10, 2009 and a follow-up letter on January 25, 2013, EEI commissioned a hydrogeologic study, water well survey, development of a groundwater monitoring plan, and an initial groundwater quality assessment.

The objectives of this report are to:

- Summarize hydrogeologic information pertinent to the site.
- Evaluate groundwater quality data to determine whether or not operation of the impoundment has adversely affected groundwater.
- Determine the potential for off-site migration and whether or not there are potential groundwater receptors in the event of a release.

2 SETTING

Portions of the information in this section were previously presented and have been modified from the CCP impoundment hydrogeologic assessment plan (October 2009) and the hydrogeologic report for the Station's CCP landfill (June 2009) prepared by Hanson Professional Services, Inc. (Hanson).

2.1 Power Plant and CCP Impoundments

The Joppa Generating Station (Station) is located west of the Village of Joppa and northeast of the Ohio River in Massac County, Illinois. The Station lies in Section 14, Township 15 North, Range 3 East of the 3rd Principal Meridian. The Station has two CCP impoundments, the West Ash Pond located in the east half of Section 15 and the East Ash Pond located in the west half of Section 14 directly north of the power plant (Figure 2)

During initial operation of the plant, coal ash was impounded within the levees formed by the construction of the Station railroad loop. The East Ash Pond was later constructed inside the railroad loop.

The West Ash Pond (WAP), encompassing approximately 84 acres, was used from the early 1950's until it was removed from service in the 1970's. The base elevation of the WAP is reportedly 320 feet above mean sea level (amsl). The elevation of the top of the CCP within the impoundment ranges from approximately 362 feet amsl towards the south end to 370 feet amsl at the northern tip, although most of the WAP lies at an elevation of 362 feet amsl. The height of the WAP is approximately 22 feet relative to surrounding grade.

The East Ash Pond (EAP), encompassing approximately 103 acres, was built in two stages. The northern portion (Phase I) was placed into service in late 1973. The southern portion (Phase II) was permitted in May 1985 with completion of construction activities in late 1985. The elevation of the top of the CCP within Phase I of the impoundment ranges from approximately 372 to 380 feet amsl, although most of the CCP lies between 372 and 374 feet amsl. The elevation of CCP within Phase II of the impoundment ranges from approximately 351 to 363 feet amsl, with most of the CCP between 352 and 356 feet amsl. The height of the EAP is approximately 55 feet relative to surrounding grade. The EAP is currently operated in accordance with IEPA NPDES Permit No. IL0004171.

2.2 Regional Geology

The Station lies at the southern boundary of the Illinois Basin and the northern edge of the Mississippi Embayment, a relatively low lying area that is part of the Coast Plain Physiographic Province (Figure 3)

(Leighton, 1948). Based on stack-unit maps prepared by the Illinois State Geological Survey (Berg and Kempton, 1987) the vicinity of the Station generally has less than 6 meters (<19.7 feet) of silty and clayey diamictons overlying Cretaceous age sediments, silts, sands, etc. between depths of 6 to 15 meters (19 to 50 feet). However, in some areas along the Ohio River, the predominant unlithified materials are Quaternary age sand and gravel outwash deposits belonging to the Henry Formation. The unlithified materials rest on Mississippian age bedrock.

2.2.1 Unlithified Materials

Regionally, unlithified materials consist of diamictons and lacustrine/alluvial deposits. These deposits may exceed 100 feet in thickness. Several deep boring logs within the property boundary of the Station have thicknesses of unlithified materials ranging from 135 to 142 feet. Four principal unlithified deposits exist in the vicinity of the Station: (1) the Equality Formation; (2) Peoria Silt / Roxana Silt / Loveland Silt; (3) Metropolis Formation; and (4) McNairy Formation (Figure 4).

The Equality Formation is the uppermost material encountered in the vicinity of the Station. The Equality Formation consists of silt, clay, and minor amounts of sand and gravel. The silt and clay are medium to dark gray to brown; less commonly they are greenish to bluish gray. Some reddish to orange-brown layers occur in the upper part of the unit. Consistency varies from stiff to soft, plastic “gumbo.” Structure varies from massive to finely laminated or varved. Wood fragments and decomposed vegetation are common. This formation is interpreted as fine-grained fluvial overbank sediments and slack-water lacustrine deposits that accumulated during the Wisconsinan age (Nelson, 2007). Based on seventeen borings advanced as part of a subsurface geologic investigation for the landfill approximately ¼ to 1 mile northwest of the WAP (Hanson, 2009a), the thickness of the Equality Formation ranges from 14 to 32 feet.

Contiguous with the Equality Formation are the Peoria Silt, Roxana Silt, and Loveland Silt (these silts are not shown on regional maps of this area, but have been encountered in soil borings in the vicinity of the Station). The Peoria Silt and Roxana Silt are both wind-blown (eolian) deposits of Wisconsinan age that are difficult to distinguish from one another. Their lower contacts are gradational. The Peoria Silt is a massive, slightly clayey silt with rare fine sand grains. The upper part is generally yellowish brown to dark brown, grading downward to mottled gray and yellowish brown. The Roxana Silt is medium dark brown to reddish brown that typically has uniform color with no mottling and higher clay content than the Peoria Silt. The Loveland Silt is of Illinoian age and is a massive silt, interpreted as an eolian deposit, with high clay content. The Loveland is strongly mottled in yellow, red, and orange and has prominent vertical gray streaks. It is strongly weathered and commonly displays root casts or traces. The Loveland is generally thin and lenticular and its lower contact is gradational to the Metropolis Formation but unconformable to older units.

Underlying the Equality Formation, or at some locations the Loveland Silt, is the Metropolis Formation, which consists of silt, sand, clay, and gravel. The Metropolis is composed of silty sand and sandy silt in a clay matrix and contains scattered pebbles and lenses of gravel. Much of the unit may be classified as diamicton. These sediments are strongly mottled and streaked in shades of gray, yellowish brown, and yellowish orange. The lower part of the formation contains bright red and orange sand. Sediments are poorly sorted to unsorted and massive to weakly stratified. Gravel occurs as common scattered pebbles and as lenses up to 4 feet thick (Nelson, 2007). The Metropolis Formation, originally defined by Nelson et al. (1999a), borders the Ohio River, where it underlies a loess-capped terrace. The Metropolis Formation is interpreted as alluvial sediment deposited in the valley of the ancestral Tennessee River (Nelson et al. 1999a, 1999b). The lower contact is unconformable on the McNairy Formation in most places. Age is Pleistocene, Illinoian, and older. Based on thirteen borings advanced approximately ¼ to 1 mile northwest of the WAP (Hanson, 2009a) the thickness of the Metropolis Formation ranges from 25 to 40 feet. A drillers log for plant well 4, located south of the EAP, indicates fine-grained deposits from the land surface to a depth of 50 feet. These deposits represent the combined thickness of the Equality and Metropolis Formations south of the CCP impoundments.

The lowermost unlithified unit encountered in the vicinity of the Station is the McNairy Formation, which consists of sands, silts, and clays. The McNairy is Upper Cretaceous in age and consists of very fine- to medium-grained sand, mostly highly micaceous, and ranges from white and light-gray to bright orange, red and yellow in color. The silts and clays are light to dark gray and may be mottled in yellow, gray, and magenta. The lower contact is unconformable (Nelson, 2007). Based on a boring advanced to bedrock by Hanson (2009a) approximately 0.7 miles mile northwest of the WAP, the thickness of the McNairy is approximately 76 feet. The drillers log for plant well 4 indicates sand from a depth of 50 to 135 feet, suggesting that the McNairy formation is 85 feet thick south of the CCP impoundments.

Thick outwash deposits of the Wisconsinan aged Henry Formation may be encountered within the Ohio River Valley. These deposits, which are not present beneath the CCP impoundments, consist of sorted and stratified water-laid material that is predominantly sand and gravel.

2.2.2 Bedrock

Bedrock in the region surrounding the Station consists of a sequence of Mississippian System sedimentary rocks hundreds of feet thick and consolidated prior to the Cretaceous Period. The bedrock dips gently northward toward the center of the Illinois Basin. The upper-most bedrock unit near the Station generally consists of limestone. The total thickness of the Mississippian System in southern Illinois is greater than 3,200 ft (Willman et al., 1975).

The uppermost unit encountered in the vicinity of the Station is the Salem Limestone. The Salem Limestone is described as fine-grained, fossiliferous limestone, and is approximately 200 to 500 feet thick in the area. The Salem Limestone overlies the Ullin Limestone; the Ullin Limestone is described as a light-colored fine- to coarse-grained limestone. The overall thickness of the Ullin Limestone near the Station is approximately 200 feet. The Fort Payne Formation, which is overlain by the Ullin Limestone, is described as a very fine-grained, siliceous, cherty limestone, and is approximately 200 to 600 feet thick in the study area (Kolata, 2005; Willman et al., 1967; Willman et al., 1975).

2.3 Water Resources

2.3.1 Surface Water

The major surface water body in the vicinity of the Station is the Ohio River, which borders the entire Station property to the south. The southern edges of the WAP and EAP are approximately 1,500 and 2,100 feet from the north bank of the Ohio River, respectively, during normal flow. The primary drainage in the area of the WAP is an intermittent stream that runs parallel to the east side of the impoundment and runs south initially and then south-southwest to the Ohio River. The primary drainage in the vicinity of the EAP is a stream that begins between the east portion of impoundment and the railroad loop and runs approximately 1,000 feet south from a culvert beneath the railroad loop before turning to the south-southwest to the Ohio River. This stream conveys discharge water from the EAP.

2.3.2 Groundwater

No surficial aquifers, i.e., aquifers that are present or exposed at the ground surface, are present in the vicinity of the ash impoundments. Berg, Kempton and Cartwright (1984) classified the area as D2 - uniform, relatively impermeable silty or clayey till at least 20 feet thick with no evidence of interbedded sand and gravel. Aquifers in the area of the Station generally fall into two broad categories: (1) intermittent sand and gravel deposits within the McNairy Formation; and, (2) bedrock consisting of limestone and fractured limestone, which vary widely in transmissivity.

No known wells in the area utilize the deposits of the Equality or Metropolis Formation for groundwater. These formations predominantly consist of silt and clay with isolated lenses of sand and gravel, which do not yield large amounts of water. Most wells in the area obtain groundwater from the McNairy sand and gravels or Mississippian limestone, principally the Salem or Ullin Limestones.

2.3.3 Well Search

Public records were searched to identify water wells located within 2,500 feet of the CCP impoundments. The Station Property is located in Township 15 South, Range 3 East, and the CCP impoundments are located within Sections 14 and 15. The 2,500 foot search radius spans across Sections 10, 11, 14, 15, 22, and 23. All water supply wells within these sections are shown on Figure 5 and tabulated in Appendix A.

The following sources of information were queried to identify water well locations and locations near the Station serviced by public water supplies:

- Illinois State Geological Survey's Illinois Water Well (ILWATER) Internet Map Service
- Illinois State Water Survey Domestic Well Database (ISWS)
- Illinois EPA's web-based Geographic Information System (GIS) files
- Illinois Department of Public Health
- Massac County Health Department
- The Joppa Water District
- The Ft. Massac Water District
- LaFarge Corporation, located immediately west of the Station
- Trunkline Gas Pumping Station, located north of the west ash pond

Records were identified for 68 wells within the six sections surrounding the unlined ash ponds. Twenty of the 68 wells were identified as monitoring wells associated with the Station's landfill. In addition, 9 wells on the LaFarge property west of the power plant were identified as test holes rather than water wells. These 29 wells are not shown on Figure 5 but are listed in Appendix A, Table A-1. The remaining wells are current or former water wells listed for industrial/commercial use or farm/domestic use.

A follow-up field survey was performed to visually verify the locations of water wells within the search radius (Appendix A). During this survey, personnel from the Joppa and Ft. Massac Water Districts were consulted to identify locations served by these districts. This survey identified:

- Eight records with incorrect coordinates. New coordinates were obtained using a hand-held GPS unit, and the locations on Figure 5 reflect the corrected coordinates.
- One well (79) that did not appear in the well records search. This well was added to Table A-1 and Figure 5.
- Six locations where no building and no wells could be located. These locations either represent water well records that have incorrect locations listed in the database or were associated with buildings that were abandoned and torn down. These locations are shown in grey on Figure 5.
- One well on property recently purchased by EEI where the building has been removed and the well will be abandoned. This location is also shown in grey on Figure 5.

In addition, the Station wells (including Midwest Electric Power) and Trunkline Gas Pumping Station wells are shown in grey on Figure 5 because they were verified to be non-potable. The Station wells are used only for production water, and the Trunkline Gas Pumping Station wells are not active. Both facilities obtain potable water from the Ft. Massac Water District.

Based on information derived from the well search, there are 25 water wells within a 2,500 foot radius of the two CCP impoundments, nine of which may be active and used for potable water (Figure 5). The water wells range from 52 to 451 feet in depth, with an average depth of 189 feet and a median depth of 158 feet. Of the eight water wells within the search radius with sufficient data to indicate the primary water-bearing zone supplying the well, three are in sand and gravel deposits and five are in limestone.

The closest active water supply wells to the EAP are wells 7 and 8, which are Station wells completed at depths of 350 and 403 feet. These wells supply production water, but are not used for potable water supply. The four active Station wells were sampled in February 2013 for analysis of coal ash indicator constituents, boron and sulfate. Boron concentrations in all four wells were <0.10 mg/L and sulfate concentrations were 6 mg/L (Appendix A). These low concentrations demonstrate that groundwater withdrawn from the Station's water wells is not affected by any release from the CCP impoundments.

There are no active potable wells downgradient of the EAP. The only potentially active potable well within 2,500 feet of the EAP that is not upgradient is well 3, which is sidegradient. This well is not considered a potential receptor because it is sidegradient, rather than downgradient of the EAP and is in an area served by the Joppa Water District.

There are no water wells directly downgradient of the WAP. The closest wells to the WAP are wells 49 and 50. These wells are non-potable and supply production water to the combustion gas turbines at the Station. There are two industrial wells (wells 20 and 75) associated with the LaFarge cement plant immediately west of the Station that are sidegradient of the WAP. The cement plant uses bottled drinking water, while well water is used in sinks and shower facilities as well as for production. The closest of these wells is more than 2,400 feet from the WAP.

Based on state records, there is one community water supply (CWS) well in the sections surrounding the CCP impoundments, but outside the 2,500 foot search radius. Well number 51 on Figure 5 and in Appendix A, Table A-1 is located in the village of Joppa in Section 23, 3,000 feet east of the Station property boundary. According to the IEPA database, CWS well 51 has a minimum setback zone of 200 feet, and a Phase I Wellhead Protection Area (WHPA) of 1,000 ft. The western edge of the WHPA falls within the 2,500 foot search radius. On-line water quality data available for this well[1] indicate low boron (<0.010 to 0.044 mg/L) and sulfate (<10 to 25 mg/L) concentrations, demonstrating that groundwater withdrawn by these wells has not been affected by any release from the CCP impoundments.

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[1] http://163.191.83.31/dww/JSP/WaterSystemDetail.jsp?tinwsys_is_number=717415&tinwsys_st_code=IL&wsnumber=IL1270100

3 MONITORING WELL INSTALLATION, DEVELOPMENT, AND SAMPLING

3.1 Monitoring Well Installation and Development

Seven monitoring wells (G101, G111, G112B, G113, G151, G152, and G153) were installed between June 1 and 25, 2010 (Table 1, Figure 1) by Geotechnology, Inc. (Geotechnology, 2010). At each well location, subsurface borings were advanced with a rotary drill rig equipped with hollow-stem augers to facilitate soil classification. Soil was continuously sampled through the center of the hollow stem auger. Monitoring wells, constructed of 2” inside diameter schedule 40 PVC riser and screen, with steel above-ground well covers, were installed at each location to monitor groundwater within the uppermost water-bearing unit adjacent to the impoundments. All of the monitoring wells were screened within one or more of the following unlithified materials: silty clay, silty/sandy clay, clay or silt. The wells were constructed consistent with monitoring well construction standards per 35 IAC 811.318. Drilling and sampling equipment was decontaminated before sampling and between sample locations to prevent cross contamination. The monitoring wells were surveyed by a licensed surveyor.

In a November 7, 2012 meeting between the Illinois Environmental Protection Agency (IEPA) and EEI, it was proposed by EEI that monitoring wells G112B and G152 be relocated because they were installed beneath fill materials that appeared to be impacting analytical results. Subsequent to that meeting and with the IEPA’s approval, wells G112B and G152 were replaced by new monitoring wells G112C and G152B in January 2013 by Natural Resource Technology, Inc. (NRT). The original monitoring wells, G112B and G152 were properly sealed and abandoned at that time.

Monitoring well construction, survey data, and screened formation are summarized in Table 1. Boring logs and well diagrams are included in Appendix B. In addition, copies of the monitoring well sealing forms submitted to the Illinois Department of Public Health are also in Appendix B. Boring depths for the original seven monitoring wells and two replacement wells were between 25 and 50 feet bgs.
A cross-sectional view of the seven current monitoring wells showing ground surface and well screen elevations is provided in Figure 6.

Following installation, the initial seven monitoring wells were developed in June 2010 by surging and pumping a minimum of five well volumes and until specific conductivity stabilized. The depth to groundwater was measured in each monitoring well using an electronic water level indicator. The two replacement wells (i.e., G112C and G152B) were developed on February 7, 2013. Groundwater levels and elevations at all of the monitoring wells at the EAP and WAP impoundments from August 2010 through May 2013 are provided in Table 2.

3.2 Groundwater Sampling and Chemical Analysis

The seven monitoring wells installed in June 2010 were sampled during nine consecutive quarterly monitoring events from August 2010 through August 2012 to establish a statistical baseline for groundwater quality. The monitoring wells were purged and sampled for the first quarterly sampling event on August 17, 2010 using disposable bailers; purging and sampling of wells in subsequent events was through low-flow sampling methods with dedicated bladder pumps. Groundwater levels measured in the seven wells for the first monitoring event ranged from 5.46 to 42.68 feet bgs (Table 2).

During the first monitoring event each well was purged until three well volumes were removed. Water quality parameters including pH, specific conductivity, and temperature were monitored in the field. In subsequent monitoring events, starting with the 4th Quarter event in November 2010, the wells were purged until the field parameters stabilized.

Following the completion of baseline sampling in the 3rd Quarter 2012, evaluation of the initial groundwater quality, and approval of the revised monitoring plan by IEPA, monitoring wells G112B and G152 were abandoned and replaced by wells G112C and G152B. Groundwater sampling of the modified monitoring well network was conducted in the 1st and 2nd Quarters of 2013 for inclusion with this hydrogeologic assessment.

Water samples were field filtered for dissolved constituents, unfiltered for totals, and preserved as required for each constituent. Sample containers were labeled, placed in an ice-filled cooler, and transported using standard chain-of-custody procedures. All groundwater sampling events from August 2010 through May 2013 were conducted by Geotechnology, Inc. and sample analyses conducted by Teklab, Inc., located in Collinsville, Illinois. The initial groundwater sampling information and laboratory analytical reports are provided in the Geotechnology, Inc. monitoring report dated October 19, 2010 (Geotechnology, 2010). The groundwater sampling reports for the 1st and 2nd Quarters of 2013 are found in the groundwater monitoring reports by Geotechnology dated March 25 and May 23, 2013, respectively.

All eleven quarters of groundwater samples were analyzed for the inorganic parameters listed under 35 IAC 620.410 with the exception of radium 226/228.[2] Table 3 lists the field, general chemistry, and metal parameters monitored along with the analytical methods.

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[2] Perchlorate and vanadium were added to 35 IAC 620.410 on October 5, 2012, after the groundwater monitoring plan for this site was approved, and therefore were not monitored.

4 SITE HYDROGEOLOGY

4.1 Lithology

The information used to describe site hydrogeology is based on the local geology obtained from published sources as presented in Section 2, supplemented with the boring data collected at the seven current monitoring well locations G101, G111, G112C, G113, G151, G152B, and G153. These seven borings ranged from 25 to 50 feet bgs. The upper portion of two other borings (G112B and G152) were determined to be through fill materials that included some coal and an unknown amount of fly ash. The monitoring wells installed within these two borings were abandoned in January 2013 and replaced by nearby wells G112C and G152B, so the lithology data from the earlier well locations is not included in the following discussion.

Other than an 8.5 foot thick silt layer intercepted at boring G152B at a depth of 4 to 12.5 feet bgs, all geologic materials below the top few feet were logged as clay, silty clay, clayey silt, and sandy clay. Out of a total of 296 feet of unlithified materials logged in the seven borings, the following percentages of materials were described:

- 1.0% fill material at the surface, described generically as “Fill” or gravel, and intercepted at well locations G113 and G151
- 3.5% silt or clayey silt, intercepted at depths of 4.5 to 12.5 feet at well G152B and 38 to 40 feet at well G153
- 5.0% sandy clay, intercepted at depths of 32 to 36 feet at well G113, 36 to 42 feet at well G151, and 32 to 38 feet at well G153
- 90.5% clay and silty clay, intercepted through most of the logged depths of all monitoring well locations at both the EAP and WAP

Bedrock was not encountered in the borings for any of the monitoring wells installed around the EAP or WAP, but limestone bedrock was intercepted as part of another study, approximately 3,500 feet northwest of the WAP, at 142 feet bgs (227 feet amsl), and at a depth of 135 feet bgs (~210 feet amsl) at plant well 4, which is 900 feet south of the EAP. The lowest elevation drilled during the hydrogeologic characterization around the two impoundments was at well G112C, which extended to 299 feet amsl.

The uppermost hydrostratigraphic unit encountered by the monitoring wells installed around the two impoundments is composed of the Equality Formation and the underlying Metropolis Formation (Figure 4), which both consist of predominantly clay and silty clay with some minor intervals of sandy clay. This Surficial Groundwater Unit (i.e., Upper Groundwater Unit) extends downward to the McNairy Formation, which was not intercepted by any of the borings advanced around the EAP and WAP.

The McNairy Formation (i.e., Lower Groundwater Unit) is the lowest unlithified unit identified in the vicinity of the Station and rests on top bedrock. Based on regional data, the McNairy Formation is typically more permeable than the overlying Equality and Metropolis Formations owing to the larger amount of sand and gravel in that unit. The McNairy Formation would be considered the second hydrostratigraphic unit at the Station. The third hydrostratigraphic unit is defined by the uppermost bedrock unit, the Salem Limestone, which is the uppermost bedrock unit underlying the Station.

4.2 Groundwater Flow

Groundwater elevation data (potentiometric levels) were collected from the monitoring wells installed within the uppermost water-bearing unit surrounding the CCP impoundments. Groundwater depths and elevations for the eleven quarterly monitoring events are provided on Table 2 and graphically illustrated in time-series plots on Figure 7 (note: only three and two sample events have been recorded for replacement monitoring wells G112C and G152B, respectively). Groundwater levels were the closest to ground surface at the three wells adjacent to the WAP (G111, G112C, and G113), with water levels for the period of August 2010 through May 2013 ranging from 2.64 to 16.65 feet bgs. Groundwater levels were deepest at the three wells adjacent to the EAP (G151, G152B, and G153), with water levels ranging from 17.08 to 42.70 feet bgs.

Groundwater conceptually flows north to south from topographically higher areas at the north end of the site toward the Ohio River which is topographically lower than the rest of the site and a regional discharge point for groundwater. Topographically upgradient from both the EAP and WAP is monitoring well G101, which is conceptually upgradient of the CCP impoundments. However, groundwater elevations in well G101 were lower than all other monitoring wells during two quarters (February 2012 and May 2013) and were the second lowest of all the wells in the remaining nine quarters (Figure 7). Similarly, G151 and G153 have lower groundwater elevations than G152B which is topographically lower than those wells. This appears to be counter-intuitive given that well G152B is further south and conceptually downgradient from the rest of the wells at the EAP. There are no known high capacity wells north of the station that could explain the groundwater elevations observed in G101 (Section 2.3.3).

Based on the lack of correlation between topography and groundwater elevations, and given that the wells are all screened clay that has very low hydraulic conductivity, it is apparent that the measured groundwater elevations are not reflective of groundwater flow patterns in the upper hydrostratigraphic unit in the vicinity of the EAP. Therefore, groundwater elevation measurements from wells G101, G151, and G153 were not included in the development of the potentiometric surface map in the area of the EAP (Figure 8).

Conversely, the three wells adjacent to the WAP (G111, G113, and G112C) appear to have a consistent correlation between topographic and groundwater elevations. Groundwater elevations are highest in the topographically upgradient well G111, which is located west of the central portion of the WAP, and lowest at the topographically downgradient well G112C, located to the south of the impoundment. Therefore, a potentiometric surface map was prepared for the 2nd Quarter 2013 utilizing the three monitoring wells adjacent to the WAP and well G152B south of the EAP (Figure 8) but excluding the non-representative groundwater elevations at background well G101 and the EAP wells G151 and G153. As seen on the map, groundwater flow in the vicinity of the WAP is south-southwest at a gradient of approximately 0.014 ft/ft.

The conceptual model for groundwater flow beneath both impoundments is southwest towards the Ohio River, with baseflow discharge from the unlithified deposits to the river during most of the year, as conceptualized in Figure 9. Given the close proximity of the CCP impoundments, particularly the EAP, to the Station property boundary and expected east-west variations in groundwater flow direction, there may be potential for off-site migration in the event of a release.

4.3 Potential for Groundwater Receptors

A potential groundwater receptor is a potable water supply well located in a position that can be interpreted as downgradient from the CCP impoundment, and screened within a geologic formation that can reasonably be expected to be a groundwater migration pathway in the event of a release.

As described in Section 2.3.3, Figure 5 shows water wells located within the vicinity of the CCP impoundments. The Station and areas within 2,500 feet both east and west of the CCP impoundments obtain drinking water from the Joppa or Ft. Massac Water Districts; although, the LaFarge cement plant to the west reportedly uses well water for sinks and showering, so these wells would be considered potable. The closest cement plant well is slightly less than 2,500 feet west of the WAP. The only downgradient water supply wells are on the Station property; however, these wells are not potable. Water quality data from these wells shows no evidence of impacts from the CCP impoundments. The closest CWS well is in the village of Joppa, approximately 3,000 feet southeast of the EAP. Water quality data for this well shows no evidence of impacts from the CCP impoundment.

5 GROUNDWATER CHEMISTRY

5.1 Overview

The purpose of the sampling and inorganic analysis of groundwater from monitoring wells at the Station was to assess background and downgradient groundwater quality; to evaluate elevated concentrations and those exceeding groundwater standards; and to identify primary factors potentially influencing groundwater quality changes spatially and temporally.

All of the groundwater quality data collected and analyzed for both field and laboratory parameters, including the full list of inorganic constituents listed in 35 IAC 620.410 except for radium 224/226,[3] are listed in Appendix C for the 11 quarters of monitoring conducted from August 2010 through May 2013. A statistical summary of all of the water quality data at each active monitoring well, including the mean, median, maximum, minimum, standard deviation, and percent non-detects, is provided in Table 4 for the period of November 2010 through May 2013. The first quarterly monitoring event (conducted in August 2010) is not included in the statistical analysis since the wells were purged and sampled using bailers, as opposed to low-flow sampling methods with dedicated bladder pumps in the subsequent 10 events. In addition, monitoring wells G112B and G152 were not included in the statistical analysis or the discussion that follows because groundwater quality in these monitoring wells was affected by the overlying fill materials, and they were subsequently replaced by G112C and G152B.

5.2 Groundwater Classification

As set forth in 35 IAC 620, any geologic material with a hydraulic conductivity of less than $1x10^{-4}$ cm/sec, and which does not meet the provisions of Section 620.210 (Class I), Section 620.230 (Class III), or Section 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater. Based on the hydrogeologic information provided below, groundwater within the shallow (<50 feet bgs) unlithified materials in which the monitoring wells are screened is classified as Class II groundwater and the groundwater quality standards set forth in 35 IAC 620.420 are the applicable groundwater quality standards.

Specifically, groundwater monitored at the CCP impoundments is from the clay, silt, and silty clay of the Equality Formation, Peoria/Roxana/Loveland Silts, or the Metropolis Formation, and does not qualify as Class I groundwater because:

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[3] Perchlorate and vanadium were added to 35 IAC 620.410 on October 5, 2012, after the groundwater monitoring plan for this site was approved, and therefore were not monitored.

- The CCP impoundments are not within the minimum setback zone of a well which serves as a potable water supply.
- The monitoring wells are screened in clay and silty clay rather than unconsolidated sand, gravel, or sand and gravel which is 5 feet or more in thickness and that contains 12 percent or less of fines.
- The monitoring wells are not screened in a sandstone which is 10 feet or more in thickness, nor are they screened in fractured carbonate which is 15 feet or more in thickness.
- Hydraulic conductivity was tested in 2010 (Geotechnology, 2010), and ranges from 1.1×10^{-6} to 7.6×10^{-5} cm/s (see table below). The geometric mean hydraulic conductivity for the screened intervals of the monitoring wells is 5.9×10^{-6} cm/s.

Monitoring Well	**Hydraulic Conductivity (cm/sec)**
G101	5.6E-06
G111	1.5E-05
G112B	1.1E-06
G113	6.1E-06
G151	3.1E-06
G152	7.6E-05
G153	1.9E-06
Geometric Mean	*5.9E-06*

Since shallow groundwater in the uppermost water-bearing unit meets the classification criteria of a Class II (General Resource) groundwater, groundwater quality monitored at the EAP and WAP was compared to the Class II groundwater standards.

5.3 Comparison of Groundwater Quality to Class II Standards

Constituents with exceedances of Class II groundwater quality standards between November 2010 and May 2013 are:

- pH: G113 (1 of 10 samples) and G151 (8 of 8 samples); and
- Boron: G112C (3 of 3 samples).

The only exceedance potentially related to the CCP impoundments is boron. Boron had three exceedances at well G112C during the three monitoring events conducted in the first two quarters of 2013, with concentrations of 3.1 to 3.3 mg/L versus a Class II groundwater quality standard of 2 mg/L.

The pH values lower than the 6.5 SU standard at wells G113 and G151 are not associated with coal ash leachate, which tends to be alkaline. Additionally, the boron concentrations at both these wells were at background concentrations (relative to G101), indicating no correlation between pH and the primary coal ash indicator parameter, boron.

5.4 Groundwater Quality Analysis

5.4.1 Primary Coal Ash Leachate Indicators

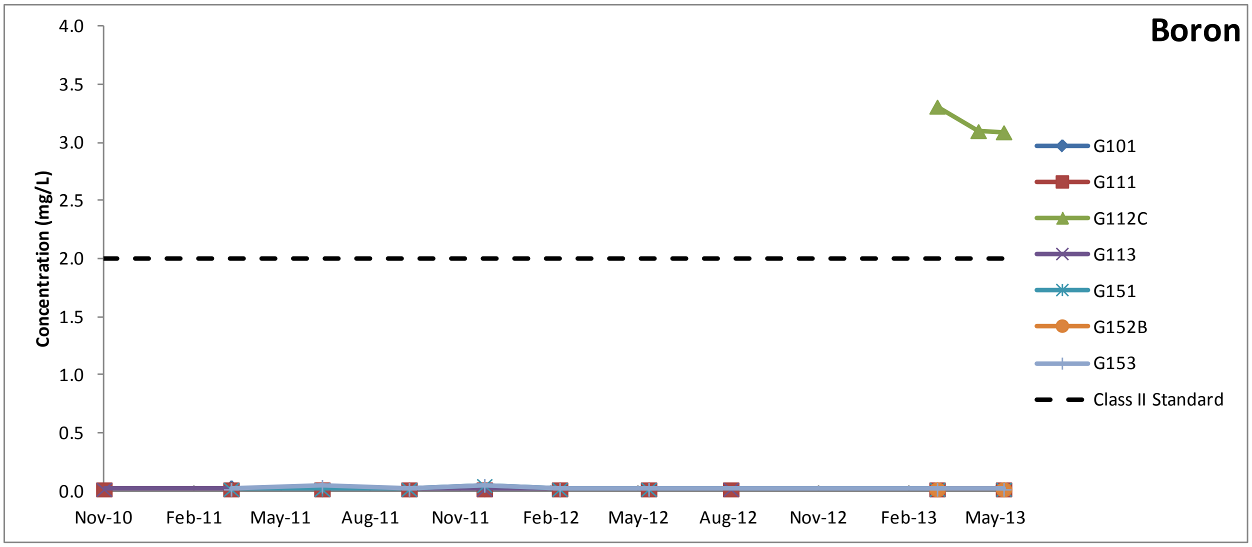
Boron and sulfate are the primary indicator constituents for coal ash leachate. Median boron concentrations in groundwater at the CCP impoundments were mostly lower than the laboratory reporting limit of 0.02 mg/L at all monitoring wells except G112C, located south of the WAP. Only 3 of 46 samples contained boron concentrations above the laboratory reporting limit at the six monitoring wells (other than G112C) collected during ten quarterly monitoring events from November 2010 through May 2013. Those three boron concentrations reported by the laboratory were less than 3 percent of the Class II groundwater quality standard of 2 mg/L.

Median sulfate concentrations were similar to background (as monitored at G101) at G111, G113, and G152B. The highest median sulfate concentrations of 103 and 104 mg/L were observed at wells G151 and G153, respectively, and the highest individual sulfate concentrations (111 mg/L in both instances) were also observed at these wells. All sulfate concentrations observed in groundwater were less than one-third of the Class II groundwater standard.

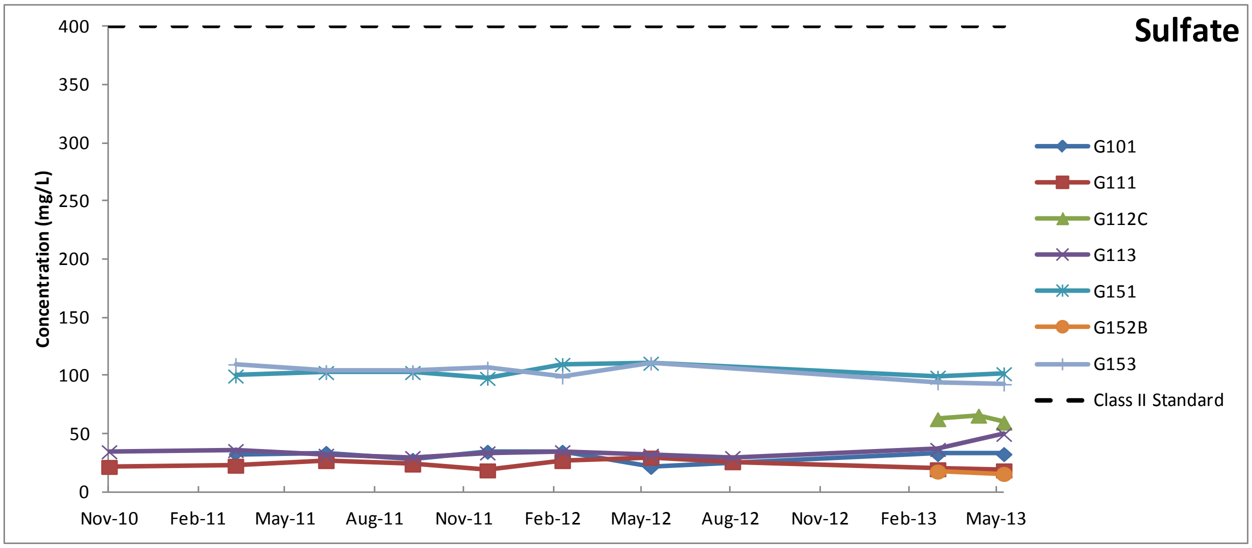
Well No.	**Median Concentration**	
	Boron mg/L	**Sulfate mg/L**
G101	<0.02	33
G111	<0.02	24
G112C	3.1	63
G113	<0.02	35
G151	<0.02	103
G152B	<0.02	17
G153	<0.02	104
IL Class II Standard	*2.0*	*400*

There is no correlation between boron and sulfate concentrations, suggesting that the sulfate concentrations are not related to the boron concentrations. The CCP impoundments are the only likely source of boron in the area, while sulfate has other potential sources. This lack of correlation suggests that boron is the better indicator constituent for the Station’s CCP impoundments than sulfate.

Boron and sulfate concentrations were stable during the 2½ year monitoring period, with neither parameter increasing or decreasing significantly. Graphs of boron and sulfate trends are shown below. Most boron concentrations were below the detection limit, with the exception of well G112C where the three samples had similar concentration and no discernible increasing or decreasing trend. Sulfate concentration trends were flat for all monitoring wells.



Graph showing boron concentration versus time. Non-detects are plotted as zero values.



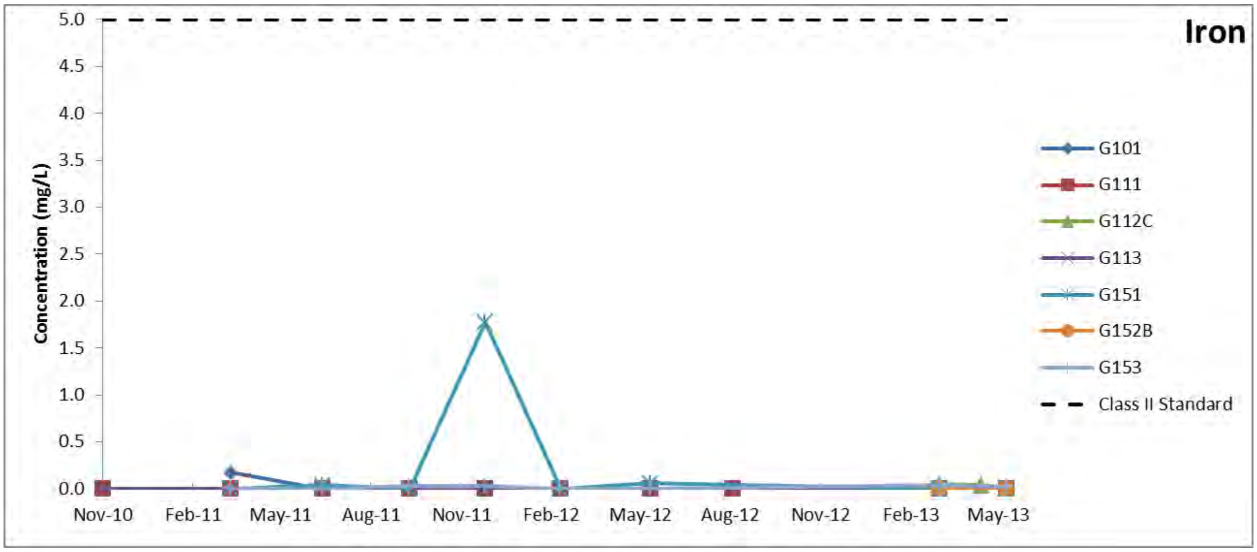
Graph showing sulfate concentrations versus time.

5.4.2 Other Constituents Potentially Impacted by Coal Ash Leachate

Median iron and manganese concentrations were higher in samples from monitoring well G112C than in samples from the other monitoring wells at the Station. G112C also had relatively high boron concentrations that suggest potential for a release from the WAP. However, iron and manganese are sensitive to redox conditions, and exhibit a tendency to have relatively high naturally occurring concentration in reduced hydrogeologic environments.

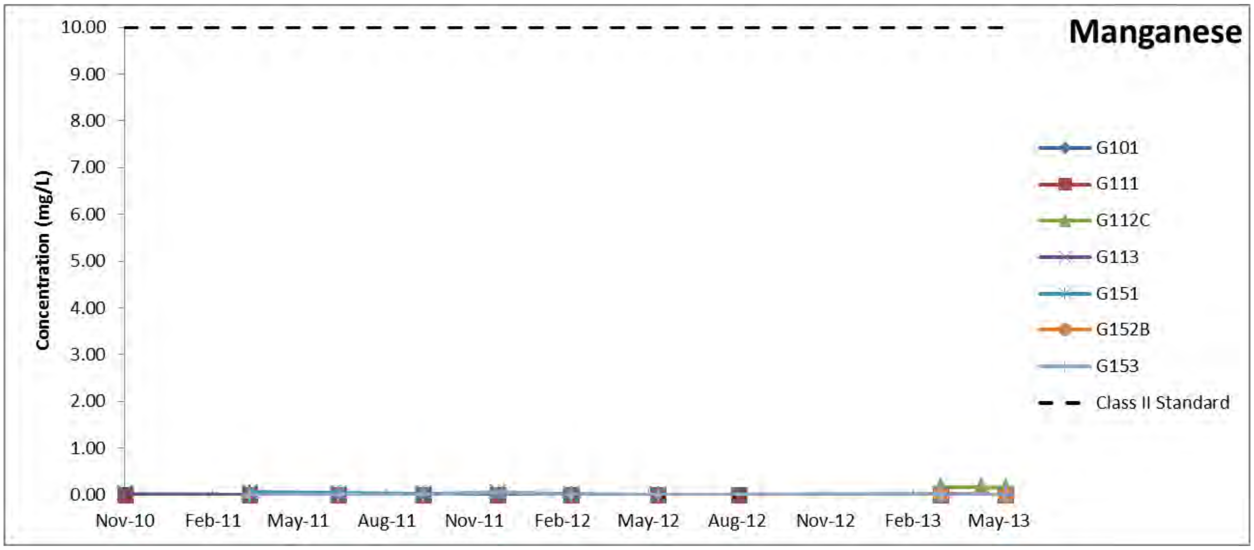
Well No.	**Median Concentration**	
	Iron mg/L	**Manganese mg/L**
G101	0.020	<0.005
G111	<0.020	<0.005
G112C	0.039	0.17
G113	<0.020	<0.005
G151	<0.020	0.027
G152B	<0.020	0.010
G153	0.021	<0.005
IL Class II Standard	*5.0*	*10*

Iron concentrations from individual samples in G112C were not high relative to iron concentrations detected in other monitoring wells (see graph below). The median concentration appears relatively high because iron was detected in two of the three samples from G112C, while it was detected in half or fewer of the samples from the other monitoring wells—causing the median value for the other wells to be the reporting limit. The low boron concentrations at the other monitoring wells indicate that iron observed in those wells is not associated with a release from the CCP impoundments, meaning it is likely naturally occurring. Therefore, the iron concentrations at G112C, which are lower than naturally occurring iron concentrations in the other monitoring wells and less than 1 percent of the Class II standard, may also be naturally occurring.



Graph showing iron concentrations vs time. Non-detects are plotted as zero values.

Manganese concentrations in G112C were higher than in the other wells. Given the close proximity of this monitoring well to the Ohio River, where reducing conditions are expected, it is possible that the manganese is naturally occurring; however, the WAP cannot be ruled out as a potential source for the manganese observed in this monitoring well because the concentrations are higher than observed in any other monitoring well, although less than 2 percent of the Class II groundwater quality standard.

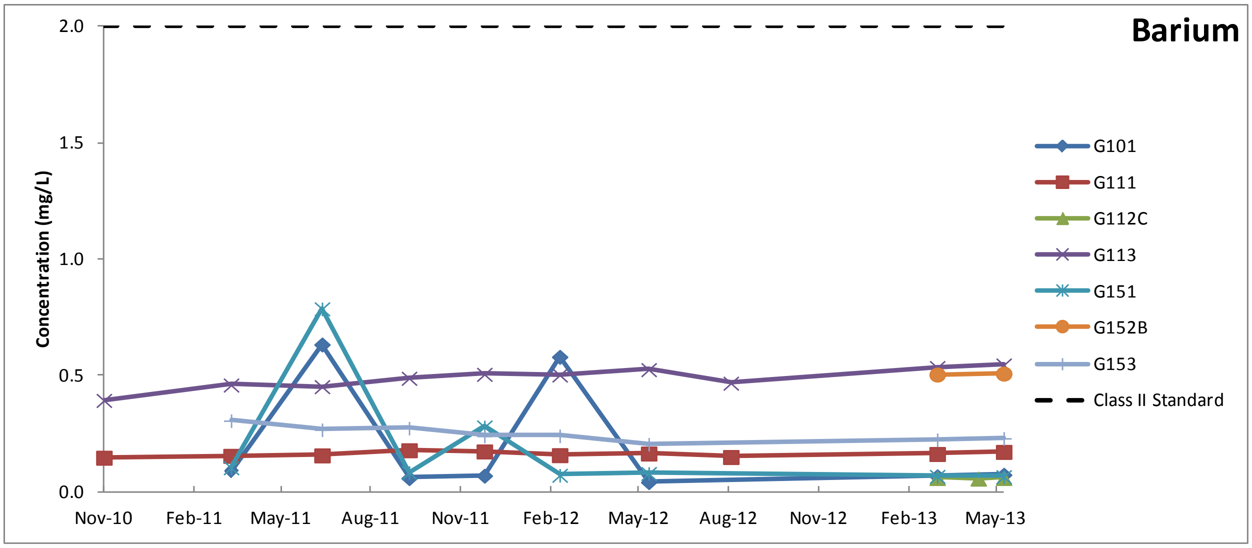


Graph showing manganese concentrations vs time. Non-detects are plotted as zero values.

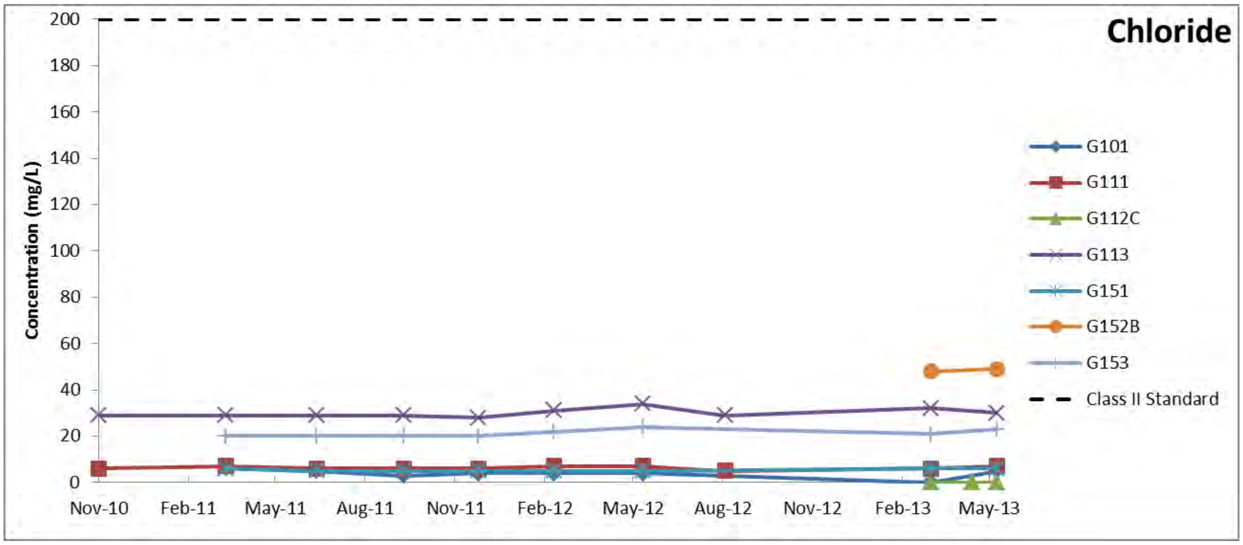
5.4.3 Constituents with Elevated Concentrations Due to Causes Other than Coal Ash Leachate

Barium, chloride, fluoride, and TDS had median concentrations in some downgradient monitoring wells that were higher than the median concentrations in background monitoring well G101. In addition, pH in G151 was low relative to the other monitoring wells. There were no exceedances of Class II groundwater quality standards for barium, chloride, fluoride, and TDS; while pH in G151 (and one sample from G113) was lower than the Class II range. Concentrations in G111, G113, G151, G152B, and G153 are not attributed to coal ash leachate because coal ash indicator concentrations in these monitoring wells are low. The concentrations of barium, chloride, fluoride, TDS, and pH in G112C are not attributed to coal ash leachate because they fall within the range of concentrations observed in the other wells, which are not attributed to a coal ash leachate source.

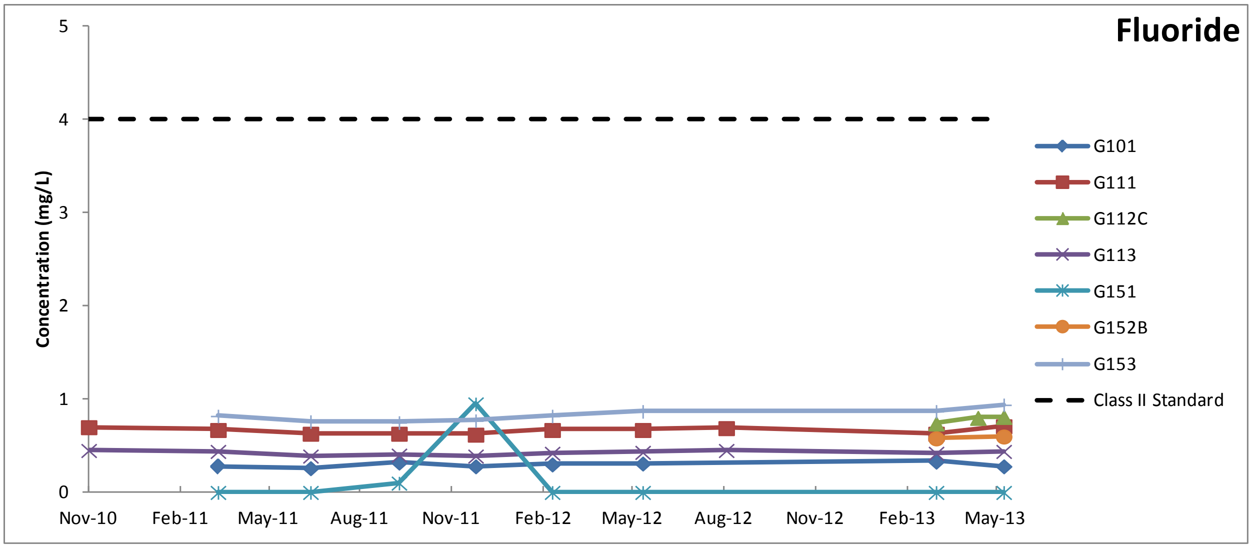
Well No.		**Median Concentration**			
	Barium mg/L	**Chloride mg/L**	**Fluoride mg/L**	**TDS mg/L**	**pH SU**
G101	0.074	4.5	0.29	245	6.97
G111	0.16	6.0	0.67	363	7.09
G112C	0.062	<5.0	0.80	432	6.79
G113	0.50	29	0.43	590	6.57
G151	0.083	5.0	<0.10	248	6.01
G152B	0.51	49	0.59	483	6.81
G153	0.24	21	0.82	433	6.93
IL Class II Standard	*2.0*	*200*	*4.0*	*1,200*	*6.5 / 9.0*



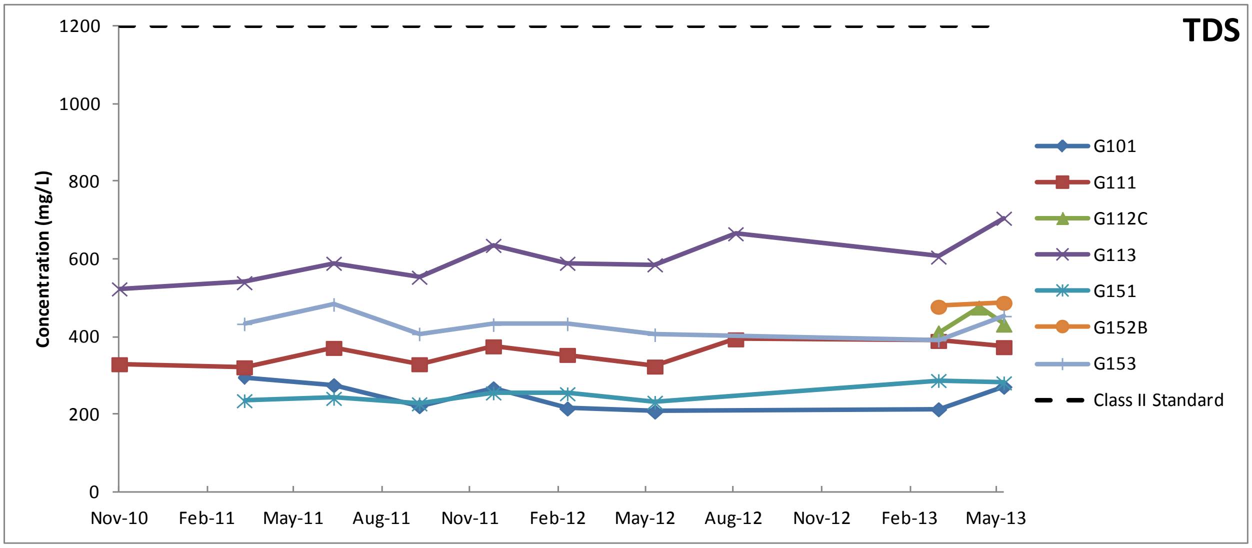
Graph showing barium concentrations vs time.



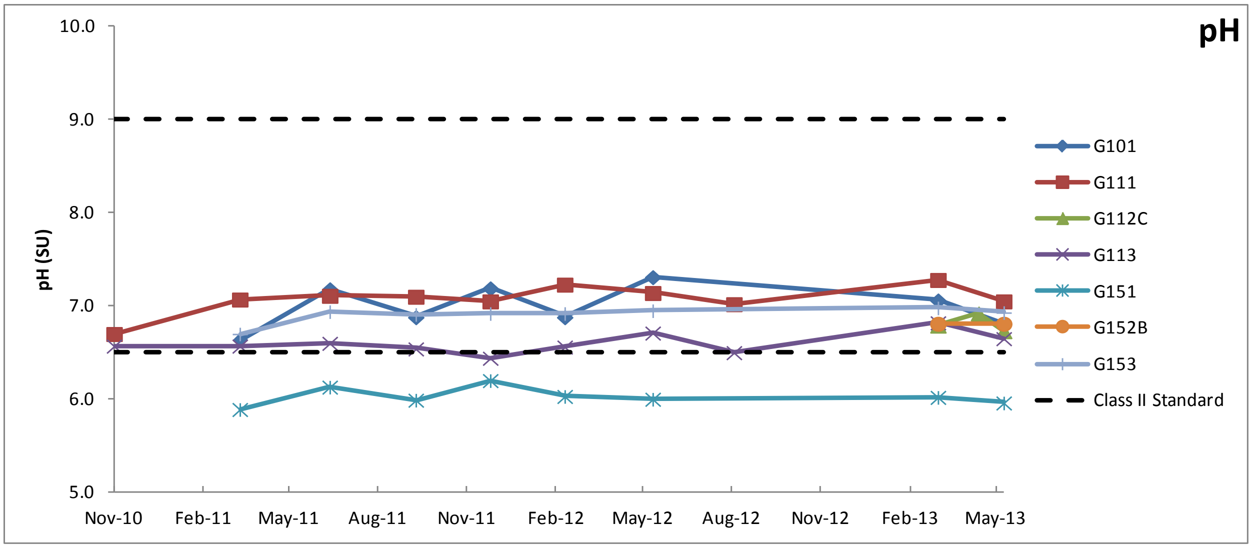
Graph showing chloride concentrations vs time. Non-detects are plotted as zero values.



Graph showing fluoride concentrations vs time. Non-detects are plotted as zero values.



Graph showing total dissolved solids concentrations vs time.

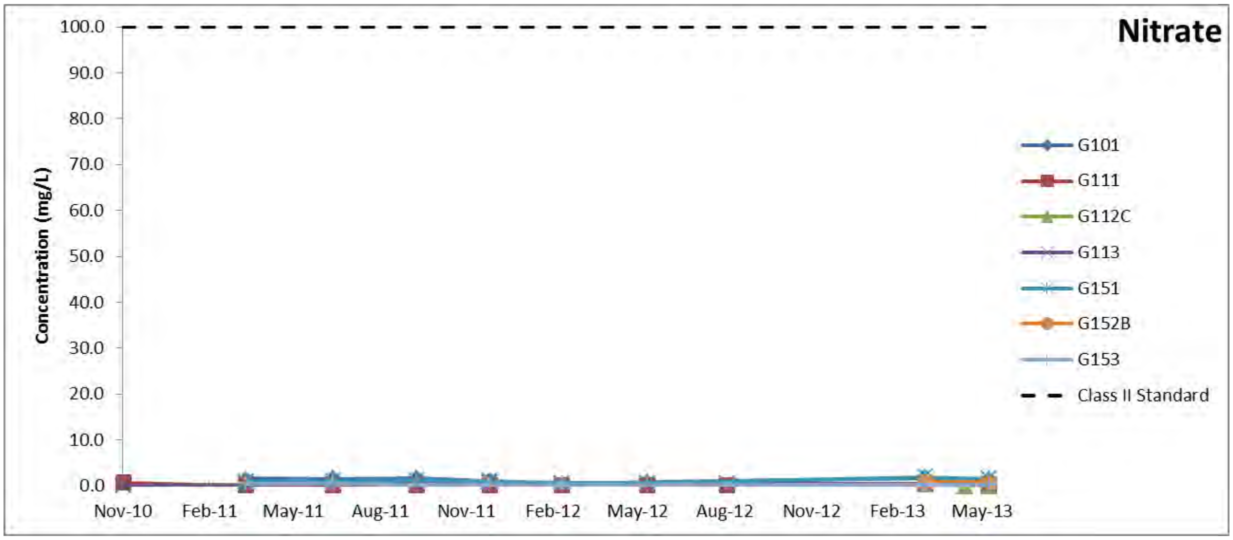


Graph showing pH values vs time.

5.4.4 Constituents with Concentrations Near or Below Background

The median nitrate concentration in background monitoring well G101 was higher than the other monitoring wells, indicating that observed nitrate concentrations are due to a source other than the CCP impoundments. The likely nitrate source is agricultural activity immediately north of this monitoring location.

Well No.	Median Concentration
	Nitrate mg/L
G101	1.5
G111	0.12
G112C	<0.05
G113	0.44
G151	1.1
G152B	0.84
G153	0.28
IL Class II Standard	*100*



Graph showing nitrate concentrations. Non-detects are plotted as zero values.

5.4.5 Constituents That Were Infrequently or Not Detected

Antimony, arsenic, beryllium, cadmium, chromium, cobalt, cyanide, lead, mercury, nickel, selenium, silver, and thallium were below their respective reporting limits in all seven monitoring wells during all ten quarterly monitoring events conducted from November 2010 through May 2013.

		Copper mg/L	**Zinc mg/L**
G101	Max	n/a	n/a
	% BDL	100%	100%
G111	Max	n/a	0.018
	% BDL	100%	80%
G112C	Max	n/a	n/a
	% BDL	100%	100%
G113	Max	n/a	n/a
	% BDL	100%	100%
G151	Max	0.011	0.017
	% BDL	87.5%	62.5
G152B	Max	n/a	n/a
	% BDL	100%	100%
G153	Max	n/a	n/a
	% BDL	100%	100%
Illinois Class II Standard		*0.65*	*10.*

Copper and zinc had reportable concentrations in one and five samples, respectively, out of 49 possible samples. However, the maximum concentrations of these constituents was more than an order of magnitude lower than the Class II standard.

6 CONCLUSIONS

6.1 Conclusions

The primary conclusion from voluntary monitoring of groundwater at the Joppa Generating Station CCP impoundments is that past operation of the west ash pond has caused a localized exceedance of Class II groundwater quality standards for boron. The west ash pond is no longer in service. There are no exceedances attributed to the east ash pond, which is currently in service. Exceedances of the Class II standard for pH were also observed, but those exceedances are not related to CCP impoundment operation. Furthermore:

- The impoundments are underlain by more than 50 feet of clay-rich deposits. These clays restrict migration of leachate from the impoundment to surrounding groundwater.
- Groundwater beneath the impoundments is conceptually interpreted to flow south toward the Ohio River.
- The exceedances attributed to former operation of the west ash pond were only observed in monitoring well G112C, immediately south and downgradient of the impoundment.
- Manganese concentrations in G112C are elevated relative to background, although less than 2 percent of the Class II groundwater quality standard, and while these concentrations may be naturally occurring due to a reduced hydrogeologic environment, the west ash pond cannot be ruled out as a source of this manganese.
- A search of water well records indicates that there are no potential receptors downgradient, and potential receptors are unlikely within 2,500 feet sidegradient of the east impoundment. Drinking water in this area is provided by the Joppa and Ft. Massac Water Districts.
- There are no potential receptors directly downgradient of the west impoundment. There are active potable wells sidegradient, and within 2,500 feet of the west impoundment. These wells are used for sinks and showers, but not drinking water supply. The property owner brings in bottled drinking water.
- The Station’s non-potable water supply wells are the closest water wells downgradient of the CCP impoundments. Water quality data for the Station wells and the closest community water supply well (3,000 feet sidegradient of the east impoundment) indicate very low boron and sulfate concentrations, indicating no evidence of impacts from the CCP impoundments after more than 50 years of service.

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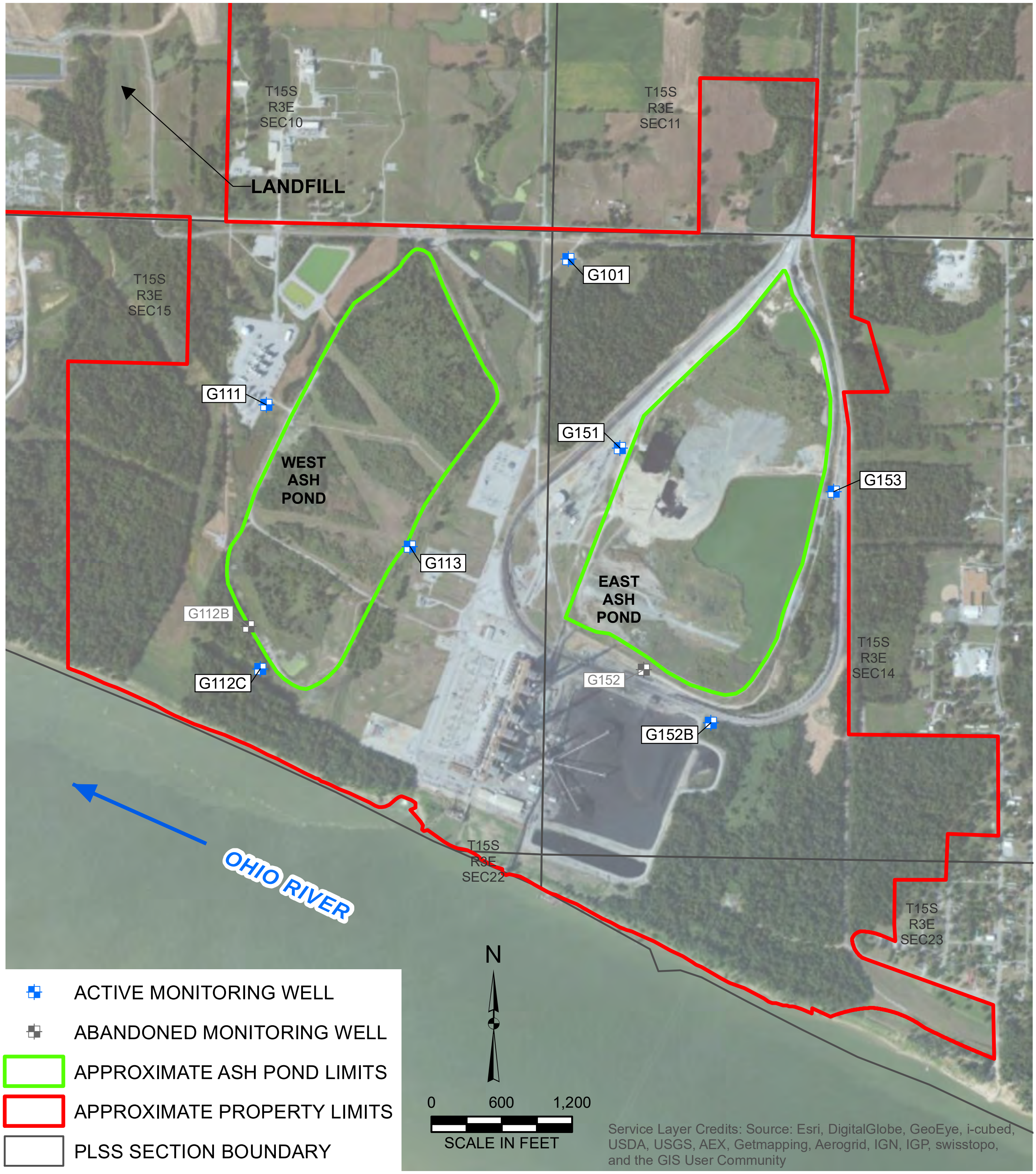
FIGURES



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BRH 6/26/13

SITE OVERVIEW MAP

PHASE I HYDROGEOLOGIC ASSESSMENT
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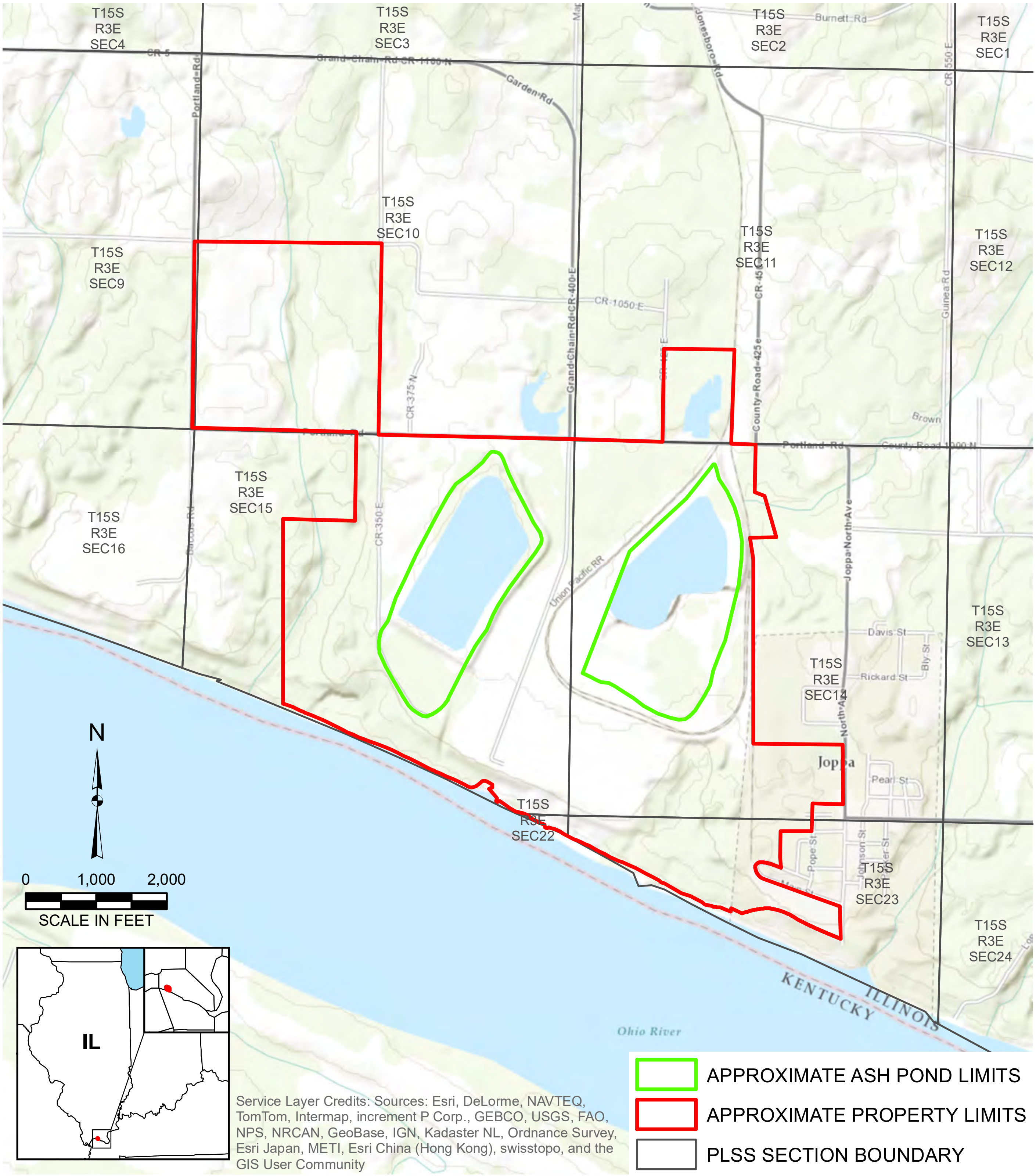
ELECTRIC ENERGY INC.
JOPPA, ILLINOIS

PROJECT NO: 2126

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



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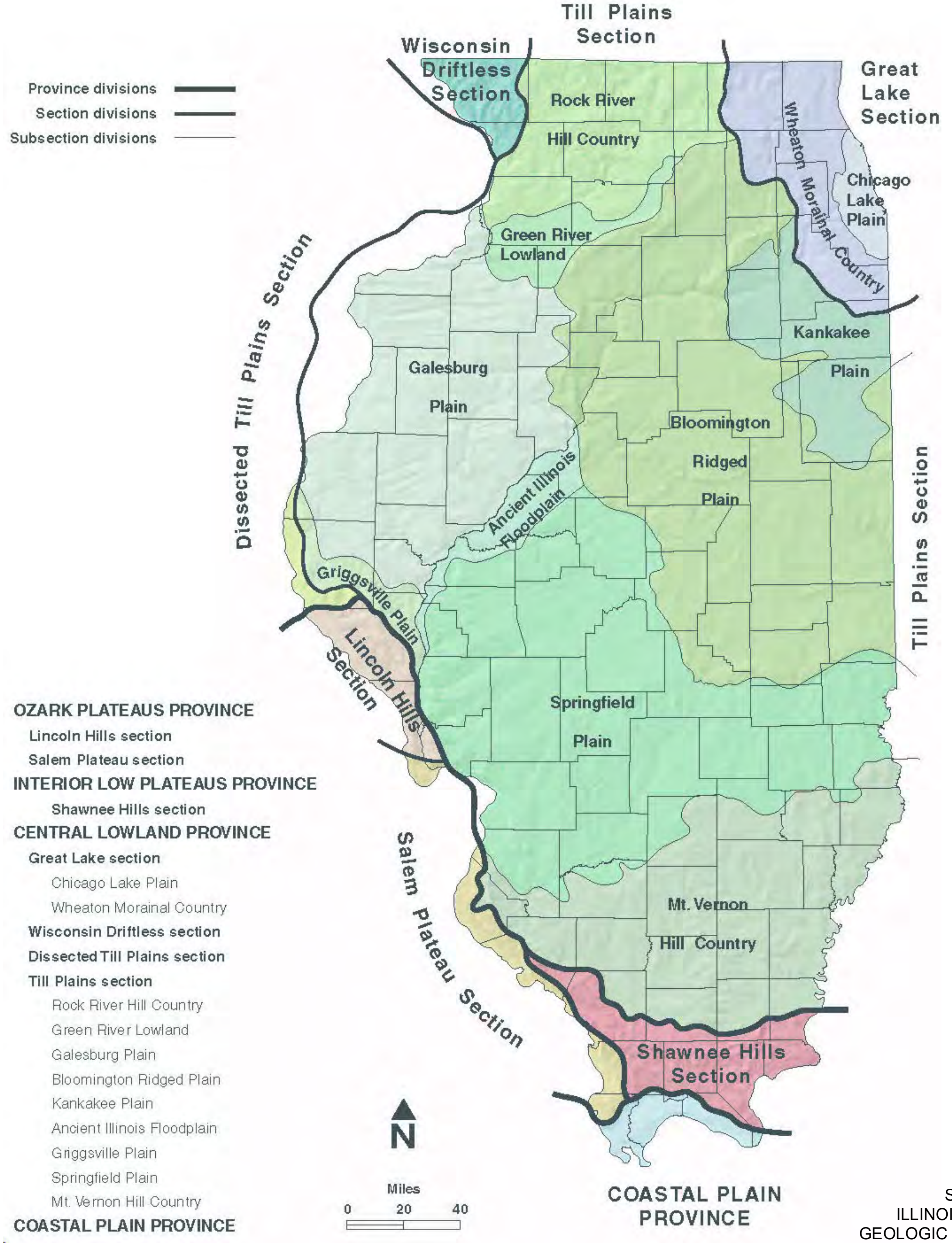
Y:\Mapping\Projects\21\2126\MXD\HydroGeo_Assmnt\Figure 2_Site Location Map.mxd Author: nkron; Date/Time: 7/22/2013, 11:14:39 AM

DRAWN BY/DATE: TDC 6/18/13 REVIEWED BY/DATE: BGH 6/21/13 APPROVED BY/DATE: BRH 6/26/13	**SITE LOCATION MAP** PHASE I HYDROGEOLOGIC ASSESSMENT JOPPA GENERATING STATION ELECTRIC ENERGY INC. JOPPA, MASSAC COUNTY, ILLINOIS	PROJECT NO: 2126 FIGURE NO: 2 NATURAL RESOURCE TECHNOLOGY



SOURCE:
ILLINOIS STATE
GEOLOGIC SURVEY

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PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

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JOPPA, ILLINOIS

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FIGURE NO: 3

NATURAL RESOURCE TECHNOLOGY

GEOLOGIC UNITS				Groundwater Hydrologic Units	Lithology in Vicinity of Impoundments
System	Series / Stage	Formation			
Quaternary	Pleistocene (Wisconsinan, Illinoian, and Pre-Illinoian Glacial Stages)	Equality or Henry	*Peoria Silt* *Roxana Silt* *Loveland Silt*	(Upper) Surficial Groundwater Unit	**Equality Fm:** Clay, Silt, minor Sand (14 to 32 feet *Henry Fm (not intercepted at Impoundments): Sand and Gravel Outwash*
			Metropolis		**Metropolis Fm:** Primarily Clay (Diamicton), Some Silty Sand and Sandy Silt, Occasional Gravel Lenses (25 to 40 feet thick)
Tertiary	Pliocene	McNairy		Lower Groundwater Unit	**McNairy Fm:** Sands, Silts, and Clays (not intercepted at Impoundments): up to 76 feet thick 3/4 miles northwest of West Ash Pond
	Miocene				
Cretaceous	Maastrichtian				
	Campanian				
Mississippian	Valmeyeran	Salem Limestone		Bedrock Groundwater Unit	Limestone

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GENERALIZED STRATIGRAPHIC COLUMN

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FIGURE NO: 4

NATURAL RESOURCE TECHNOLOGY

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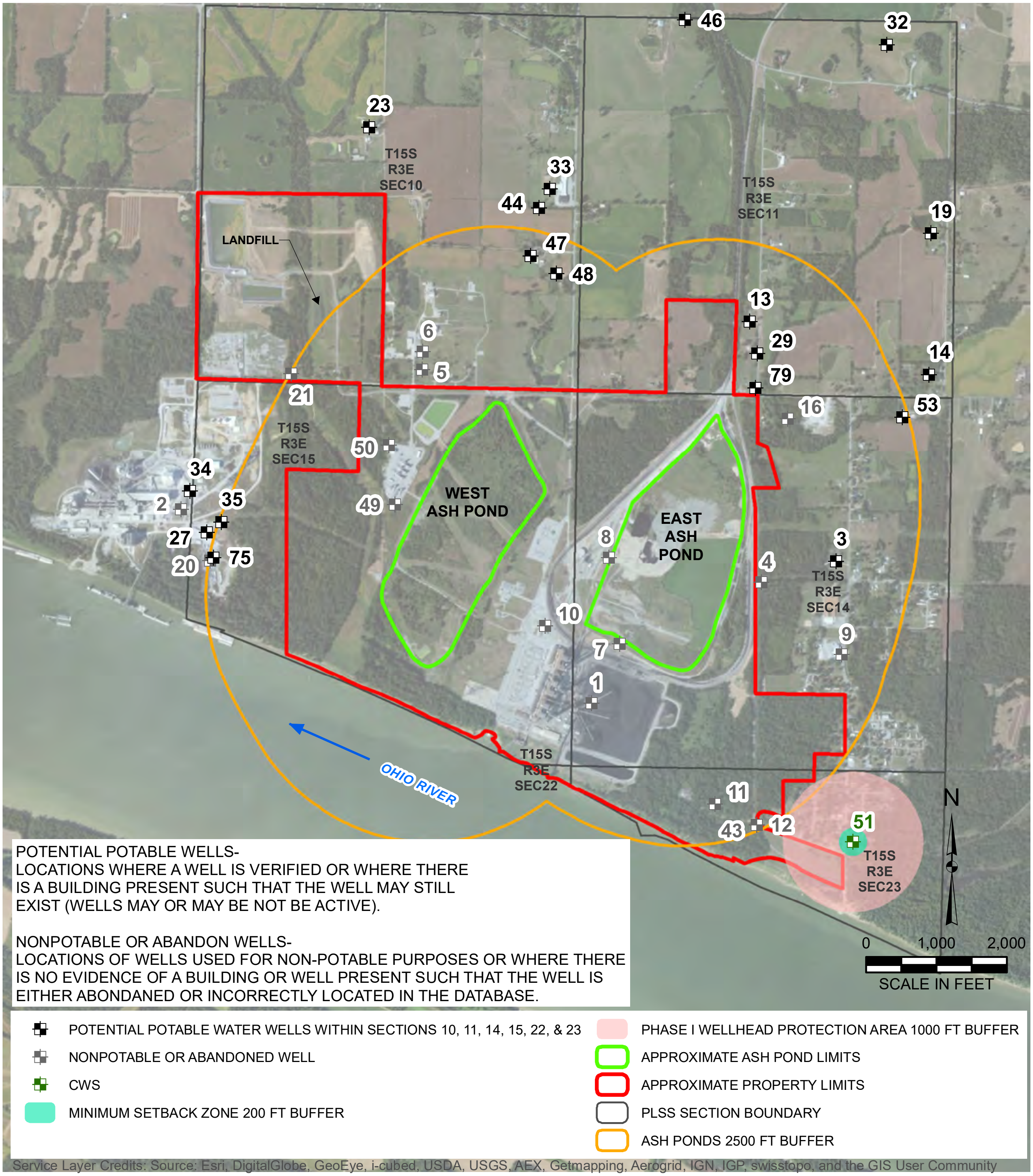

POTENTIAL POTABLE WELLS-
LOCATIONS WHERE A WELL IS VERIFIED OR WHERE THERE
IS A BUILDING PRESENT SUCH THAT THE WELL MAY STILL
EXIST (WELLS MAY OR MAY BE NOT BE ACTIVE).

NONPOTABLE OR ABANDON WELLS-
LOCATIONS OF WELLS USED FOR NON-POTABLE PURPOSES OR WHERE THERE
IS NO EVIDENCE OF A BUILDING OR WELL PRESENT SUCH THAT THE WELL IS
EITHER ABONDANED OR INCORRECTLY LOCATED IN THE DATABASE.

✚	POTENTIAL POTABLE WATER WELLS WITHIN SECTIONS 10, 11, 14, 15, 22, & 23	🟥	PHASE I WELLHEAD PROTECTION AREA 1000 FT BUFFER
✚	NONPOTABLE OR ABANDONED WELL	▭	APPROXIMATE ASH POND LIMITS
✚	CWS	▭	APPROXIMATE PROPERTY LIMITS
▬	MINIMUM SETBACK ZONE 200 FT BUFFER	▭	PLSS SECTION BOUNDARY
		▭	ASH PONDS 2500 FT BUFFER

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BRH 7/19/13
APPROVED BY/DATE:
BRH 7/22/13

WELL SEARCH RESULTS

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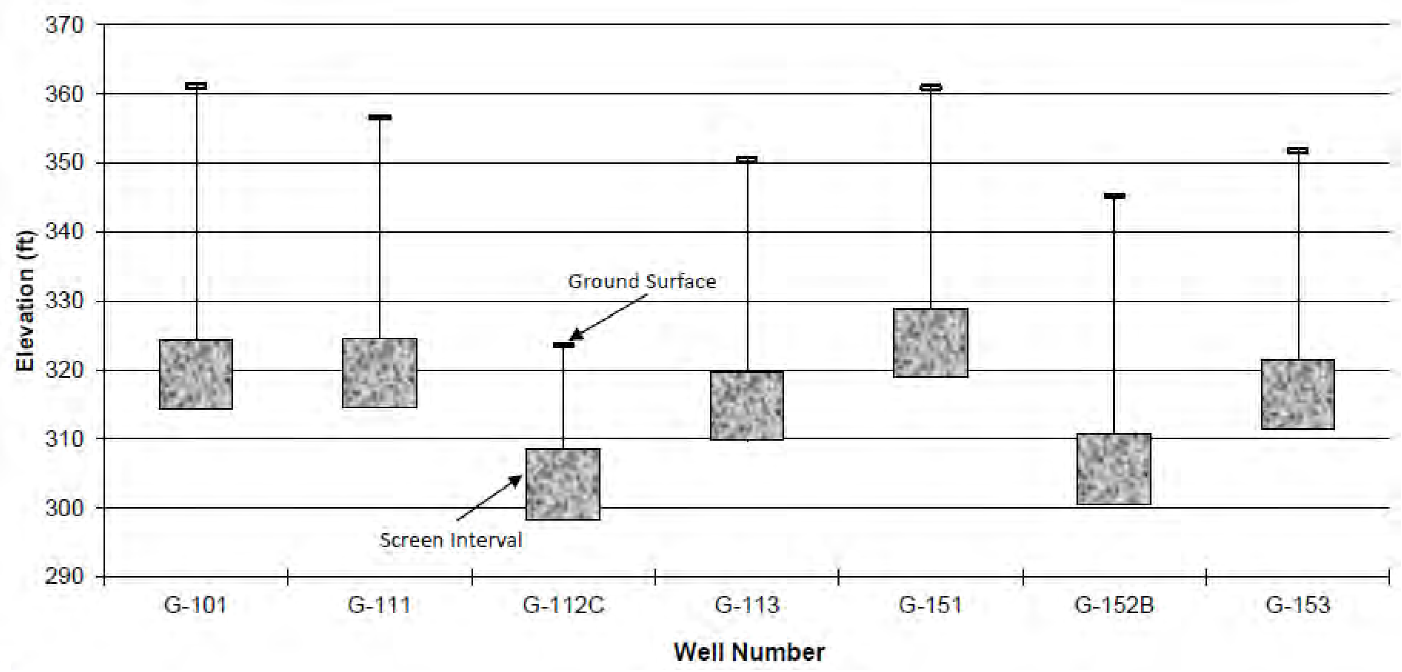
JOPPA, ILLINOIS

PROJECT NO: 2126

FIGURE NO: 5

NATURAL
RESOURCE
TECHNOLOGY



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MONITORING WELL SCREEN ELEVATIONS

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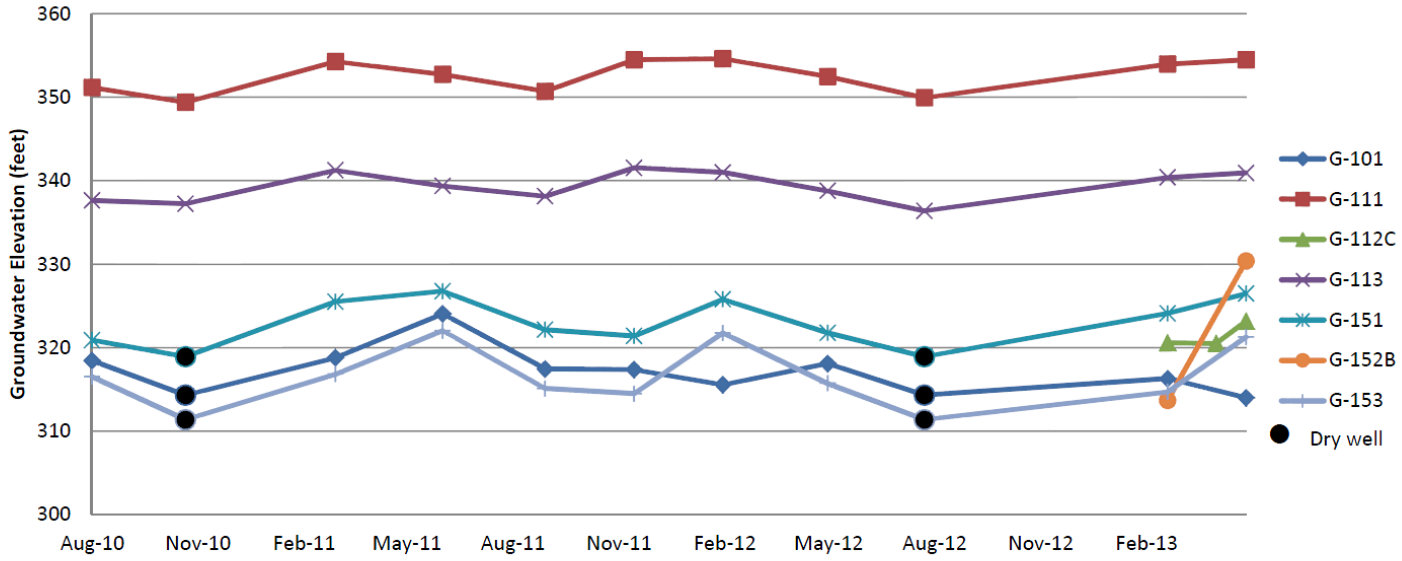
JOPPA, ILLINOIS

PROJECT NO: 2126

FIGURE NO: 6

NATURAL
RESOURCE
TECHNOLOGY

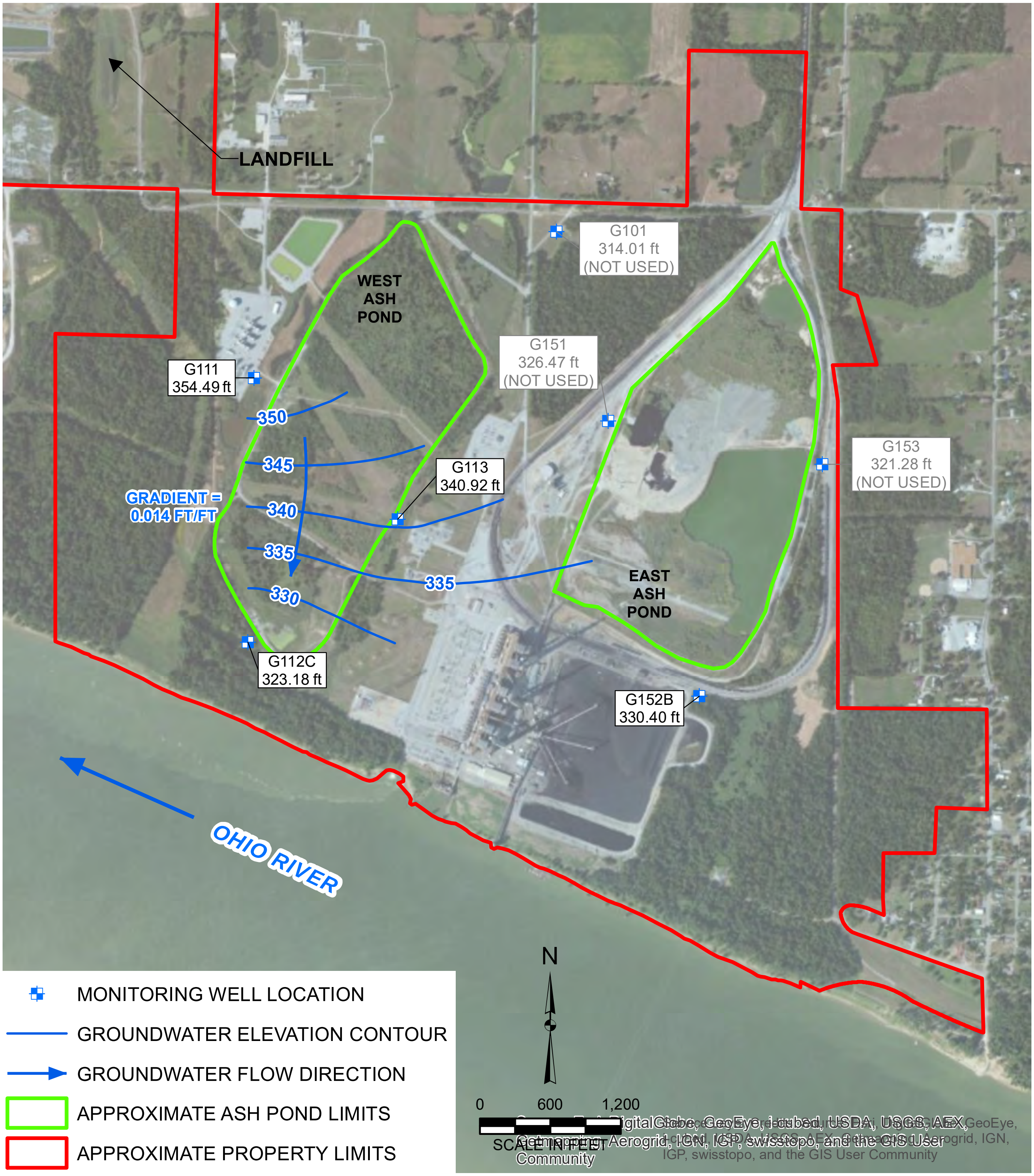
Y:\Mapping\Projects\21\2126\MXD\HydroGeo_Assmnt\Figure 6_Monitoring Well Screen Elevations.mxd Author: nkron; Date/Time: 7/22/2013, 11:17:53 AM



NOTE: DRY WELLS NOTED WITH DIFFERENT MARKER

DRAWN BY/DATE: TDC 6/18/13 REVIEWED BY/DATE: BGH 6/21/13 APPROVED BY/DATE: BRH 6/26/13	GROUNDWATER ELEVATION TIME SERIES PHASE I HYDROGEOLOGIC ASSESSMENT JOPPA GENERATING STATION ELECTRIC ENERGY INC. JOPPA, ILLINOIS	PROJECT NO: 2126 FIGURE NO: 7 NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\21\2126\MXD\HydroGeo_Assmnt\Figure 7_Groundwater Elevation Time Series.mxd Author: nkron; Date/Time: 7/22/2013, 11:18:26 AM



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APPROVED BY/DATE:
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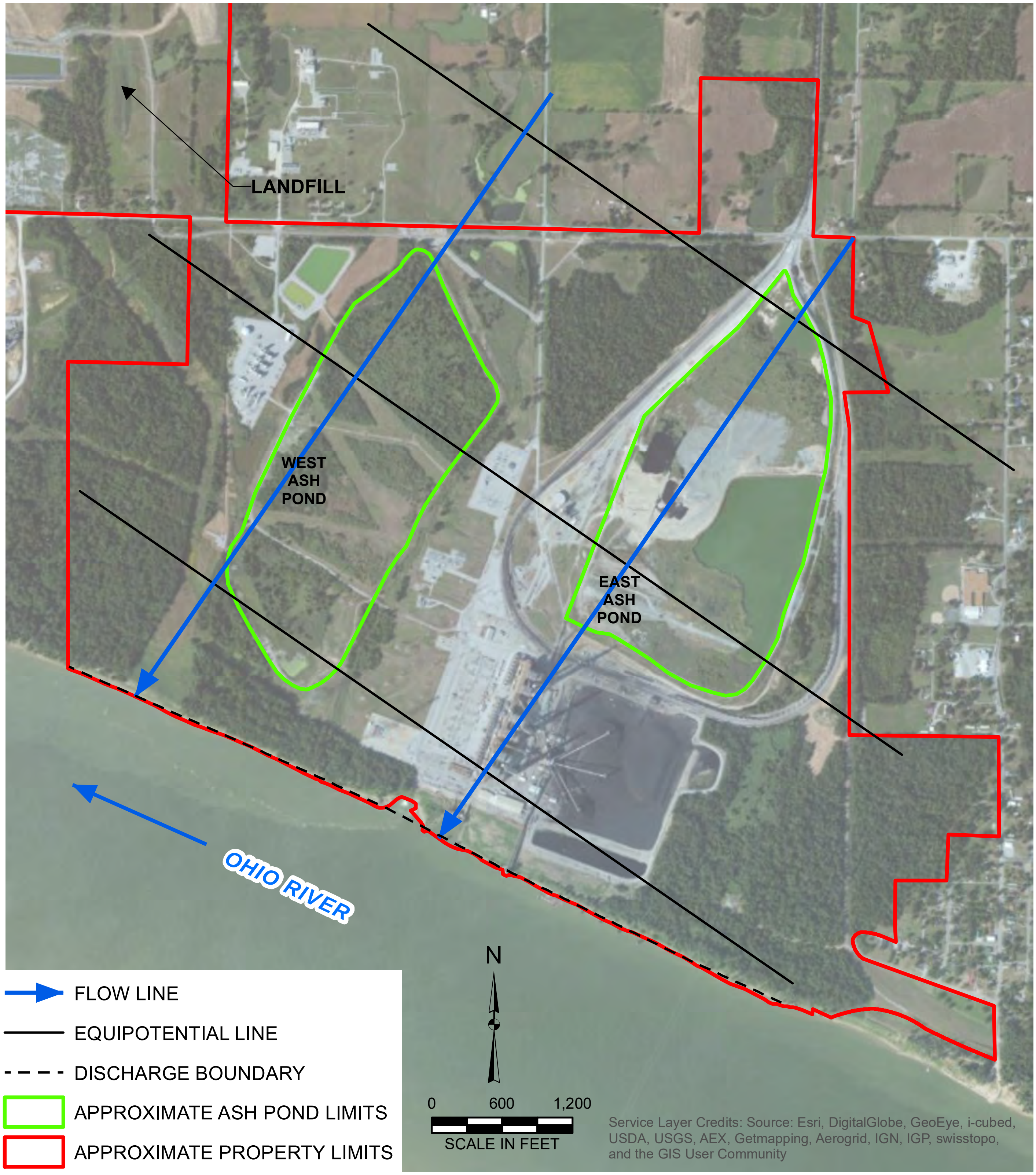
GROUNDWATER ELEVATIONS AND CONTOURS
MAY 2013

PHASE I HYDROGEOLOGIC ASSESSMENT
JOPPA GENERATING STATION
ELECTRIC ENERGY INC.
JOPPA, ILLINOIS

PROJECT NO: 2126

FIGURE NO: 8

NATURAL RESOURCE TECHNOLOGY



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Y:\Mapping\Projects\21\2126\MXD\HydroGeo_Assmnt\Figure 9_Conceptual Groundwater Flow System.mxd Author: nkron; Date/Time: 7/22/2013, 11:20:04 AM

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CONCEPTUAL GROUNDWATER FLOW SYSTEM

PHASE I HYDROGEOLOGIC ASSESSMENT
JOPPA GENERATING STATION
ELECTRIC ENERGY INC.
JOPPA, ILLINOIS

PROJECT NO: 2126

FIGURE NO: 9

NATURAL RESOURCE TECHNOLOGY

TABLES

Table 1. Monitoring Well Construction Details

Phase I Hydrogeologic Assessment
Joppa Generating Station
Electric Energy Inc.
Joppa, IL

Monitoring Well Number	Installation Date	Top of Well Riser Elevation	Ground Elevation	Screen Top Depth (BGS)	Screen Bottom Depth (BGS)	Slotted Screen Length	Screen Top Elevation	Screen Bottom Elevation	Bottom of Boring Elevation	Total Boring Depth	Screened Formation
G101[1]	06/01/10	363.69	361.12	36.80	46.80	10.00	324.32	314.32	309.1	52.0	Silty Clay
G111[1]	06/24/10	359.17	356.63	32.13	42.13	10.00	324.50	314.50	311.6	45.0	Silty Clay
G112C[2]	01/29/13	325.82	323.60	15.00	25.00	10.00	298.30	308.60	298.6	25.0	Silty Clay
G113[1]	06/25/10	353.04	350.46	30.69	40.69	10.00	319.77	309.77	306.9	43.6	Silty/Sandy Clay
G151[1]	06/19/10	363.60	360.90	31.97	41.97	10.00	328.93	318.93	315.9	45.0	Silty/Sandy Clay
G152B[2]	01/30/13	347.48	345.20	34.40	44.40	10.00	300.60	310.80	300.7	44.5	Silty Clay
G153[1]	06/18/10	354.65	351.73	30.35	40.35	10.00	321.38	311.38	308.1	43.6	Silty/Sandy Clay & Silt
G112B[1][A]	06/20/10	347.62	345.16	32.41	42.41	10.00	312.75	302.75	300.0	45.2	Silty Clay
G152[1][B]	06/21/10	351.18	348.55	13.94	23.94	10.00	334.61	324.61	321.7	26.9	Silty Clay

Monitoring Well Number	Northing[3]	Easting[3]
G101	202,050.25	831,716.43
G111	200,806.11	829,139.79
G112C	198,552.26	829,088.33
G113	199,599.53	830,364.44
G151	200,437.41	832,154.25
G152B	198,547.23	832,358.44
G153	200,067.47	833,979.90
G112B	198,913.55	828,988.60
G152	198,547.23	832,358.44

Notes:

BGS = below ground surface.

All depths are in feet. All elevation measurements are in feet relative to NAVD 1988.

All wells constructed with 2-inch diameter, 10-slot, Schedule 40 PVC screens.

[1] Drilling and well installation by Geotechnology, Inc.

[2] Drilling and well installation by Natural Resource Technology, Inc.

[3] Coordinates are referenced to Illinois State Plane Coordinates, East Zone - NAD 1983.

[A] Well sealed and abandoned on 1/28/13.

[B] Well sealed and abandoned on 1/29/13.

Table 2. Groundwater Levels and Elevations

Phase I Hydrogeologic Assessment
Joppa Generating Station
Electric Energy Inc.
Joppa, IL

Monitoring Well Number	Ground Surface Elevation[1] (feet)	Measuring Point Elevation[1,2] (feet)	Groundwater Depth (feet below measuring point)											
			1	2	3	4	5	6	7	8	9	10	11	12
			8/16/10	11/5/10	3/15/11	6/16/11	9/13/11	11/29/11	2/14/12	5/15/12	8/7/12	3/6-7/13	04/17/13	5/13-14/13
G101	361.12	363.69	45.25	dry	44.88	39.64	46.24	46.32	48.12	45.59	dry	47.40	- -	49.68
G111	356.63	359.17	8.00	9.77	4.90	6.42	8.45	4.68	4.55	6.68	9.22	5.20	- -	4.68
G112C[3]	323.60	325.82	- -	- -	- -	- -	- -	- -	- -	- -	- -	5.25	5.31	2.64
G113	350.46	353.04	15.40	15.80	11.80	13.66	14.90	11.50	12.05	14.25	16.65	12.65	- -	12.12
G151	360.90	363.60	42.70	dry	38.10	36.83	41.45	42.20	37.80	41.82	dry	39.49	- -	37.13
G152B[3]	345.20	347.48	- -	- -	- -	- -	- -	- -	- -	- -	- -	33.80	- -	17.08
G153	351.73	354.65	38.13	dry	37.82	32.62	39.55	40.17	32.90	38.92	dry	39.95	- -	33.37
G112B[4]	345.16	347.62	26.42	26.18	15.50	22.03	26.05	20.80	9.72	24.01	28.45	- -	- -	- -
G152[4]	348.55	351.18	9.21	5.42	2.20	3.92	5.34	22.50	18.20	5.07	8.03	- -	- -	- -

Monitoring Well Number	Groundwater Depth (feet below ground surface)											
	1	2	3	4	5	6	7	8	9	10	11	12
	8/16/10	11/5/10	3/15/11	6/16/11	9/13/11	11/29/11	2/14/12	5/15/12	8/7/12	3/6-7/13	04/17/13	5/13-14/13
G101	42.68	dry	42.31	37.07	43.67	43.75	45.55	43.02	dry	44.83	- -	47.11
G111	5.46	7.23	2.36	3.88	5.91	2.14	2.01	4.14	6.68	2.66	- -	2.14
G112C[3]	- -	- -	- -	- -	- -	- -	- -	- -	- -	3.03	3.09	0.42
G113	12.82	13.22	9.22	11.08	12.32	8.92	9.47	11.67	14.07	10.07	- -	9.54
G151	40.00	dry	35.40	34.13	38.75	39.50	35.10	39.12	dry	36.79	- -	34.43
G152B[3]	- -	- -	- -	- -	- -	- -	- -	- -	- -	31.52	- -	14.80
G153	35.21	dry	34.90	29.70	36.63	37.25	29.98	36.00	dry	37.03	- -	30.45
G112B[4]	23.96	23.72	13.04	19.57	23.59	18.34	7.26	21.55	25.99	- -	- -	- -
G152[4]	6.58	2.79	-0.43	1.29	2.71	19.87	15.57	2.44	5.40	- -	- -	- -

Monitoring Well Number	Groundwater Elevation (feet)											
	1	2	3	4	5	6	7	8	9	10	11	12
	8/16/10	11/5/10	3/15/11	6/16/11	9/13/11	11/29/11	2/14/12	5/15/12	8/7/12	3/6-7/13	04/17/13	5/13-14/13
G101	318.44	dry	318.81	324.05	317.45	317.37	315.57	318.10	dry	316.29	- -	314.01
G111	351.17	349.40	354.27	352.75	350.72	354.49	354.62	352.49	349.95	353.97	- -	354.49
G112C[3]	- -	- -	- -	- -	- -	- -	- -	- -	- -	320.57	320.51	323.18
G113	337.64	337.24	341.24	339.38	338.14	341.54	340.99	338.79	336.39	340.39	- -	340.92
G151	320.90	dry	325.50	326.77	322.15	321.40	325.80	321.78	dry	324.11	- -	326.47
G152B[3]	- -	- -	- -	- -	- -	- -	- -	- -	- -	313.68	- -	330.40
G153	316.52	dry	316.83	322.03	315.10	314.48	321.75	315.73	dry	314.70	- -	321.28
G112B[4]	321.20	321.44	332.12	325.59	321.57	326.82	337.90	323.61	319.17	- -	- -	- -
G152[4]	341.97	345.76	348.98	347.26	345.84	328.68	332.98	346.11	343.15	- -	- -	- -

Notes:

[1] All depth and elevation measurements are in feet relative to NAVD 1988.

[2] Measuring point is top of well casing.

[3] Installed January 2013.

[4] Sealed and abandoned January 2013.

-0.43	Negative number indicates groundwater level in well is above ground surface.
- -	No data - monitoring well not installed until January 2013 or monitoring well replaced with new well in January 2013.

Table 3. Field and Laboratory Groundwater Monitoring Parameters

Phase I Hydrogeologic Assessment
Joppa Generating Station
Electric Energy Inc.
Joppa, IL

Field Parameters			**Analysis Method**
Groundwater Elevation		in-situ	
pH (field)	[1]	in-situ	SM 21st ed. 4500-H$^+$
Specific Conductance		in-situ	SM 21st ed. 2520-B
Temperature		in-situ	SM 21st ed. 2550
General Chemistry Parameters			**Analysis Method**
Chloride	[1]	dissolved	SW846 9251
Cyanide	[1]	total	SW846 9012A
Fluoride	[1]	total	SW846 9214
Nitrogen, Nitrate (as N)	[1]	dissolved	SM4500-NO3
Sulfate	[1]	dissolved	ASTM516-90,02
Total Dissolved Solids	[1]	dissolved	SM21 2540 C
METALS			**Analysis Method**
Antimony	[1]	dissolved	SW846 3005A, 7041 (by GFAA)
Arsenic	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Barium	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Beryllium	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Boron	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Cadmium	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Chromium	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Cobalt	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Copper	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Iron	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Lead	[1]	dissolved	SW846 3005A, 7421 (by GFAA)
Manganese	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Mercury	[1]	dissolved	SW846 7470A
Nickel	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Selenium	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Silver	[1]	dissolved	SW846 3005A, 6010B (by ICP)
Thallium	[1]	dissolved	SW846 3005A, 7841 (by GFAA)
Zinc	[1]	dissolved	SW846 3005A, 6010B (by ICP)

Notes:

[1] Groundwater quality parameters for Class I: Potable Resource Groundwater
(IAC 35 Part 620 Section 410).

Samples filtered and preserved in field.

Table 4. Statistical Summary of Groundwater Quality Data for Period of November 2010 - May 2013

Phase I Hydrogeologic Assessment
Joppa Generating Station
Electric Energy Inc.
Joppa, IL

Parameter, Unit	Class II GW Standard	**Monitoring Well G101 (N = 8)**						**Monitoring Well G111 (N = 10)**						**Monitoring Well G112C (N = 3)**						**Monitoring Well G113 (N = 10)**					
		Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects
Field Parameters																									
pH, Std Units	6.5 / 9.0*	6.99	6.97	7.31	6.63	0.23	N/A	7.08	7.09	7.28	6.70	0.155	N/A	6.81	6.79	6.92	6.73	0.097	N/A	6.60	6.57	6.82	6.44	0.11	N/A
General Chemistry Parameters																									
Chloride (diss), mg/L	200	4.5	4.5	6.0	3.0	0.93	0	6.3	6.0	7.0	5.0	0.67	0	nc	nc	nc	nc	nc	100	30	29	34	28	1.8	0
Cyanide (total), mg/L	0.6	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Fluoride (total), mg/L	4.0	0.29	0.29	0.33	0.26	0.025	0	0.66	0.67	0.71	0.62	0.033	0	0.78	0.80	0.81	0.74	0.038	0	0.42	0.43	0.45	0.39	0.023	0
Nitrate (diss), mg/L	100	1.3	1.5	1.7	0.28	0.51	0	0.19	0.12	0.72	<0.050	0.21	10	0.15	0.050	0.34	<0.050	0.17	67	0.43	0.44	0.68	0.14	0.15	0
Sulfate (diss), mg/L	400	32	33	35	22	4.4	0	24	24	30	19	3.8	0	63	63	66	60	3.0	0	35	35	50	30	5.8	0
Total Dissolved Solids, mg/L	1,200	246	245	294	208	34	0	357	363	394	322	28	0	440	432	476	412	33	0	600	590	706	524	57	0
Metals (dissolved)																									
Antimony, mg/L	0.024	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Arsenic, mg/L	0.20	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Barium, mg./L	2.0	0.20	0.074	0.64	0.044	0.25	0	0.16	0.16	0.18	0.15	0.011	0	0.061	0.062	0.062	0.059	0.0	0	0.49	0.50	0.55	0.40	0.046	0
Beryllium, mg/L	0.5	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Boron, mg/L	2.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	3.2	3.1	3.3	3.1	0.12	0	nc	nc	nc	nc	nc	100
Cadmium, mg/L	0.05	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Chromium, mg/L	1.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Cobalt, mg/L	1.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Copper, mg/L	0.65	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Iron, mg/L	5.0	0.039	0.020	0.17	<0.020	0.054	12.5	nc	nc	nc	nc	nc	100	0.036	0.039	0.048	<0.020	0.015	33.3	nc	nc	nc	nc	nc	100
Lead, mg/L	0.1	0.0030	0.0020	<0.0070	<0.0020	0.0023	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Manganese, mg/L	10	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	0.17	0.17	0.18	0.15	0.013	0	0.0074	0.0050	0.025	<0.0050	0.0063	70
Mercury, mg/L	0.010	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Nickel, mg/L	2.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Selenium, mg/L	0.05	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Silver, mg/L	ns	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Thallium, mg/L	0.020	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Zinc, mg/L	10	nc	nc	nc	nc	nc	100	0.011	0.010	0.018	<0.010	0.0026	80	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100

Notes:
N = number of observations (does not include August 2010 sampling event, which was not representative due to bailing of monitoring wells; all other events used low-flow sampling methods with dedicated bladder pumps).
ns = no Class II Groundwater Quality Standard for Parameter.
* Lower and Upper limits for pH is the Class I groundwater quality standard of 6.5 and 9.0 Standard Units.
Groundwater quality standards for Class II: Potable Resource Groundwater (IAC 35 Part 620 Section 420).
Statistics calculated with replacement of non-detect concentrations at 1X reported non-detect concentration: nc indicates that statistics were not calculated because all values were below reporting levels.

🟧 Exceeds Class II Groundwater Quality Standard.	🟩 Parameter is 100% Non-Detect in all 7 monitoring wells.

Table 4. Statistical Summary of Groundwater Quality Data for Period of November 2010 - May 2013

Phase I Hydrogeologic Assessment
Joppa Generating Station
Electric Energy Inc.
Joppa, IL

		Monitoring Well G151 (N = 8)						Monitoring Well G152B (N = 2)						Monitoring Well G153 (N = 8)					
Parameter, Unit	Class II GW Standard	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects	Mean	Median	Maximum	Minimum	Std Dev	% of Non-Detects
Field Parameters																			
pH, Std Units	6.5 / 9.0*	6.03	6.01	6.20	5.89	0.10	N/A	6.81	6.81	6.81	6.81	0.00	N/A	6.91	6.93	6.98	6.70	0.086	N/A
General Chemistry Parameters																			
Chloride (diss), mg/L	200	5.4	5.0	6.0	5.0	0.52	0	49	49	49	48	0.71	0	21	21	24	20	1.6	0
Cyanide (total), mg/L	0.6	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Fluoride (total), mg/L	4.0	0.21	0.10	0.95	<0.10	0.30	75	0.59	0.59	0.60	0.58	0.014	0	0.83	0.82	0.94	0.75	0.066	0
Nitrate (diss), mg/L	100	1.2	1.1	2.0	0.62	0.45	0	0.84	0.84	0.87	0.82	0.032	0	0.31	0.28	0.46	0.21	0.075	0
Sulfate (diss), mg/L	400	103	103	111	98	4.8	0	17	17	18	16	1.4	0	103	104	111	93	6.8	0
Total Dissolved Solids, mg/L	1,200	252	248	288	228	23	0	483	483	488	478	7.1	0	431	433	484	392	29	0
Metals (dissolved)																			
Antimony, mg/L	0.024	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Arsenic, mg/L	0.20	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Barium, mg./L	2.0	0.19	0.083	0.79	0.068	0.25	0	0.51	0.51	0.51	0.51	0.0028	0	0.25	0.24	0.31	0.21	0.032	0
Beryllium, mg/L	0.5	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Boron, mg/L	2.0	0.024	0.020	0.052	<0.020	0.011	87.5	nc	nc	nc	nc	nc	100	0.028	0.020	<0.020	<0.020	0.014	75
Cadmium, mg/L	0.05	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Chromium, mg/L	1.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Cobalt, mg/L	1.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Copper, mg/L	0.65	0.010	0.010	0.011	<0.010	0	87.5	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Iron, mg/L	5.0	0.25	0.020	1.8	<0.020	0.62	62.5	nc	nc	nc	nc	nc	100	0.025	0.021	0.040	<0.020	0.0072	50
Lead, mg/L	0.10	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Manganese, mg/L	10	0.029	0.027	0.062	0.011	0.018	0	0.010	0.010	0.015	<0.0050	0.0072	50	0.011	0.0050	0.056	<0.0050	0.018	87.5
Mercury, mg/L	0.010	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Nickel, mg/L	2.0	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Selenium, mg/L	0.05	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Silver, mg/L	ns	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Thallium, mg/L	0.020	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100
Zinc, mg/L	10	0.012	0.010	0.017	<0.010	0.0030	62.5	nc	nc	nc	nc	nc	100	nc	nc	nc	nc	nc	100

Notes:
N = number of observations (does not include August 2010 sampling event, which was not representative due to bailing of monitoring wells; all other events used low-flow sampling methods with dedicated bladder pumps).
ns = no Class II Groundwater Quality Standard for Parameter.
* Lower and Upper limits for pH is the Class I groundwater quality standard of 6.5 and 9.0 Standard Units.
Groundwater quality standards for Class II: Potable Resource Groundwater (IAC 35 Part 620 Section 420).
Statistics calculated with replacement of non-detect concentrations at 1X reported non-detect concentration: nc indicates that statistics were not calculated because all values were below reporting levels.
Exceeds Class II Groundwater Quality Standard.
Parameter is 100% Non-Detect in all 7 monitoring wells.

APPENDIX A

WELL SURVEY RESULTS

APPENDIX A WELL SEARCH

A.1 Well Search Overview

The following sources of information were utilized in order to determine community water source and water well locations:

- Illinois State Geological Survey's Illinois Water Well (ILWATER) Internet Map Service
- Illinois State Water Survey Domestic Well Database
- Illinois EPA web-based Geographic Information System (GIS) files
- Illinois Department of Public Health
- Massac County Health Department

A.2 Illinois State Geological Survey (ISGS)

The ISGS website provided an ArcIMS View Map as well as a database query for water wells. ISGS database information including any boring logs and well construction information is provided in this Appendix.

A.3 Illinois State Water Survey (ISWS)

All of the wells found through the ISWS database, also known as the Domestic Well Database, were previously identified on the ISGS website except for three locations, see Table A-1, (well numbers: 75-77). Records contained within the ISWS database, consisting of public, industrial, and commercial water wells, were not all received as of the date of this report. Since the ISWS database generally contains the same well information as the ISGS and Illinois EPA databases, some ISWS well entries on the Appendix A-1 Table were marked as pending. Should any new information be acquired from the ISWS including additional water wells not previously identified from the other sources of the well information, it will be provided as an addendum to this report.

A.4 Illinois Environmental Protection Agency (IEPA)

The Illinois EPA database website provided ArcIMS Viewer Maps showing information on community, non-community, and public water supply wells as defined on the Illinois EPA website:

- Community Water Supply (CWS): a public water supply that serves or is intended to serve at least 15 service connections used by residents or regularly serves at least 25 residents.

Based on the IEPA maps, there are two CWS wells in the vicinity of the Station. One CWS well is located in Section 24, east of the Station, and east of Joppa. This CWS well is not within the 2500 foot search radius from the impoundments. The second CWS well, listed on Figure 5 as well number 51, is located directly east of the Station, in Section 23 and the village of Joppa. CWS well no. 51 has a Minimum Setback Zone (MSZ) of 200 feet and a Phase I Wellhead protection area (WHPA) of 1000 ft. A MSZ is an area of 200 or 400 radial feet surrounding a water well supplying public water system through which contaminants from a source are theoretically likely to move and reach the well. The Phase I WHPA extends the surface and subsurface area surrounding the water well to 1,000 radial feet. The two CWS wells were not identified on the ISGS website.

Twenty-eight water wells owned by the Station were identified in the IEPA database, located within Sections 10, 14, 15, and 23. The IEPA database noted 20 wells owned by the Station as monitoring wells. These 20 monitoring wells can be seen in Table A-1 and are located on the Station property in Section 10.

A.5 Massac County Health Department

Attempts were made to contact the Massac County Health Department to confirm the CWS well systems located in the area. No personnel from the county health department have responded at the date of this report. Should any new information be acquired from the county health department including additional water well information not previously identified from the other sources, it will be provided as an addendum to this report.

A.6 Field Survey

A field survey was conducted on July 11, 2013 to verify selected well locations listed in the ISGS, ISWS, and IEPA databases and to locate wells not identified within the databases. Eight wells listed within State databases, and originally located based on the original boring and/or well logs, were re-located on the well location map based on the visual survey. In addition, six wells could not be located and there was no evidence of any house or building at those locations; therefore it was assumed that there was no active potable supply or receptor at that location. Finally, one well that was not identified in the state records was located and added to the Figure and Table. Meetings were held with the Joppa and Ft. Massic Water Districts to determine whether buildings with well records were serviced by the water districts.

The LaFarge Corporation and Trunkline Gas Pumping Station were consulted to review well locations on their properties, which are immediately west and north of the WAP, respectively. LaFarge personnel indicated that they had four active wells and two inactive wells, and that the remaining borings were likely “test holes”. LaFarge also revised and refined the locations for these wells. Trunkline indicated that their wells are no longer active.

Table A-1. Well Search Results

Phase I Hydrogeologic Assessment
Joppa Generating Station

Map Well#	Source of Well Information			Location Name at time of completion	Well Depth	Location					Year Drilled	Aquifer Type	Formation	Well Use	Corrected Location (visual survey)		converted coordinates (Decimal Degrees)		CWS Metered Location	Verified Water Well	Current Well Status
	ISGS (API)	ISWS	IEPA			County	Township	Range	Section	SubSection					Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)			
1	121270000100	--	1	Bechtel Corp	304	Massac	15S	3E	14	--	1955	--	--	IC					Yes (FM)	Yes	A (NP)
2	121270002300	--	23	Missouri Portland Cemt	140	Massac	15S	3E	15	NW SW	1961	--	--	IC							
3	121270003000	366704	30	Bunchman A J	153	Massac	15S	3E	14	SW SW NE	1941	--	--	FD	37° 12.873'	88° 50.699'	37.214550	-88.844983	Yes (J)	No	U
4	121270003100	366705	31	Roberts M G	156	Massac	15S	3E	14	--	1941	--	--	FD					No	No (NS)	U
5	121270004800	--	48	Joppa Compressor Station #7	150	Massac	15S	3E	10	--	1950	--	--	IC					Yes (FM)		NA(NP)
6	121270004900	--	49	Joppa Compressor Station #7	166	Massac	15S	3E	10	--	1950	--	--	IC					Yes (FM)		NA(NP)
7	121270005000	--	50	Electric Energy Inc	350	Massac	15S	3E	14	--	1951	--	--	IC					Yes (FM)	Yes	A (NP)
8	121270005100	--	51	Electric Energy Inc	403	Massac	15S	3E	14	--	1951	--	--	IC	37° 12.879'	88° 51.365'	37.214650	-88.856083	Yes (FM)	Yes	A (NP)
9	121270005200	--	52	Joppa Grade School	138	Massac	15S	3E	14	--	1940	--	--	FD					Yes (J)	No (NS)	NA*
10	121270005300	--	53	Electric Energy Inc	235	Massac	15S	3E	15	--	1951	--	--	IC					Yes (FM)		NA(NP)
11	121270005400	--	54	Joppa Colored Schl	137	Massac	15S	3E	23	--	1940	--	--	FD					No	No (NS)	NA
12	121270005500	--	55	Wilson Marie	65	Massac	15S	3E	23	--	1941	--	--	FD					No	No (NS)	NA
13	121270011100	275092	111	Adams, Guy	78	Massac	15S	3E	11	--	1969	Unconsolidated	gravel & sand	FD	37° 13.433'	88° 50.956'	37.223883	-88.849267	Yes (FM)	Yes	U
14	121270014600	275090	146	Kapley, Homer & Levina	150	Massac	15S	3E	11	SE SE SE	--	Unconsolidated	sand gravel	FD							
16	121270015800	275097	158	Mathes David Lester	160	Massac	15S	3E	14	NW NW NE	1971	--	--	FD					No	No (NS)	U
19	121270019800	275091	198	Brewer, Robert	283	Massac	15S	3E	11	NE NE SE	1973	Bedrock	broken lime	FD							
20	121272022000	--	20220	Mo Portland Cement	110	Massac	15S	3E	15	--	1974	--	--	IC							
21	121272025500	275089	20255	Sielbeck Gerry	52	Massac	15S	3E	10	SW SE SW	1976	--	--	FD	37° 13.305'	88° 52.297'	37.221750	-88.871617	No	Yes	NA (PSA)
23	121272047100	275088	20471	Pritchett, Steve	175	Massac	15S	3E	10	NE SE NW	1987	Bedrock	chert	FD							
26	121272051900	--	20519	Missouri Portland Cement Co.	110	Massac	15S	3E	15	--	1985	--	--	IC							
27	121272052000	--	20520	Missouri Portland Cmt Co.	110	Massac	15S	3E	15	--	1985	Unconsolidated	alluvial	IC							
29	121272067500	265617	20675	Jewel, William	94	Massac	15S	3E	11	NE SE SW	1994	Unconsolidated	gravel	FD	37° 13.359'	88° 50.934'	37.222650	-88.848900	Yes (FM)	Yes	NA
32	121272069900	286483	20699	Meyer, Glen	280	Massac	15S	3E	11	NW NE NE	1995	Bedrock	chert	FD							
33	121272085100	--	23716.08871	Maple Grove School	76	Massac	15S	3E	10	--	1997	--	--	IC							
34	121272085600	--	24645.42174	Lafarge Corp.	98	Massac	15S	3E	15	NE NW SW	1997	Unconsolidated	sand & gravel	IC							
35	121272091900	--	--	Missouri Portland Cement Co	451	Massac	15S	3E	15	--	1961	--	--	IC							
36	121272092600	--	--	Missouri Portland Cement Co	136	Massac	15S	3E	15	NW	1961	--	--	IC							
37	121272092700	--	25574.75477	Missouri Portland Cement Co	110	Massac	15S	3E	15	NW	1961	--	--	IC							
38	121272092800	--	26504.08779	Missouri Portland Cement T.H.	130	Massac	15S	3E	15	NW	1962	--	--	IC							
39	121272092900	--	27433.42082	Missouri Portland Cement T.H.	138	Massac	15S	3E	15	NW	1962	--	--	IC							
40	121272093000	--	28362.75385	Missouri Portland Cement T.H.	105	Massac	15S	3E	15	NW	1962	--	--	IC							
41	121272093300	--	29292.08688	Missouri Portland Cement T.H.	105	Massac	15S	3E	15	NW	1962	--	--	IC							
42	121272093400	--	30221.4199	Missouri Portland Cement T.H.	169	Massac	15S	3E	15	NW	1962	--	--	IC							
43	121272094200	--	31150.75293	Electrical Energy Corp (Joppa)	90	Massac	15S	3E	23	--	1952	--	--	IC					No	No (NS)	NA
44	121272096300	--	32080.08596	Maple Grove School	362	Massac	15S	3E	10	--	1999	--	--	IC							
47	121272100900	322429	34868.08504	Snell, Arnold	202	Massac	15S	3E	10	--	2000	Bedrock	limestone	FD					Yes (FM)	No	U
48	121272103000	--	35797.41807	Snell, Arnold	202	Massac	15S	3E	10	SE NE SE	2000	Bedrock	limestone	FD					Yes (FM)	No	U
49	121272103900	--	36726.7511	Midwest Electric Power Co.	238	Massac	15S	3E	15	SW NW NE	2000	Bedrock	limestone	IC	37° 13.000'	88° 51.992'	37.216667	-88.866533	No	Yes	A (NP)
50	121272104000	--	37656.08413	Midwest Electric Power, Inc	277	Massac	15S	3E	15	NW NW NE	1999	Bedrock	limestone	IC	37° 13.140'	88° 52.010'	37.21900000	-88.86683333	No	Yes	A (NP)
51	121272105600	--	70900	--	--	Massac	15S	3E	23	--	--	--	--	CWS							
52	121272105700	--	70901	--	--	Massac	15S	3E	24	--	--	--	--	CWS							
53	121272106100	362229	39514.75018	Terbrak, Rodger	92	Massac	15S	3E	14	NW NE NE	2001	Unconsolidated	gravel	FD	37° 13.211'	88° 50.508'	37.220183	-88.841800	No	No	A
54	121272109500	--	40444.08321	La Farge Corp.	1472	Massac	15S	3E	15	--	--	--	--	FD							
55	121272110900	--	--	Electric Energy, Inc.	73	Massac	15S	3E	10	NW NW SW	2006	Unconsolidated	sand	MONIT							
56	121272111000	--	--	Electric Energy, Inc.	60	Massac	15S	3E	10	NE NW SW	2006	Unconsolidated	sand	MONIT							
57	121272111100	--	--	Electric Energy, Inc.	66	Massac	15S	3E	10	SE NW SW	2006	Unconsolidated	sand	MONIT							
58	121272111200	--	--	Electric Energy, Inc.	61	Massac	15S	3E	10	SE SW SW	2006	Unconsolidated	sand	MONIT							
59	121272111300	--	--	Electric Energy, Inc.	73	Massac	15S	3E	10	NE SW SW	2006	Unconsolidated	sand	MONIT							
60	121272111400	--	--	Electric Energy, Inc.	81	Massac	15S	3E	10	SW NW SW	2006	Unconsolidated	sand	MONIT							
61	121272111500	--	--	Electric Energy, Inc.	68	Massac	15S	3E	10	SE SW SW	2006	Unconsolidated	sand	MONIT							
62	121272111600	--	--	Electric Energy, Inc.	71	Massac	15S	3E	10	NW NW SW	2006	Unconsolidated	sand	MONIT							
63	121272111700	--	--	Electric Energy, Inc.	81	Massac	15S	3E	10	NE SW SW	2006	Unconsolidated	sand	MONIT							
64	121272111800	--	--	Electric Energy, Inc.	68	Massac	15S	3E	10	SW SW SW	2006	Unconsolidated	sand	MONIT							
65	121272111900	--	--	Electric Energy, Inc.	29	Massac	15S	3E	10	NW NW SW	2006	Unconsolidated	silt	MONIT							
66	121272112000	--	--	Electric Energy, Inc.	12	Massac	15S	3E	10	NE NW SW	2006	Unconsolidated	silt	MONIT							
67	121272112100	--	--	Electric Energy, Inc.	20	Massac	15S	3E	10	SE NW SW	2006	Unconsolidated	clayey sand	MONIT							
68	121272112200	--	--	Electric Energy, Inc.	13	Massac	15S	3E	10	SE SW SW	2006	Unconsolidated	clayey sand	MONIT							

Table A-1. Well Search Results
Phase I Hydrogeologic Assessment
Joppa Generating Station

Map Well#	Source of Well Information			Location Name at time of completion	Well Depth	Location					Year Drilled	Aquifer Type	Formation	Well Use	Corrected Location (visual survey)		converted coordinates (Decimal Degrees)		CWS Metered Location	Verified Water Well	Current Well Status
	ISGS (API)	ISWS	IEPA			County	Township	Range	Section	SubSection					Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)			
69	121272112300	--	--	Electric Energy, Inc.	18	Massac	15S	3E	10	NE SW SW	2006	Unconsolidated	silt	MONIT							
70	121272112400	--	--	Electric Energy, Inc.	27	Massac	15S	3E	10	SW NW SW	2006	Unconsolidated	silt	MONIT							
71	121272112500	--	--	Electric Energy, Inc.	16	Massac	15S	3E	10	SE SW SW	2006	Unconsolidated	silt	MONIT							
72	121272112600	--	--	Electric Energy, Inc.	23	Massac	15S	3E	10	NW NW SW	2006	Unconsolidated	silt & sand	MONIT							
73	121272112700	--	--	Electric Energy, Inc.	24	Massac	15S	3E	10	NE SW SW	2006	Unconsolidated	silty sand	MONIT							
74	121272112800	--	--	Electric Energy, Inc.	20	Massac	15S	3E	10	SW SW SW	2006	Unconsolidated	silt	MONIT							
75	121272117200	--	--	LaFarge N.A., Midwest River	227	Massac	15S	3E	15	NW NE SW	2010	Bedrock	limestone	IC							
76	--	275094	--	Ed Cockrel	162	Massac	15S	3E	--	--	1961	--	--	FD							
77	--	366703	--	Dr. R. H. Jacobs	--	Massac	15S	3E	--	--	1896	--	--	FD							
78	--	366706	--	Mrs. O.J. Galliher	65	Massac	15S	3E	--	--	1941	--	--	FD							
79	- -	- -	- -	- -	- -	Massac	15S	3E	11		- -	- -	- -	FD	37° 13.278'	88° 50.938'	37.22130000	-88.84896667	No	Yes	A

Source of Information

IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
SWAP	IEPA Source Water Assessment

Well Use

CWS	Community Water Supply Well
MONIT	Joppa Power Station Monitoring Well
FD	Farm and/or Domestic Water Well
IC	Industrial/Commercial Water Well

Notes

--	Not Applicable or no information available
A	Active
NA	Not Active
U	Unknown
NP	Non-potable / industrial use only
J	Village of Joppa CWS metered location
FM	Fort Massac Water District CWS metered location
NS	No structure and/or well at location based on visual survey
PSA	Pending seal and abandonent of well
*	Reported sealed but no record

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well for Commercial Operation	**Top**	**Bottom**
clay	0	42
gravel & sand	42	83
gray clay	83	154
broken up limestone	154	158
gray limestone	158	227
Total Depth		**227**

Casing: 10" STEEL from -1' to 157'

Water from limestone at 160' to 222'.
Static level 56' below casing top which is 3' above GL
Pumping level 67' when pumping at 700 gpm for 3 hours

Permanent pump installed at 147' on December 22, 2010, with a capacity of 500 gpm

Remarks: Driller's Estimated Well Yield 3000 gpm

Additional location info: Lot: Subdivision: Joppa Plant

Address of well: same as above

Location source: Global Positioning System verified

Permit Date: November 9, 2010 **Permit #:** 127-12-

COMPANY Beanland, Glen
FARM LaFarge N.A., Midwest River
DATE DRILLED December 3, 2010 **NO.**
ELEVATION 367GL **COUNTY NO.** 21172
LOCATION NW NE SW
LATITUDE 37.216133 **LONGITUDE** -88.873433
COUNTY Massac **API 121272117200** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	19
silty clay	19	20
Total Depth		**20**

Casing:
2" PVC from -3' to 15'
2" PVC SCREEN from 15' to 20'
2" PVC from 20' to 20'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 13.

Grout: BENTONITE CHIPS from 13 to 14.

Grout: QUARTZ SAND from 14 to 20.

Water from silt at 14' to 20'.

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date:

Permit #:

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED December 1, 2006

NO. MW10S

ELEVATION 371

COUNTY NO. 21128

LOCATION SW SW SW

LATITUDE 37.222365

LONGITUDE -88.874989

COUNTY **Massac**

API **121272112800**

10 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	17
silty sand	17	20
silty clay	20	24
Total Depth		**24**

Casing: 2" PVC from -3' to 19'
2" PVC SCREEN from 19' to 23'
2" PVC from 23' to 24'

Screen: 4' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 16.

Grout: QUARTZ SAND from 16 to 24.

Water from silty sand at 17' to 20'.
Static level 13' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 10, 2006 **NO.** MW09S

ELEVATION 364 **COUNTY NO.** 21127

LOCATION NE SW SW

LATITUDE 37.22415 **LONGITUDE** -88.872644

COUNTY Massac **API 121272112700** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	22
clayey sand	22	23
Total Depth		**23**

Casing: 2" PVC from -3' to 18'
2" PVC SCREEN from 18' to 23'
2" PVC from 23' to 23'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 17.

Grout: QUARTZ SAND from 17 to 23.

Water from silt & sand at 17' to 23'.
Static level 22' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 17, 2006 **NO.** MW08S

ELEVATION 378 **COUNTY NO.** 21126

LOCATION NW NW SW

LATITUDE 37.227853 **LONGITUDE** -88.874897

COUNTY Massac **API 121272112600** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	14
silty clay	14	16
Total Depth		**16**

Casing: 2" PVC from -3' to 10'
2" PVC SCREEN from 10' to 15'
2" PVC from 15' to 16'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 9.

Grout: QUARTZ SAND from 9 to 16.

Water from silt at 9' to 14'.
Static level 16' below casing top which is 3' above GL

Address of well: Portland Rd & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 29, 2006 **NO.** MW07S

ELEVATION 360 **COUNTY NO.** 21125

LOCATION SE SW SW

LATITUDE 37.222321 **LONGITUDE** -88.872675

COUNTY Massac **API 121272112500** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	27
Total Depth		**27**

Casing: 2" PVC from -3' to 21'
2" PVC SCREEN from 21' to 26'
2" PVC from 26' to 27'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 19.

Grout: QUARTZ SAND from 19 to 27.

Water from silt at 19' to 27'.
Static level 25' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED November 14, 2006 **NO.** MW06S
ELEVATION 373 **COUNTY NO.** 21124
LOCATION SW NW SW
LATITUDE 37.226024 **LONGITUDE** -88.874927
COUNTY Massac **API 121272112400** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	16
silty clay	16	18
Total Depth		**18**

Casing:
2" PVC from -3' to 12'
2" PVC SCREEN from 12' to 17'
2" PVC from 17' to 18'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 6.

Grout: BENTONITE CHIPS from 7 to 11.

Grout: QUARTZ SAND from 11 to 18.

Water from silt at 12' to 16'.

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED December 6, 2006 **NO.** MW05S

ELEVATION 364 **COUNTY NO.** 21123

LOCATION NE SW SW

LATITUDE 37.22415 **LONGITUDE** -88.872644

COUNTY Massac **API 121272112300** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	7
clayey sand	7	12
silty clay	12	13
Total Depth		**13**

Casing: 2" PVC from -3' to 7'
2" PVC SCREEN from 7' to 12'
2" PVC from 12' to 13'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 6.

Grout: QUARTZ SAND from 6 to 12.

Water from clayey sand at 7' to 12'.
Static level 15' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED December 5, 2006 **NO.** MW04S
ELEVATION 351 **COUNTY NO.** 21122
LOCATION SE SW SW
LATITUDE 37.222321 **LONGITUDE** -88.872675
COUNTY **Massac** **API** **121272112200** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	16
clayey sand to 19.5', silty clay to 19.7	16	20
Total Depth		**20**

Casing: 2" PVC from -3' to 15'
2" PVC SCREEN from 15' to 19'
2" PVC from 19' to 20'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 3 to 12.

Grout: BENTONITE CHIPS from 12 to 13.

Grout: QUARTZ SAND from 13 to 20.

Water from clayey sand at 16' to 20'.

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

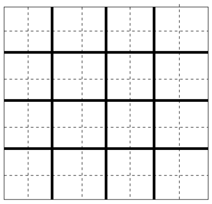
FARM Electric Energy, Inc.

DATE DRILLED December 4, 2006 **NO.** MW03S

ELEVATION 367 **COUNTY NO.** 21121

LOCATION SE NW SW

LATITUDE 37.225979 **LONGITUDE** -88.872612



COUNTY Massac **API 121272112100** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	11
silty clay	11	12
Total Depth		**12**

Casing: 2" PVC from 12' to 12'
2" PVC from -3' to 7'
2" PVC SCREEN from 7' to 12'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 7.

Grout: QUARTZ SAND from 7 to 12.

Water from silt at 7' to 11'.
Static level 9' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED November 27, 2006 **NO.** MW02S
ELEVATION 360 **COUNTY NO.** 21120
LOCATION NE NW SW
LATITUDE 37.227808 **LONGITUDE** -88.872581
COUNTY Massac **API 121272112000** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	24
clay sand	24	28
silty clay	28	29
Total Depth		**29**

Casing: 2" PVC from -3' to 24'
2" PVC SCREEN from 24' to 28'
2" PVC from 28' to 28'

Screen: 4' of 2" diameter 10 slot

Grout: BENTONITE CHIPS from 0 to 23.

Grout: QUARTZ SAND from 23 to 29.

Water from silt at 24' to 28'.
Static level 28' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED November 28, 2006 **NO.** MW01S
ELEVATION 384 **COUNTY NO.** 21119
LOCATION NW NW SW
LATITUDE 37.227853 **LONGITUDE** -88.874897
COUNTY Massac **API 121272111900** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	19
silty clay	19	26
silty sand	26	28
silty clay	28	34
clayey sand	34	51
silty sand	51	63
sand	63	68
Total Depth		**68**

Casing: 2" PVC from -3' to 63'
2" PVC SCREEN from 63' to 67'
2" PVC from 67' to 68'

Screen: 4' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 58.

Grout: BENTONITE CHIPS from 58 to 61.

Water from sand at 63' to 68'.
Static level 56' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED December 1, 2006 **NO.** MW10D

ELEVATION 371 **COUNTY NO.** 21118

LOCATION SW SW SW

LATITUDE 37.222365 **LONGITUDE** -88.874989

COUNTY Massac **API 121272111800** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	17
silty sand	17	20
silty clay	20	52
clayey sand	52	61
silty sand	61	71
sand	71	81
Total Depth		**81**

Casing: 2" PVC from -3' to 76'
2" PVC SCREEN from 76' to 81'
2" PVC from 81' to 81'

Screen: 5' of 2" diameter 20 slot

Grout: BENTONITE from 0 to 69.

Grout: BENTONITE CHIPS from 69 to 73.

Grout: QUARTZ SAND from 73 to 81.

Water from sand at 73' to 81'.
Static level 48' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 10, 2006 **NO.** MW09D

ELEVATION 364 **COUNTY NO.** 21117

LOCATION NE SW SW

LATITUDE 37.22415 **LONGITUDE** -88.872644

COUNTY Massac **API 121272111700** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	22
clayey sand	22	24
silty clay	24	37
clayey sand	37	50
silty sand	50	66
sand	66	71
Total Depth		**71**

Casing: 2" PVC from -3' to 66'
2" PVC SCREEN from 66' to 71'
2" PVC from 71' to 71'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 62.

Grout: BENTONITE CHIPS from 62 to 64.

Grout: QUARTZ SAND from 64 to 71.

Water from sand at 66' to 71'.
Static level 60' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 17, 2006 **NO.** MW08D

ELEVATION 378 **COUNTY NO.** 21116

LOCATION NW NW SW

LATITUDE 37.227853 **LONGITUDE** -88.874897

COUNTY Massac **API 121272111600** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	14
silty clay	14	33
clayey sand	33	48
silty sand	48	62
sand	62	68
Total Depth		**68**

Casing: 2" PVC from -3' to 62'
2" PVC SCREEN from 62' to 67'
2" PVC from 67' to 68'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 57.

Grout: BENTONITE CHIPS from 57 to 58.

Grout: QUARTZ SAND from 58 to 68.

Water from sand at 58' to 68'.
Static level 43' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED November 29, 2006 **NO.** MW07D
ELEVATION 360 **COUNTY NO.** 21115
LOCATION SE SW SW
LATITUDE 37.222321 **LONGITUDE** -88.872675
COUNTY **Massac** **API** **121272111500** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	28
silty clay	28	40
clayey sand	40	48
silty sand	48	77
sand	77	81
Total Depth		**81**

Casing: 2" PVC from -3' to 76'
2" PVC SCREEN from 76' to 81'
2" PVC from 81' to 81'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 69.

Grout: BENTONITE CHIPS from 69 to 74.

Grout: FORMATION SAND from 74 to 81.

Water from sand at 63' to 73'.
Static level 57' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date:

Permit #:

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 14, 2006

NO. MW06D

ELEVATION 373

COUNTY NO. 21114

LOCATION SW NW SW

LATITUDE 37.226024

LONGITUDE -88.874927

COUNTY Massac

API 121272111400

10 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	16
silty clay	16	24
clayey sand	24	31
silty sand	31	51
sand	51	73
Total Depth		**73**

Casing: 2" PVC from -3' to 68'
2" PVC SCREEN from 68' to 73'
2" PVC from 73' to 73'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 60.

Grout: BENTONITE CHIPS from 60 to 63.

Grout: FORMATION SAND from 63 to 73.

Water from sand at 63' to 73'.
Static level 44' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

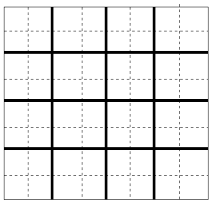
FARM Electric Energy, Inc.

DATE DRILLED December 6, 2006 **NO.** MW05D

ELEVATION 364 **COUNTY NO.** 21113

LOCATION NE SW SW

LATITUDE 37.22415 **LONGITUDE** -88.872644



COUNTY **Massac** **API** **121272111300** **10 - 15S - 3E**

Monitoring	**Top**	**Bottom**
clayey silt	0	7
clayey sand	7	12
silty clay	12	27
clayey sand	27	40
silty sand	40	54
sand	54	61
Total Depth		**61**

Casing: 2" PVC from -3' to 56'
2" PVC SCREEN from 56' to 60'
2" PVC from 60' to 61'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 0 to 52.

Grout: BENTONITE CHIPS from 52 to 54.

Grout: QUARTZ SAND from 54 to 61.

Water from sand at 54' to 61'.
Static level 34' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED December 5, 2006 **NO.** MW04D

ELEVATION 351 **COUNTY NO.** 21112

LOCATION SE SW SW

LATITUDE 37.222321 **LONGITUDE** -88.872675

COUNTY Massac **API 121272111200** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	16
clayey sand	16	20
silty clay	20	25
clayey sand	25	44
silty sand	44	50
sand	50	66
Total Depth		**66**

Casing: 2" PVC from -3' to 61'
2" PVC SCREEN from 61' to 66'
2" PVC from 66' to 66'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 6 to 54.

Grout: BENTONITE CHIPS from 54 to 58.

Grout: QUARTZ SAND from 58 to 66.

Water from sand at 61' to 66'.
Static level 50' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED December 4, 2006 **NO.** MW03D
ELEVATION 367 **COUNTY NO.** 21111
LOCATION SE NW SW
LATITUDE 37.225979 **LONGITUDE** -88.872612
COUNTY Massac **API 121272111100** **10 - 15S - 3E**

Monitoring	Top	Bottom
clayey silt	0	11
silty clay	11	14
clayey sand	14	26
silty clay	26	29
clayey sand	29	40
silty sand	40	52
sand	52	60
Total Depth		**60**

Casing: 2" PVC from -3' to 55'
2" PVC SCREEN from 55' to 60'
2" PVC from 60' to 60'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 11 to 52.

Grout: BENTONITE CHIPS from 52 to 53.

Grout: QUARTZ SAND from 58 to 66.

Water from sand at 52' to 60'.
Static level 36' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.

FARM Electric Energy, Inc.

DATE DRILLED November 27, 2006 **NO.** MW02D

ELEVATION 360 **COUNTY NO.** 21110

LOCATION NE NW SW

LATITUDE 37.227808 **LONGITUDE** -88.872581

COUNTY Massac **API 121272111000** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
clayey silt	0	24
clayey sand	24	28
silty clay	28	41
clayey sand	41	49
silty sand	49	64
sand	64	73
Total Depth		**73**

Casing: 2" PVC SCREEN from 67' to 72'
2" PVC from -3' to 67'
2" PVC from 72' to 73'

Screen: 5' of 2" diameter 10 slot

Grout: BENTONITE from 12 to 63.

Grout: BENTONITE CHIPS from 63 to 65.

Grout: QUARTZ SAND from 65 to 72.

Water from sand at 67' to 73'.
Static level 62' below casing top which is 3' above GL

Address of well: Portland Rd. & Baccus Rd.
Joppa, IL

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Holcomb Foundation Eng.
FARM Electric Energy, Inc.
DATE DRILLED November 28, 2006 **NO.** MW01D
ELEVATION 384 **COUNTY NO.** 21109
LOCATION NW NW SW
LATITUDE 37.227853 **LONGITUDE** -88.874897
COUNTY Massac **API 121272110900** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Test Hole	Top	Bottom
Total Depth		**1472**

Gamma Ray Log filed

Location source: Field verified

Permit Date:

Permit #:

COMPANY IL State Geological Survey

FARM La Farge Corp.

DATE DRILLED

NO. J2-04

ELEVATION 0

COUNTY NO. 21095

LOCATION 1098'N line, 1226'W line of section

LATITUDE 37.218362

LONGITUDE -88.872106

COUNTY Massac

API 121272109500

15 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	**Top**	**Bottom**
dirt & clay	0	42
sandy clay	42	50
gravel & clay	50	62
sand & clay	62	87
gravel	87	92
Total Depth		**92**

Casing: 6.25" PVC from 1' to 89'
6.25" PVC SCREEN from 89' to 92'

Screen: 3' of 6.25" diameter .03 slot

Grout: CLAY from 0 to 3.

Grout: ENVIROPLUG from 3 to 85.

Grout: WASHED PEA GVL from 85 to 92.

Water from gravel at 89' to 92'.
Static level 60' below casing top which is 1' above GL
Pumping level 70' when pumping at 10 gpm for 24 hours

Permanent pump installed at 83' on , with a capacity of 10 gpm

Remarks: driller's est. well yield 30 gpm

Address of well: same as above

Location source: Location from permit

Permit Date: September 17, 2001 **Permit #:**

COMPANY Beanland, Leonard Ralph
FARM Terbrak, Rodger
DATE DRILLED **NO.**
ELEVATION 0 **COUNTY NO.** 21061
LOCATION NW NE NE
LATITUDE 37.220051 **LONGITUDE** -88.842823
COUNTY **Massac** **API** **121272106100** **14 - 15S - 3E**

Municipal Water Supply	**Top**	**Bottom**
no record	0	448
Total Depth		**448**

Casing: 10" OUTER CASING from 0' to 0'
6" CASING from 0' to 75'

Static level 32' below casing top which is 0' above GL
Pumping level 175' when pumping at 141 gpm for 3 hours

Permit Date: **Permit #:**

COMPANY
FARM Joppa, Village
DATE DRILLED January 1, 1952 **NO.** 1
ELEVATION 0 **COUNTY NO.** 21057
LOCATION 500'S 500'E NW/c
LATITUDE 37.20493 **LONGITUDE** -88.837921
COUNTY Massac **API 121272105700** **24 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Non Potable Water Well	**Top**	**Bottom**
topsoil clay & gray silty sand	0	28
clay & silty sand w/trace of gravel	28	160
limestone shelf followed by f sy clay	160	263
sandy & silty clay/weather limestone	263	273
fractured limestone	273	277
Total Depth		**277**

Casing: 12" STAINLESS 49.56FT from -2' to 160'
10" STAINLESS 40.48FT from -2' to 273'

Grout: CEMENT from 0 to 273.

Size hole below casing: 10"

Water from limestone at 273' to 277'.
Static level 45' below casing top which is 2' above GL
Pumping level 50' when pumping at 600 gpm for 12 hours

Permanent pump installed at 150' on , with a capacity of 600 gpm

Address of well: 2100 Portland Rd.
Joppa IL

Location source: Location from permit

Permit Date: November 18, 1999 **Permit #:**

COMPANY Stollhans, Jeff
FARM Midwest Electric Power, Inc
DATE DRILLED January 19, 2000 **NO.** 5
ELEVATION 0 **COUNTY NO.** 21040
LOCATION NW NW NE
LATITUDE 37.220361 **LONGITUDE** -88.865779
COUNTY **Massac** **API** **121272104000** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Non Potable Water Well	**Top**	**Bottom**
topsoil & clay w/silty sand	0	22
clay w/fine to medium sand	22	136
fine to medium sand w/clay seams	136	220
weathered limestone	220	225
fractured limestone	225	238
Total Depth		**238**

Casing: 12" STAINLESS #49.56/FT from -2' to 228'

Grout: CEMENT from 1 to 228.

Size hole below casing: 12"

Water from limestone at 228' to 238'.
Static level 40' below casing top which is 2' above GL
Pumping level 44' when pumping at 603 gpm for 12 hours

Permanent pump installed at 150' on , with a capacity of 600 gpm

Address of well: 2100 Portland Rd
Joppa IL

Location source: Location from permit

Permit Date: November 18, 1999 **Permit #:**

COMPANY Stollhans, Jeff
FARM Midwest Electric Power Co.
DATE DRILLED February 29, 2000 **NO.** 6
ELEVATION 380 **COUNTY NO.** 21039
LOCATION SW NW NE
LATITUDE 37.218537 **LONGITUDE** -88.86584
COUNTY **Massac** **API** **121272103900** **15 - 15S - 3E**

Irrigation Well	**Top**	**Bottom**
yellow clay	0	27
gravel	27	28
white clay	28	36
yellow sandy clay/gravel	36	58
yellow sandy clay/coarse ylw sand	58	65
yellow sandy clay/white streaks	65	105
fine yellow sand & clay streaks	105	118
chert	118	142
chert w/yellow/white clay streaks	142	160
chert w/gravel clay streaks	160	178
weathered limestone	178	180
chert w/gray clay	180	191
fractured gray limestone	191	202
Total Depth		**202**

Casing: 6.12" PVC from -1' to 140'
4" PVC from 135' to 195'

Grout: BENTONITE from 0 to 139.

Water from limestone at 175' to 200'.
Static level 41' below casing top which is 1' above GL
Pumping level 100' when pumping at 15 gpm for 72 hours

Remarks: driller's est. well yield 30 gpm

Address of well: same as above

Location source: Location from permit

Permit Date: February 8, 2000 **Permit #:**

COMPANY Beanland, Ronald D.
FARM Snell, Arnold
DATE DRILLED March 30, 2000 **NO.**
ELEVATION 0 **COUNTY NO.** 21030
LOCATION SE NE SE
LATITUDE 37.225712 **LONGITUDE** -88.858722
COUNTY **Massac** **API** **121272103000** **10 - 15S - 3E**

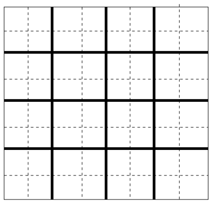
Irrigation Well	**Top**	**Bottom**
yellow clay	0	27
gravel	27	28
white clay	28	36
yellow sandy clay with gravel	36	58
yellow sandy clay with coarse yl sand	58	65
yellow sandy clay with white streaks	65	105
fine yellow sand with clay streaks	105	118
chert	118	142
chert with yellow to white clay streaks	142	160
chert with gray clay streaks	160	178
weathered limestone	178	180
chert with gray clay	180	191
fractured gray limestone	191	202

Interpretation by: John Nelson on 07-APR-00
samples are wet and disaggregated

Loess: silt, medium yellowish brown; less than 1% sand grains.	0	10
Loess: sandy silt, medium yellowish-brown, 5% to 10% fine to medium sand.	10	25
Metropolis Formation: sandy silt, light gray to yellowish-gray, 10 to 20% very fine to fine sand. note on bag says "little gravel at 27 ft."	25	30
Metropolis Formation: sand, light brownish gray, very fine grained (to coarse silt), fluid.	30	35
Metropolis Formation: sandy silt, yellowish-orange to yellowish-brown, a little gray (mottled?), sand fraction very fine to fine, sand increasing downward.	35	45

Permit Date: **Permit #:**

COMPANY Beanland, John R.
FARM Snell, Arnold
DATE DRILLED March 28, 2000 **NO.** 1
ELEVATION 0 **COUNTY NO.** 21009
LOCATION 1900'S line, 700'E line of section
LATITUDE 37.226406 **LONGITUDE** -88.859969



COUNTY Massac **API 121272100900** **10 - 15S - 3E**

Metropolis Formation: silty sand, dark yellowish brown, some lighter yellow mottling, very fine to fine, clay present.	45	60
Metropolis Formation: silty sand, mottled light gray, yellowish gray, yellowish orange; otherwise similar to above. mica appears at 75 feet.	60	80
McNairy Formation: sand, light yellowish to brownish gray, vey fine grained, clean, dominantly quartz with a little mica.	80	105
McNairy Formation: sand, medium yellowish brown, very fine to fine-grained, otherwise as above. scattered coarse sand to small granules, mostly dark brown chert (?) appear at 115 feet. clay present at 120-125 feet.	105	125
McNairy Formation: sand, brownish gray, poorly sorted, fine to very coarse, composed fo quartz and dull, opaque gray to brown chert. some clay present.	125	130
Post Creek Formation: sand and fine gravel, a washed sample consists of fine to medium quartz sand and angular fragments of dull, opaque, light to medium gray and brownish-gray chert. matrix is yellowish-brown silt.	130	135
Post Creek Formation: gravel, composed of broken chert pebbles, fragments of rounded pebbles common. mostly dull, opaque gray to brown chert as above, some light gray and tripolitic, some sand matrix partially cemented with gravel.	135	140
Total Depth		**202**

Sample set # 68834 (0' - 140') Received: April 4, 2000

Location source: Field verified Verified by: WJN on April 7, 2000.

Stratigraphic Test	**Top**	**Bottom**
Loess	0	10
Metropolis formation	10	59
Unidentified	59	127
McNairy formation	127	328
Post Creek formation	328	359
Salem limestone	359	362

Interpretation by: W. John Nelson on 27-JUL-99
Drilled with USGS Mobile B-61 wireline coring rig.
Driller: Gene Cobbs.

Silt, yellowish brown with orange and gray mottling, massive, slightly clayey, roots at top, scattered organic matter throughout.	.5	5
Silt, similar to above. Only 1' recovered for 5' run.	5	10
Gap (recovered about 6' for the run from 10' to 20').	10	20
Silt and sand, yellowish orange and light to medium gray, strongly mottled, contains scattered chert granules. This silty sand to sandy silt with a clay matrix. Sand consists of fine to very coarse quartz, common red grains, and brown chert granules with Mounds patina. Massive to laminated, laminated, laminations dip 10 to 30 degrees. Gradational contact:	20	26.7
Sandy silt, light gray and yellowish orange, strongly streaked and mottled. Clay-rich, granules rare. No layering, appears brecciated. Irregular contact:	26.7	33.8
Silty sand, gray, brown, and yellowish-orange mottled, much coarse sand to small grainules in a silty clay matrix, granules are largerly well-rounded	33.8	48.2

Permit Date: **Permit #:**

COMPANY IL State Geological Survey
FARM Maple Grove School
DATE DRILLED **NO.** 2
ELEVATION 0GL **COUNTY NO.** 20963
LOCATION 2575'S line, 600'E line of section
LATITUDE 37.228262 **LONGITUDE** -88.85959
COUNTY Massac **API 121272096300** **10 - 15S - 3E**

brown chert, reworked Mounds Gravel. Massive to weakly laminated, laminae gently inclined. Sharp contact:		
Gravel, reworked Mounds-type chert pebbles to 1" across supported in matrix of silty sand, as above. Sharp contact:	48.2	48.5
Sand, reddish orange with a little gray mottling, dominantly fine to medium grained but contains scattered coarse sand grains and small brown chert pebbles. No layering. Barely coherent, a little silt and clay matrix. Black laminae in lower part are probably iron/manganese oxides. Grades to:	48.5	50.8
Sand, colors vary, mostly yellowish gray, some layers light gray and reddish gray. Fine grained, well sorted, subrounded to rounded quarts sand, barely coherent, has irregular nearly horizontal silty lamination. Black layers (common at 54' - 55') proably iron/manganese oxide. Thin gravelly layer at 59', rounded quarts granules and small pebbles, also brown chert pebbles that appear to be reworked Mounds. Grades to:	50.8	60
Sand, light gray with small yellowish-orange and black patches, mainly in upper part of unit. Very fine to fine grained, slightly silty, nearly all quartz with a trace of heavy minerals. Slightly coherent, no lamination noted in upper 10'. Below 70' sand has faint planar laminations that dip about 30 degrees. Quartz grains largely rounded to well-rounded. Grades to:	60	79
Sand, light grayish orange, fine grained, otherwise as above. Sharp contact:	79	82.5
Silty sand, light gray with small yellowish orange patches, sand very fine and quartzose, massive, a	82.5	87.5

little clay matrix makes the sediment coherent. Grades to:		
Silty clay, light gray, massive, moderately stiff, can be formed into balls. Grades to:	87.5	89
Silty sand, like next-to-last unit. Less silt and clay downward, grades to:	89	94.1
Sand, light orange to yellowish gray, very fine to medium, coarser near base, like that at 60' at 82.5'. Grain size and colors vary, some intervals are silty. Rare quartz granules, near base. No mica or caly laminae as would be typical for McNairy. Sharp contact:	94.1	109.7
Gravel, composed of subangular to well rounded pebbles to at least 1" across in a sand matrix, with a little clay binder. Pebbles largely light gray, opaque, tripolitic chert. Dark gray chert and silicified limestone (some oolitic), white to red quartz pebbles less than 10% of total. Sand medium to coarse, dominantly rounded quartz grains. Mostly gravel-supported. No bedding evident. Only partial recovery; 6' recovered from 110' to 119'.	109.7	119
Gravel, as above? Drilled 9' but recovered only about 1' of gravel, as above. Last 2' was easier drilling, like sand or clay.	119	127
Sand; as below? Not sampled, but drilled like next 11'.	127	129
Sand, light gray to light yellowish gray, fine-grained, dominantly quartz with less than 1% very fine black grains and a few mica flakes. Massive to faintly laminated, weakly coherent (a little clay and silt binder). Basically the same as sands above the gravel. Recovered only 2.5' from 129' to 140', but easy drilling indicates consistent material. Nearly	129	179.7

complete recovery 140' - 150'; several thin white clay laminae in this interval dip 30-40 degrees. Near-vertical clay laminae or veinlets at 150' - 155'. Sharp contact:		
Clayey sand, light to medium gray, very fine grained, silty, laminated; as before the sand is dominantly quartz with less than 1% dark grains and a few mica flakes. Grades to:	179.7	180.9
Sand, upper 2' light gray, changing back to light yellowish or orange-gray, fine-grained, like next-to-last unit. Occasional clay laminae dipping 20-30 degrees. Grades to:	180.9	201
Sand, light gray, very fine to fine grained. As before, dominantly quartz with less than 1% black grains and sparse mica. many laminae and stringers (veinlets) of light gray plastic clay crisscross the core at various angles. The clay contains only scattered mica flakes and is unlike typical McNairy.	201	210.5
Sand, mostly yellowish-orange, some light gray, fine-grained, light gray clay laminae inclined 40-50 degrees.	210.5	213.5
Sand, light gray, fine grained, well sorted, dominantly quartz with silt-sized black grains, barely coherent (slightly silty), uniform, massive.	213.5	237
Sand, light orange to light gray, fine-grained, contains a few steeply dipping light gray clay veinlets, otherwise, as above. Small-scales faulting was visible on freshly extracted sample at about 275' and steeply dipping clay laminae or veins at 300' - 305'. Mica becomes more common downward, but still sparse.	237	304.7
Silty sand, light gray, very fine grained, clayey, slightly micaceous. Dominantly quartz as above.	304.7	320

Appears to be riddled with a network of light gray clay laminae. Gradational contact:		
Sandy clay, light gray and yellowish orange, mixture of fine quartz sand and plastic clay, yellowish orange color increases downward. Chert granules in lower 2'.	320	327
Pebbly sand and clay, yellowish orange to brownish orange, mostly granule-size, but some pebbles to 1" of dark gray to brown chert. Indistinct and irregular layering in places.	327	334
Chert, a few large angular fragments of bluish gray slightly translucent chert that is silicified, coarse-grained crinoidal grainstone, probably from bedrock. No sample from about 334' to 340'.	334	340
Pebbly sand and clay, like next-to-last unit. No large chunks of chert recovered. Only about 3' of sample recovered.	340	350
Pebbly sand and clay, as above, about 1.5' recovered for 9' run.	350	359
Limestone, medium to dark gray, coarse crinoid-bryozoan packstone with shaly partings and chert nodules; bryozoan fronds parallel with bedding. Bedding horizontal, probably Salem Limestone.	359	362

Interpretation by: Jack Masters & John Nelson on 04-AUG-99

Silt, light yellowish brown, uniform color, clayey, sand-size iron-manganese pellets common. Soft, massive.	.5	2
Silt, similar to above but has dinstinct light gray mottling, pellets as above have orange rims. Gray zones are silty clay and appear to be steeply inclined fractures and/or burrows.	2	4.7

Silt, medium yellowish brown, faintly mottled, slightly sandy with fine to medium white to pink quartz grains. Faint distorted grayish laminations, darker laminations more clayey. A few chert granules.	4.7	6.1
No sample - recovered 1.1 feet of core between 5' and 10'.	6.1	10
Sandy silt, strongly mottled in gray, brown and yellowish orange, gray zones are clay-rich. Scattered granules and small pebbles of brown chert probably derived from Mounds Gravel. Gradational contact:	10	11.5
Sany silt, strongly mottled in light orange-brown, yellowish gray, and gray. Intermixed silty clay, some of which is clay skins. Irregular lamination in lower part of interval. A few chert granules, as above.	11.5	13.5
Sandy silt and clay, darker than above; clay yellowish brown to gray, silt medium to dark orange-brown, all mottled. Two layers of chert granules and pebbles, as above. No lamination. Large chert pebbles at base.	13.5	15.1
No sample. core loss believed to be in lower 4.9' of interval from 10' to 20', because chert pebbles at base of sample may have plugged core barrel.	15.1	20
Silty sand, mottled orange-brown, sand is medium to coarse, several gray silty clay layers. Weakly layered, chert granules and pebbles (as above) common. Gradational contact:	20	21.4
Sandy silt, colors as above, clay-rich, clayey zones lighter gray to yellowish brown. Thick clay skins abundant. Massive to weakly laminated, stiff. Gradational contact:	21.4	23.4

Sandy silt, mottled light brownish-gray to light brown, coarse silt to fine sand, scattered chert pebbles as above. Massive to weakly layered.	23.4	26.5
Clayey and sandy silt, strongly mottled in light gray and yellowish to brownish orange, sand content increases downward. Gray patches are clay-rich. Probably bioturbated, lower 3' appears brecciated but colors less distinct. Scattered chert granules. Sharp contact:	26.5	33.7
Pebbly sand, coarse to very coarse, dominantly quartz sand with pink grains common, pebbles a mixture of Mounds-type chert and quartz, subrounded to well rounded (quartz pebbles well rounded). Sand has a clay matrix. Sharp contact:	33.7	34.1
Silty sand, light orange-brown with yellowish gray mottling, clayey, contains iron oxide nodules (dark brown) and manganese (black). Pink to rose-colored quartz grains common. Largely bioturbated, a few silty clay laminations. Lower contact sharp.	34.1	39.9
Silty and clay, silt orange to brown, clay light to medium gray, clay and silt intermixed and mottled, no layering. Concentrated black iron/manganese stains near top, along with scattered pebbles (but this could be slop at top of core run). Material appears bioturbated. A hint of lamination. Scattered white to pink, fine to medium quartz sand grains and rare granules. Black iron/manganese stains and pellets common. Sand increases downward. Possible small fault dipping 40-50 degrees at 45.3'. Sharp contact:	39.9	48.2
Sand, pebbly, grayish to orange brown, fine to very coarse sand, dominantly quartz, with clay matrix, abundant shiny brown clay-skins; gravel dominantly reworked Mounds-type chert pebbles, some have patina,	48.2	48.6

but many are bleached, sharp lower contact.		
Sand, red to orange with gray mottling, dominantly fine grain with scattered coarse grains, subrounded to well rounded, trace of muscovite mica, lower 0.5' has distorted banding (maybe liesegang) black iron manganese stains abundant, scattered granules and pebbles of reworked Mounds gravel. Sharp contact:	48.6	50.8
Sand, light gray to light yellowish and reddish orange, fine to medium grain-size, almost entirely quartz, slightly silty, more silty at top, some sand nearly loose and water saturated when drilled, faint disturbed laminations, spots and patches of black iron manganese oxide, rare well-rounded quartz granules throughout, basal 0.1' is a concentration of well-rounded granules and small pebbles, of mostly quartz, with some reworked iron oxide and Mounds-type chert.	50.8	58.8
Sand, light gray, yellowish orange stains at top diminish below upper 1', to nearly all light gray, nearly 100% quartz, rare pink to red quartz grains, few very fine grain black heavy minerals, upper part is silty, decreses downward to loose, clean sand, grades to fine to medium at base (fining upward interval), gradational contat.	58.8	79
Sand, light grayish orange, fine to medium grain-size, subrounded to rounded quartz, maybe 1% chert and black heavy mineral grains, less well sorted than above, loose (water saturated), contact gradational, possibly smeared out by sampling.	79	83
Sand, silty, light gray, coarse silt to very fine sand intermixed, massive, angular to hackly fractures and clay concentrations suggest paleosol, interval looks bleached, lower contact indistinct.	83	88

Silt, clayey, medium light gray, massive, fractures more even than above, less paleosol-like than above, very fine sand in lower part and increases downward.	88	90
Silt and sand interbedded, silt is medium light gray, sand is light gray, very fine grain, all quartz except for few heavies, faint laminations to thin beds inclined 40-60 degrees, gradational contact.	90	93
Sand, light wellowish gray to grayish orange, very fine to fine grain size, becomes coarser downward with some medium sand in lower 2', mineralogy as above, except maybe 1% chert and heavies in lower 2', sand mostly clean and loose, but contains several silty intervals. Sharp contact:	93	109.7
Gravel, light gray, composed mainly of chert pebbles, largest nearly 2" across, subrounded to rounded, light gray, tripolitic chert, few medium to dark gray chert (vitreous to bioclastic texture) granules to small pebbles of white to pink or rose colored chert, matrix fine to very coarse quartz sand with common pink grains, gravel largely grain supported, but some matrix supported intervals. Only 1' of loose gravel in 10' core run. Lower contact based on drilling rate with no recovery, but probably like underlying sand.	109.7	127
Sand, light gray and light brownish gray very fine grain, dominantly quartz, but conspicuous mica and silt-size heavies (black), silt and clay lamination is common and coated with mica flakes, sand loose to weakly indurated, less than 3' recovery in 14' or coring (126'-140'), contact with gravel lost.	127	140
Sand, light yellowish gray, light gray to yellowish orange, fine grain, subrounded to rounded, less than 1% black heavies, scattered mica flakes, loose to	140	179.6

wekaly indurated, some intervals slightly silty, scattered black spots of manganese oxide, local concentrated clay laminations (especially between 150'-153') are steeply inclined.		
Sand, light to medium gray, upper part contains several thin interbeds of light to medium gray plastic clay, otherwise similar to above.	179.6	182.8
Sand, light to medium grayish orange with few light gray streaks. Fine grained like next to last unit, concentrations of black iron-manganese oxides at base.	182.8	201
Sand, light gray and light brownish gray, very fine to fine grain, laminae and veins or stringers of light gray clay at various angles, possible microfault at top of unit, slightly micaceous (more mica than in clean fine-grain sands). Sharp contact:	201	210.8
Sand, yellowish orange with gray layers and veins that are more clayey, probable core loss through this unit, some black iron manganese stained spots.	210.8	215
Sand, light gray, fine grained, sugary texture, loose, well sorted, subround to rounded, +99% quartz, some siltsize black heavies and mica flakes.	215	237.1
Sand, light gray and light grayish orange, colors intermixed, near vertical color and textural boundaries (veins and possible Ophiomorphia).	237.1	239.5
Sand, medium grayish orange, fine to medium grain-size, otherwise like next to last unit.	239.5	251
Sand, light gray to light grayish orange, color intermixed, fine to medium grained, orange portions tend to be a little coarser grained, slightly micaceous, few steeply inclined light gray stringers or veinlets, loose to weakly indurated, gradational	251	280

contact.		
Sand, medium light gray and light brownish grain, fine grained, more than 99% quartz, many grains sparkly, silt size heavies, mica flakes as above, mostly loose, liquified in core box, possibly little faint laminations in places, fairly sharp contact.	280	304.6
Sand, very light gray to gray, very fine laminae of silty clay, same color as sand, bedding planes lined with mica flakes, inclined 40 degrees plus/minus, gradiation contact.	304.6	320
Sand, clayey to sandy clay, light gray and dark yellowish brown mottling, more brown toward base, upper half of unit is contorted and broken laminations with blebs of sand cemented by limonite, lower part, structureless mix of sand, silt and clay, with few fragments broken chert, gradational contact.	320	328
Sand, clay and gravel mixture, dark yellowish to orange brown, with a little gray mottling in places, gravel fraction is rounded small pebbles, larger chunks of chert, largely bluish gray, at 334' was very large chunk of such chert, overall look of highly weathered and oxidized, all matrix supported (mud-like), poor core recovery.	328	359
Limestone, medium to dark gray, coarse bryozoan and crinoid wackestone, large fronds of fennestrate bryozoans define bedding, horizontal to gently dipping, numerous partings of dark gray, slightly silty shale, in lower part are nodules of dark gray chert.	359	362

Interpretation by: John Nelson & Jack Masters on 05-AUG-99

This hole was drilled to investigate an apparent graben indicated by long of school water well and previous shallow ISGS boring (ISGS #1 Maple Grove

School).

Peoria silt	0	4.7
Roxana silt	4.7	6.1
Core loss, may include Loveland silt	6.1	10
Metropolis Formation, silt and sand with much clay and reworked Mounds-type gravel. Laminations appear to dip 10 to 30 degrees in places.	10	58.8
Unidentified strata, about 51' and and minor silt overlying 17' of gravel. Two upward-fining sequences are present. These materials could be as young as Quarternary or as old as Cretaceous, but Eocene to Miocene age appears most likely based on absence of mica in sands (as would be tuypical for Cretaceous) and absence of brown Mounds-type chert pebbles.	58.8	127
McNairy Formation, clean quartz sand, minor silt and clay laminae and interbeds, some of which contain considerable mica. An unusually sandy McNairy section.	127	328
Post Creek Formation, clay and sand mixture, oxidized and weathered, mixed with chert gravel and fragments.	328	359
Salem Limestone, the lithology is fairly typical of this unit.	359	362
Total Depth		**362**

Core #C 14730 (0' - 10') Received: August 2, 1999

Core #C 14730 (10' - 59') Received: August 2, 1999

Core #C 14730 (59' - 127') Received: August 2, 1999

Core #C 14730 (127' - 328') Received: August 2, 1999

Core #C 14730 (328' - 359') Received: August 2, 1999

Core #C 14730 (359' - 362') Received: August 2, 1999

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Total Depth		**90**

Sample set # 23753 (5' - 90') Received: January 9, 1952

Permit Date:

Permit #:

COMPANY Layne Western

FARM Electrical Energy Corp (Joppa)

DATE DRILLED

NO. 3

ELEVATION 0

COUNTY NO. 20942

LOCATION

LATITUDE 37.204248

LONGITUDE -88.84879

COUNTY Massac

API 121272094200

23 - 15S - 3E

	Top	Bottom
Total Depth		**169**

Core #C 4292 (145.5' - 149') Received: March 5, 1962
Core #C 4292 (154' - 169') Received: March 5, 1962

Permit Date: **Permit #:**

COMPANY Layne Western
FARM Missouri Portland Cement T.H.
DATE DRILLED **NO.** 61-9(62)
ELEVATION 0 **COUNTY NO.** 20934
LOCATION 825'N 325'E SW/c NW
LATITUDE 37.216334 **LONGITUDE** -88.875329
COUNTY Massac **API 121272093400** **15 - 15S - 3E**

	Top	Bottom
Total Depth		**105**

Sample set # 41920 (0' - 105') Received: March 5, 1962

Permit Date: **Permit #:**

COMPANY Layne Western

FARM Missouri Portland Cement T.H.

DATE DRILLED **NO.** 61-9(62)

ELEVATION 0 **COUNTY NO.** 20933

LOCATION 825'N 325'E SW/c NW

LATITUDE 37.216334 **LONGITUDE** -88.875329

COUNTY Massac **API 121272093300** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Total Depth		**105**

Sample set # 41919 (0' - 105') Received: March 5, 1962

Permit Date:

Permit #:

COMPANY Layne Western

FARM Missouri Portland Cement T.H.

DATE DRILLED

NO. 61-6(62)

ELEVATION 0

COUNTY NO. 20930

LOCATION 335'N 500'E SW/c NW

LATITUDE 37.214973

LONGITUDE -88.874799

COUNTY Massac

API 121272093000

15 - 15S - 3E

	Top	Bottom
Total Depth		**138**

Sample set # 41921 (0' - 138') Received: March 5, 1962

Permit Date: **Permit #:**

COMPANY Layne Western

FARM Missouri Portland Cement T.H.

DATE DRILLED **NO.** 61-7(62)

ELEVATION 0 **COUNTY NO.** 20929

LOCATION 570'N 740'E SW/c NW

LATITUDE 37.215609 **LONGITUDE** -88.873938

COUNTY Massac **API 121272092900** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Total Depth		**130**
Sample set # 41922 (0' - 130') Received: March 5, 1962		

Permit Date: **Permit #:**

COMPANY Layne Western

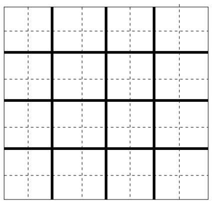
FARM Missouri Portland Cement T.H.

DATE DRILLED **NO.** 61-4

ELEVATION 0 **COUNTY NO.** 20928

LOCATION 442'N 395'E SW/c NW

LATITUDE 37.215273 **LONGITUDE** -88.875145



COUNTY Massac **API 121272092800** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Total Depth		**110**

Sample set # 41685 (0' - 110') Received: December 20, 1961

Permit Date:

Permit #:

COMPANY Layne Western

FARM Missouri Portland Cement Co

DATE DRILLED

NO. 5

ELEVATION 0

COUNTY NO. 20927

LOCATION 173'N 288'E SW/c NW

LATITUDE 37.214536

LONGITUDE -88.875555

COUNTY Massac

API 121272092700

15 - 15S - 3E

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

	Top	Bottom
Total Depth		**136**

Sample set # 41556 (0' - 136') Received: November 22, 1961

Permit Date: **Permit #:**

COMPANY Layne Western

FARM Missouri Portland Cement Co

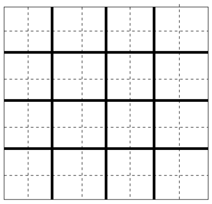
DATE DRILLED **NO.** 2

ELEVATION 0 **COUNTY NO.** 20926

LOCATION 512'N 40'E SW/c NW

LATITUDE 37.215484 **LONGITUDE** -88.876362

COUNTY Massac **API 121272092600** **15 - 15S - 3E**



ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Total Depth		**451**

Sample set # 41557 (160' - 451') Received: November 22, 1961

Permit Date: **Permit #:**

COMPANY Layne Western

FARM Missouri Portland Cement Co

DATE DRILLED **NO.** 1

ELEVATION 0 **COUNTY NO.** 20919

LOCATION 489'N 143'E SW/c NW

LATITUDE 37.215416 **LONGITUDE** -88.876007

COUNTY Massac **API 121272091900** **15 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Industrial Water Well	**Top**	**Bottom**
topsoil	0	5
brown clay	5	35
fine sand with gray clay	35	65
sand & gravel	65	98
Total Depth		**98**

Casing: 16" STEEL 62.58#/FT from -2' to 72'
16" STNLESS STL SCREEN from 72' to 97'

Screen: 2' of 16" diameter 80 slot

Grout: CEMENT from 2 to 20.

Size hole below casing: 48"

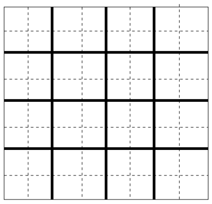
Water from sand & gravel at 72' to 97'.
Static level 48' below casing top which is 2' above GL
Pumping level 71' when pumping at 0 gpm for 8 hours

Permanent pump installed at 90' on August 12, 1997, with a capacity of 325 gpm

Address of well: same as above

Location source: Location from permit

Permit Date: July 8, 1997 **Permit #:**



COMPANY Stollhans, Jeff
FARM Lafarge Corp.
DATE DRILLED July 21, 1997 **NO.** 5
ELEVATION 0 **COUNTY NO.** 20856
LOCATION NE NW SW
LATITUDE 37.213209 **LONGITUDE** -88.873085
COUNTY Massac **API 121272085600** **15 - 15S - 3E**

Stratigraphic Test	**Top**	**Bottom**
Total Depth		**76**
Core #C 14531 (0' - 6.2') Received: August 25, 1997		
Core #C 14531 (6.2' - 11') Received: August 25, 1997		
Core #C 14531 (11' - 16') Received: August 25, 1997		
Core #C 14531 (16' - 38.1') Received: August 25, 1997		
Core #C 14531 (38.1' - 76') Received: August 25, 1997		

Permit Date: **Permit #:**

COMPANY IL State Geological Survey

FARM Maple Grove School

DATE DRILLED **NO.** J-1

ELEVATION 0 **COUNTY NO.** 20851

LOCATION 2450'N line, 450'E line of section

LATITUDE 37.229018 **LONGITUDE** -88.859059

COUNTY Massac **API 121272085100** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	**Top**	**Bottom**
clay	0	76
sandy clay & yellow sand	76	120
gray clay	120	145
gray clay & sand	145	210
chert	210	280
Total Depth		**280**

Casing: 6" PVC SDR 21 from -1' to 235'

Grout: BENTONITE from 0 to 230.

Water from chert at 265' to 280'.
Static level 120' below casing top which is 1' above GL
Pumping level 160' when pumping at 12 gpm for 72 hours

Permanent pump installed at 200' on February 10, 1996, with a capacity of 7 gpm

Remarks: Well not completed at this time

Location source: Location from permit

Permit Date: October 12, 1995 **Permit #:**

COMPANY Beanland, Ronald D.
FARM Meyer, Glen
DATE DRILLED November 10, 1995 **NO.**
ELEVATION 0 **COUNTY NO.** 20699
LOCATION NW NE NE
LATITUDE 37.234715 **LONGITUDE** -88.842652
COUNTY Massac **API 121272069900** **11 - 15S - 3E**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Private Water Well	**Top**	**Bottom**
dirt & clay	0	18
clay & soapstone	18	72
brown pea gravel	72	94
Total Depth		**94**

Casing: 6" SDR 21 from -1' to 88'
6" PVC SCREEN from 88' to 94'

Screen: 6' of 6" diameter .02 slot

Grout: BENSEAL/SLRY from 0 to 72.

Grout: GRAVEL PACK from 72 to 94.

Size hole below casing: 6"

Water from gravel at 85' to 94'.
Static level 52' below casing top which is 1' above GL
Pumping level 70' when pumping at 0 gpm for 24 hours

Permanent pump installed at 80' on October 21, 1994, with a capacity of 10 gpm

Address of well:
Joppa, IL

Location source: Location from permit

Permit Date: October 7, 1994 **Permit #:**

COMPANY Beanland, Leonard Ralph
FARM Jewel, William
DATE DRILLED October 9, 1994 **NO.**
ELEVATION 0 **COUNTY NO.** 20675
LOCATION NE SE SW
LATITUDE 37.223783 **LONGITUDE** -88.84962
COUNTY Massac **API 121272067500** **11 - 15S - 3E**

Page 1

ILLINOIS STATE GEOLOGICAL SURVEY

Industrial Water Well	**Top**	**Bottom**
SS #64975 (0'-105')	0	0
light brown clay	0	10
dark brown clay	10	25
gray clay	25	40
gray & brown clay	40	55
brown fine sdy till	55	60
coarse sand & gravel	60	92
Total Depth		**110**

Casing: 42" STEEL 166.71 LB from 0' to 20'
16" STEEL 62.58 LB from -3' to 71'

Screen: 25' of 16" diameter 5 slot

Grout: READY MIX from 0 to 20.

Size hole below casing: 42"

Water from alluvial at 71' to 94'.
Static level 52' below casing top which is 3' above GL
Pumping level 62' when pumping at 300 gpm for 4 hours

Permanent pump installed at 65' on April 4, 1985, with a capacity of 300 gpm

Sample set # 64975 (0' - 105')

Location source: Location from permit

Permit Date: December 21, 1984 **Permit #:** 116253

COMPANY Ruester, John T.

FARM Missouri Portland Cmt Co.

DATE DRILLED February 22, 1985 **NO.** 4

ELEVATION 0 **COUNTY NO.** 20520

LOCATION 1980'S 800'E NW/c

LATITUDE 37.215958 **LONGITUDE** -88.873711

COUNTY Massac **API 121272052000** **15 - 15S - 3E**

Test Hole	**Top**	**Bottom**
SS #64976 (0'-95')	0	0
light brown clay	0	5
brown clay	5	25
gray clay	25	40
drk brn cl w/fine s	40	50
brn fine sand & gvl	50	65
coarse sand & gravel	65	75
fine to medium sand	75	80
coarse sand & gravel	80	95
fine sand	95	110
Total Depth		**110**

Size hole below casing: 0"

Remarks: test hole for fm spls.sealed w/bentonite

Sample set # 64976 (0' - 95') Received: March 5, 1985

Location source: Location from permit

Permit Date: December 21, 1984 **Permit #:** 116252

COMPANY Ruester, John T.

FARM Missouri Portland Cement Co.

DATE DRILLED January 3, 1985 **NO.**

ELEVATION 0 **COUNTY NO.** 20519

LOCATION 1800'N line, 700'W line of section

LATITUDE 37.216462 **LONGITUDE** -88.874027

COUNTY Massac **API 121272051900** **15 - 15S - 3E**

Household - Livestock Watering Well	**Top**	**Bottom**
clay	0	21
clay & fine sand	21	150
chert	150	175
Total Depth		**175**

Casing: 6" PVC SDR-21 from -1' to 174'

Grout: BENTONITE/SAND from 0 to 160.

Size hole below casing: 0"

Water from chert at 165' to 174'.
Static level 50' below casing top which is 1' above GL
Pumping level 90' when pumping at 20 gpm for 2 hours

Permanent pump installed at 120' on May 16, 1987, with a capacity of 20 gpm

Address of well: R.R.
Joppa, IL

Location source: Location from permit

Permit Date: April 23, 1987 **Permit #:** 131156

COMPANY Beanland, Ronald D.
FARM Pritchett, Steve
DATE DRILLED May 15, 1987 **NO.**
ELEVATION 0 **COUNTY NO.** 20471
LOCATION NE SE NW
LATITUDE 37.231377 **LONGITUDE** -88.867889
COUNTY Massac **API 121272047100** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**52**
Driller's Log filed		

Permit Date:

Permit #:

COMPANY Horman, Paul

FARM Sielbeck Gerry

DATE DRILLED October 1, 1976

NO. 1

ELEVATION 0

COUNTY NO. 20255

LOCATION SW SE SW

LATITUDE 37.222274

LONGITUDE -88.870363

COUNTY Massac

API 121272025500

10 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**110**
Driller's Log filed		

Permit Date:

Permit #:

COMPANY Luhr Brothers, Inc.

FARM Mo Portland Cement

DATE DRILLED September 1, 1974

NO. 3

ELEVATION 355GL

COUNTY NO. 20220

LOCATION 2220'N line, 500'W line of NW

LATITUDE 37.215316

LONGITUDE -88.874782

COUNTY Massac

API 121272022000

15 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
surface red clay	0	20
big, red gravel	20	70
sandy clay	70	120
dry sand	120	135
blue clay, dark	135	270
broken limerock	270	280
limerock	280	283
Total Depth		**283**

Casing: 6" STEEL 20# from 0' to 280'

Grout: DRILL CUTTINGS from 0 to 40.

Size hole below casing: 6"

Water from broken lime at 280' to 283'.
Static level 135' below casing top which is 1' above GL
Pumping level 160' when pumping at 15 gpm for 4 hours

Driller's Log filed
Location source: Location from permit

Permit Date: January 24, 1973 **Permit #:** NF17726

COMPANY Horman, Paul
FARM Brewer, Robert
DATE DRILLED February 7, 1973 **NO.** 1
ELEVATION 0 **COUNTY NO.** 00198
LOCATION NE NE SE
LATITUDE 37.22736 **LONGITUDE** -88.840461
COUNTY Massac **API 121270019800** **11 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**160**
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY Geer, Alonzo

FARM Mathes David L

DATE DRILLED July 1, 1971 **NO.** 1

ELEVATION 0 **COUNTY NO.** 00158

LOCATION NW NW NE

LATITUDE 37.2201 **LONGITUDE** -88.847389

COUNTY Massac **API 121270015800** **14 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
clay	0	20
gravel	20	130
sand	130	150
Total Depth		**150**

Casing: 7" NEW STEEL 23# FT from 0' to 104'

Size hole below casing: 6.25"

Water from sand gravel at 0' to 0'.
Static level 60' below casing top which is 1' above GL
Pumping level 100' when pumping at 15 gpm for 4 hours

Permanent pump installed at 120' on , with a capacity of 15 gpm

Driller's Log filed
Location source: Location from permit

Permit Date: **Permit #:** 12094

COMPANY Sergent, William E.
FARM Kapley, Homer & Levina
DATE DRILLED **NO.** 1
ELEVATION 0 **COUNTY NO.** 00146
LOCATION SE SE SE
LATITUDE 37.22186 **LONGITUDE** -88.840518
COUNTY Massac **API 121270014600** **11 - 15S - 3E**

Water Well	**Top**	**Bottom**
soil	0	11
yellow clay	11	26
gravel	26	31
yellow clay	31	38
sandy clay	38	45
gravel & sand	45	78
Total Depth		**78**

Casing: 6" PVC from 30' to -2'
24" CONCRETE from 78' to 30'

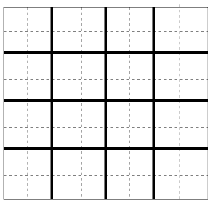
Grout: TILE 24" from 78 to 30.

Grout: PVC 6" from 30 to -2.

Water from gravel & sand at 58' to 78'.
Static level 20' below casing top which is 2' above GL
Pumping level 15' when pumping at 10 gpm for 1 hour

Driller's Log filed
Location source: Location from permit

Permit Date: August 11, 1969 **Permit #:** 06803



COMPANY Jennings, James E.
FARM Adams, Guy
DATE DRILLED August 21, 1969 **NO.** 19
ELEVATION 0 **COUNTY NO.** 00111
LOCATION 50'N 60'W SE/c NE SE SW
LATITUDE 37.222994 **LONGITUDE** -88.848699
COUNTY Massac **API 121270011100** **11 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**65**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 6595 (1' - 65') Received: September 25, 1941		

Permit Date: **Permit #:**

COMPANY Smith & Cunningham

FARM Wilson Marie

DATE DRILLED January 1, 1941 **NO.** 1

ELEVATION 340GL **COUNTY NO.** 00055

LOCATION

LATITUDE 37.204248 **LONGITUDE** -88.84879

COUNTY Massac **API 121270005500** **23 - 15S - 3E**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	**Top**	**Bottom**
Total Depth		**137**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 4671 (0' - 137') Received: June 20, 1940		

Permit Date: **Permit #:**

COMPANY Smith & Cunningham
FARM Joppa Colored Schl
DATE DRILLED June 1, 1940 **NO.** 1
ELEVATION 340GL **COUNTY NO.** 00054
LOCATION 500'N line, 600'E line of NW
LATITUDE 37.205054 **LONGITUDE** -88.850833
COUNTY Massac **API 121270005400** **23 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**235**
Driller's Log filed		
Sample set # 21218 (0' - 235') Received: July 11, 1951		

Permit Date:

Permit #:

COMPANY Layne Western Co., Inc.

FARM Electric Energy Inc

DATE DRILLED January 1, 1951

NO. 1

ELEVATION 348GL

COUNTY NO. 00053

LOCATION 675'N line, 400'E line of NE SE

LATITUDE 37.211974

LONGITUDE -88.859164

COUNTY **Massac**

API **121270005300**

15 - 15S - 3E

Water Well	**Top**	**Bottom**
Total Depth		**138**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 4599 (5' - 138') Received: June 4, 1940		

Permit Date: **Permit #:**

COMPANY Smith & Cunningham

FARM Joppa Grade School

DATE DRILLED April 1, 1940 **NO.**

ELEVATION 340GL **COUNTY NO.** 00052

LOCATION 1000'N line, 1150'W line of SE

LATITUDE 37.21092 **LONGITUDE** -88.8447

COUNTY Massac **API 121270005200** **14 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		**403**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 21445 (0' - 405') Received: January 9, 1951		

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

FARM Electric Energy Inc

DATE DRILLED January 1, 1951 **NO.** 3

ELEVATION 355GL **COUNTY NO.** 00051

LOCATION 2352'N line, 2088'E line of NE

LATITUDE 37.214512 **LONGITUDE** -88.84669

COUNTY Massac **API 121270005100** **14 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**350**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 21219 (0' - 350') Received: January 9, 1951		

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

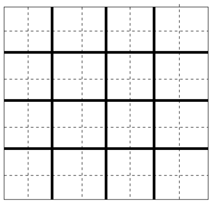
FARM Electric Enrgy Inc

DATE DRILLED January 1, 1951 **NO.** 2

ELEVATION 0 **COUNTY NO.** 00050

LOCATION 910'N line, 660'W line of NW SW

LATITUDE 37.211275 **LONGITUDE** -88.855516



COUNTY **Massac** **API** **121270005000** **14 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**166**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 20885 (0' - 166') Received: July 11, 1950		

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

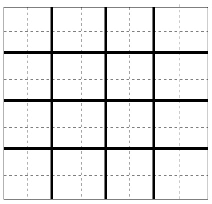
FARM Joppa Compressor Station #7

DATE DRILLED October 1, 1950 **NO.** 2

ELEVATION 360GL **COUNTY NO.** 00049

LOCATION 500'S line, 2200'E line of SE

LATITUDE 37.222643 **LONGITUDE** -88.865214



COUNTY **Massac** **API** **121270004900** **10 - 15S - 3E**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	**Top**	**Bottom**
Total Depth		**150**
Survey Sample Study filed		
Driller's Log filed		
Sample set # 20884 (0' - 150') Received: July 11, 1950		

Permit Date: **Permit #:**

COMPANY Layne Western Co., Inc.

FARM Joppa Compressor Station #7

DATE DRILLED November 1, 1950 **NO.** 1

ELEVATION 360GL **COUNTY NO.** 00048

LOCATION 250'S line, 2200'E line of SE

LATITUDE 37.221953 **LONGITUDE** -88.865227

COUNTY Massac **API 121270004800** **10 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**156**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 6594 (1' - 156') Received: September 25, 1941		

Permit Date:

Permit #:

COMPANY Smith & Cunningham

FARM Roberts M G

DATE DRILLED April 1, 1941

NO. 1

ELEVATION 340GL

COUNTY NO. 00031

LOCATION

LATITUDE 37.21372

LONGITUDE -88.848626

COUNTY **Massac**

API **121270003100**

14 - 15S - 3E

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		**153**
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY Smith & Cunningham

FARM Bunchman A J

DATE DRILLED January 1, 1941 **NO.**

ELEVATION 0 **COUNTY NO.** 00030

LOCATION SW SW NE

LATITUDE 37.214621 **LONGITUDE** -88.847472

COUNTY Massac **API 121270003000** **14 - 15S - 3E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	**Top**	**Bottom**
Total Depth		**140**
Driller's Log filed		

Permit Date:

Permit #:

COMPANY Layne Western Co., Inc.

FARM Missouri Prtlnd Cemt

DATE DRILLED November 1, 1961

NO. 1A

ELEVATION 355GL

COUNTY NO. 00023

LOCATION NW SW

LATITUDE 37.21218

LONGITUDE -88.874319

COUNTY Massac

API 121270002300

15 - 15S - 3E

Water Well	Top	Bottom
Total Depth		**304**
Driller's Log filed		
Survey Sample Study filed		
Sample set # 25675 (0' - 304') Received: July 29, 1955		

Permit Date:

Permit #:

COMPANY Layne Western Co., Inc.

FARM Bechtel Corp

DATE DRILLED July 1, 1955 **NO.** 4

ELEVATION 0 **COUNTY NO.** 00001

LOCATION 4400'N line, 275'W line of section

LATITUDE 37.208964 **LONGITUDE** -88.856879

COUNTY Massac **API 121270000100** **14 - 15S - 3E**

McCOY & McCOY
LABORATORIES, Inc.

P.O. Box 907, 825 Industrial Road
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270.821.7375
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859.299.7775

Pikeville, KY
606.432.3104

Louisville, KY
502.961.0001

Paducah, KY
270.444.6547

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Certificate of Analysis

Chris Skates
Electric Energy Inc
P O Box 165
Joppa IL, 62953

Report Printed: 02/26/2013 15:34

Project Name:	Process Control	Workorder:	3022088

Dear Chris Skates

Enclosed are the analytical results for samples received at the lab on 02/14/2013 15:15.

McCoy & McCoy Laboratories, Inc located in Madisonville, Kentucky is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact us at (270) 821-7375.

Please visit us at www.mccoylabs.com for a listing of NELAP accreditations and Scope of Work, as well as other links to Water Quality documentation on the internet.

This laboratory report may not be reproduced, except in full, without the written approval of McCoy & McCoy Laboratories, Inc.

60 YEARS
McCOY & McCOY LABORATORIES, Inc.

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Brett Davis

Brett Davis, Project Manager

SAMPLE SUMMARY

Lab ID	Client Sample ID/Alias	Matrix	Date Collected	Date Received	Sampled By
3022088-01	Groundwater/Well #1	Wastewater	02/12/2013 12:25	02/14/2013 15:15	Chris Skates
3022088-02	Groundwater/Well #2	Wastewater	02/12/2013 12:40	02/14/2013 15:15	Chris Skates
3022088-03	Groundwater/Well #3	Wastewater	02/12/2013 14:20	02/14/2013 15:15	Chris Skates
3022088-04	Groundwater/Well #4	Wastewater	02/12/2013 13:10	02/14/2013 15:15	Chris Skates

McCOY & McCOY
LABORATORIES, Inc.

P.O. Box 907, 825 Industrial Road
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606.432.3104

Louisville, KY
502.961.0001

Paducah, KY
270.444.6547

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ANALYTICAL RESULTS

Lab Sample ID: **3022088-01**
Description: **Groundwater Well #1**

Sample Collection Date Time: 02/12/2013 12:25
Sample Received Date Time: 02/14/2013 15:15

Metals by EPA 200 Series Methods

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Boron	ND	L1, U	mg/L	0.10	0.10	EPA 200.7	02/18/2013 08:14	02/18/2013 21:31	MLC

Conventional Chemistry Analyses_01

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Sulfate	**6**		mg/L	1	0.2	EPA 300.0	02/25/2013 18:03	02/25/2013 18:03	DMH

ANALYTICAL RESULTS

Lab Sample ID: **3022088-02**
Description: **Groundwater Well #2**

Sample Collection Date Time: 02/12/2013 12:40
Sample Received Date Time: 02/14/2013 15:15

Metals by EPA 200 Series Methods

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Boron	ND	L1, U	mg/L	0.10	0.10	EPA 200.7	02/18/2013 08:14	02/18/2013 21:42	MLC

Conventional Chemistry Analyses_01

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Sulfate	**6**		mg/L	1	0.2	EPA 300.0	02/25/2013 18:26	02/25/2013 18:26	DMH

ANALYTICAL RESULTS

Lab Sample ID: **3022088-03**
Description: **Groundwater Well #3**

Sample Collection Date Time: 02/12/2013 14:20
Sample Received Date Time: 02/14/2013 15:15

Metals by EPA 200 Series Methods

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Boron	ND	L1, U	mg/L	0.10	0.10	EPA 200.7	02/18/2013 08:14	02/18/2013 21:46	MLC

Conventional Chemistry Analyses_01

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Sulfate	**6**		mg/L	1	0.2	EPA 300.0	02/25/2013 18:49	02/25/2013 18:49	DMH

ANALYTICAL RESULTS

Lab Sample ID: **3022088-04**
Description: **Groundwater Well #4**

Sample Collection Date Time: 02/12/2013 13:10
Sample Received Date Time: 02/14/2013 15:15

Metals by EPA 200 Series Methods

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Boron	ND	L1, U	mg/L	0.10	0.10	EPA 200.7	02/18/2013 08:14	02/21/2013 14:09	MLC

Conventional Chemistry Analyses_01

Analyte	Result	Flag	Units	MRL	MDL	Method	Prepared	Analyzed	Analyst
Sulfate	**6**		mg/L	1	0.2	EPA 300.0	02/25/2013 19:11	02/25/2013 19:11	DMH

Notes for work order 3022088

- Samples collected by MMLI personnel are done so in accordance with procedures set forth in MMLI field services SOPs.
- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- The Chain of Custody document is included as part of this report.
- All Library Search analytes should be regarded as tentative identification based on the presumptive evidence of the mass spectra.

U	Target analyte was analyzed for, but was below detection limit (the value associated with the qualifier is the laboratory method detection limit in our LIMS system).
L1	The associated blank spike recovery was above method acceptance limits.
J	Estimated value.

Standard Quallifiers/Acronymns

MDL	Method Detection Limit
MRL	Minimum Reporting Limit
ND	Not Detected
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
% Rec	Percent Recovery
RPD	Relative Percent Difference
>	Greater than permit limits
<	Less than permit limits

Analyses performed at the Madisonville KY location unless specified with the following location codes.

02	Pikeville, KY
03	Paducah, KY
04	Lexington, KY
05	Louisville, KY

Certified Analyses included in this Report

Analyte	**Certifications**
EPA 200.7 in Water	
Boron	VA NELAC (460210)
EPA 300.0 in Water	
Sulfate	KY Drinking Water (00030) VA NELAC (460210)

APPENDIX B

BORING LOGS, WELL DIAGRAMS, AND WELL ABANDONMENT REPORTS

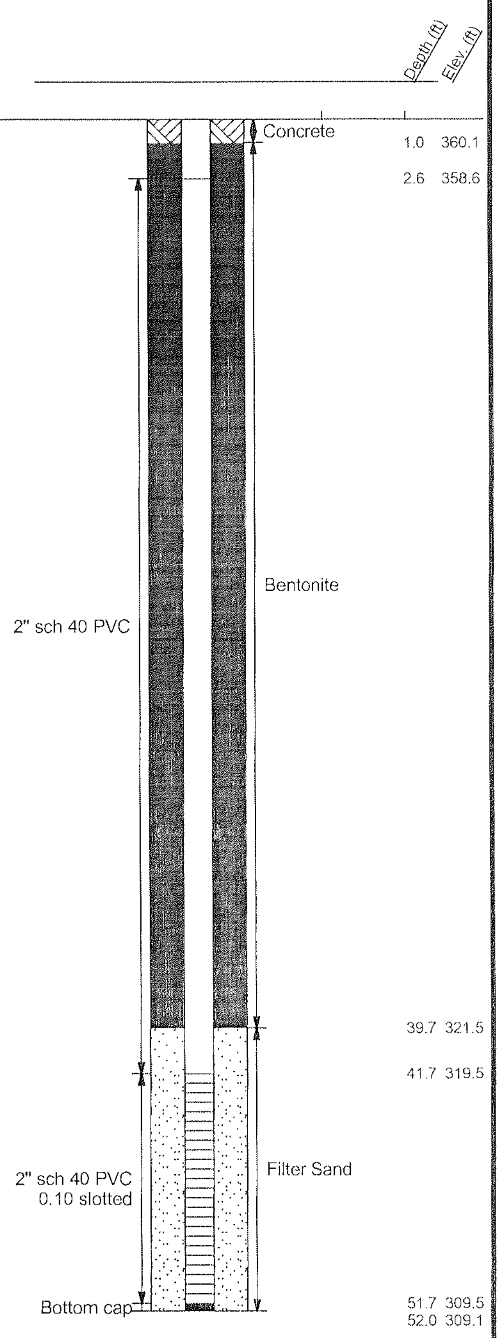
Surface Elevation: 361.12 Completion Date: ________

Datum msl

WELL DIAGRAM

Flushmount

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to stiff, brown and gray, silty CLAY - (CL)		2-4-4-5	SS1
	k = 2.8 x 10^{-8}cm/s		2-2-3-4	SS2
5			2-3-4-5	SS3
			5-4-5-6	SS4
10			3-5-6-7	SS5
			3-5-7-9	SS6
			3-4-4-5	SS7
15			2-2-4-5	SS8
			2-4-5-5	SS9
			2-4-6-7	SS10
20			2-4-7-5	SS11
			2-3-4-4	SS12
25	trace sand		3-4-6-6	SS13
			2-4-5-8	SS14
			2-3-4-6	SS15
30	trace gravel and weathered limestone		2-4-8-18	SS16
	Weathered LIMESTONE with silty clay		15-18-22-22	SS17
35	Stiff, brown and gray, silty CLAY with sand - CL		7-7-6-6	SS18
	Medium stiff, brown and gray, silty CLAY, trace sand - CL		2-3-4-4	SS19
			3-3-4-4	SS20
40	soft		1-2-2-1	SS21
			1-4-6-7	SS22
45	very stiff, with weathered limestone		4-10-12-6	SS23
		∇	3-4-4-4	SS24
			1-2-3-3	SS25
50			2-3-4-6	SS26
	Boring terminated at 52 feet.			



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

ENCOUNTERED AT 48 FEET ∇

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

___ DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RAP	App'vd. by: KBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-101

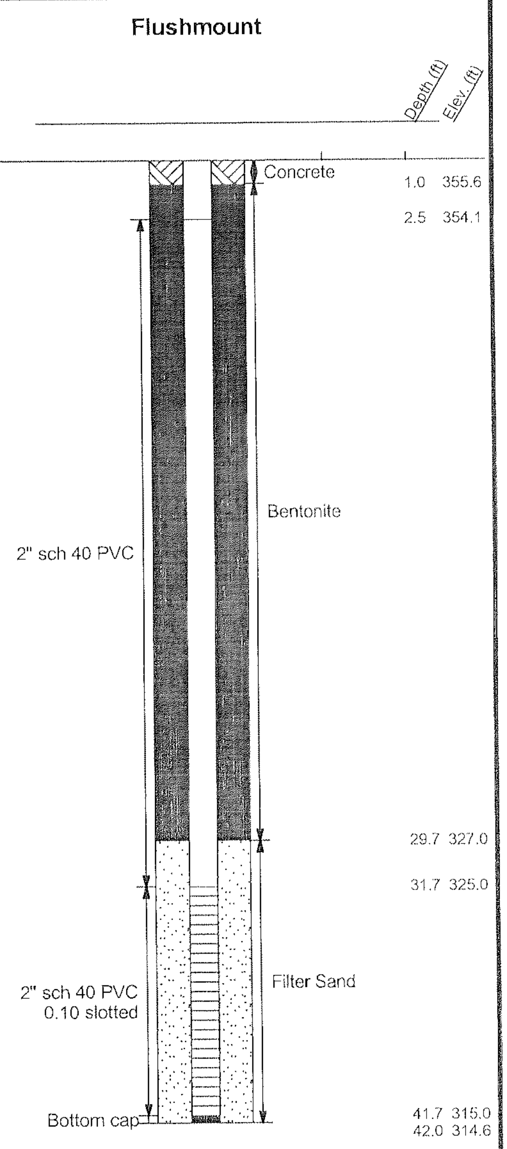
Project No. J017150.02

Surface Elevation: 356.63 Completion Date: 6/24/10

Datum msl

WELL DIAGRAM

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pc SPT BLOW COUNTS CORE RECOVERY/RQ	SAMPLES
	Medium stiff to stiff, brown, silty CLAY - (CL)	▨	2-2-3-4	SS1
		▨	2-3-4-5	SS2
5		▨	1-3-4-5	SS3
		▨	1-3-4-4	SS4
		▨	1-4-4-4	SS5
10		▨	2-3-5-6	SS6
		▨	2-3-5-7	SS7
15		▨	2-4-4-4	SS8
		▨	3-6-7-9	SS9
		▨	5-6-7-8	SS10
20		▨	1-5-5-10	SS11
		▨	3-5-6-8	SS12
25	k = 4.6 x 10^{-9}cm/s	▨	3-5-7-9	SS13
	brown and gray	▨	2-4-6-6	SS14
		▨	3-6-10-11	SS15
30		▨	3-4-7-8	SS16
	Stiff, brown and gray, silty CLAY, trace sand - CL	▨	2-3-6-7	SS17
35		▨	6-5-5-8	SS18
		▨	3-5-6-7	SS19
		▨	1-3-5-6	SS20
40		▨	3-4-5-7	SS21
	Boring terminated at 42 feet.			
45				
50				



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM
WASHBORING FROM __ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KDP	App'vd. by: KDP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-111

Project No. J017150.02

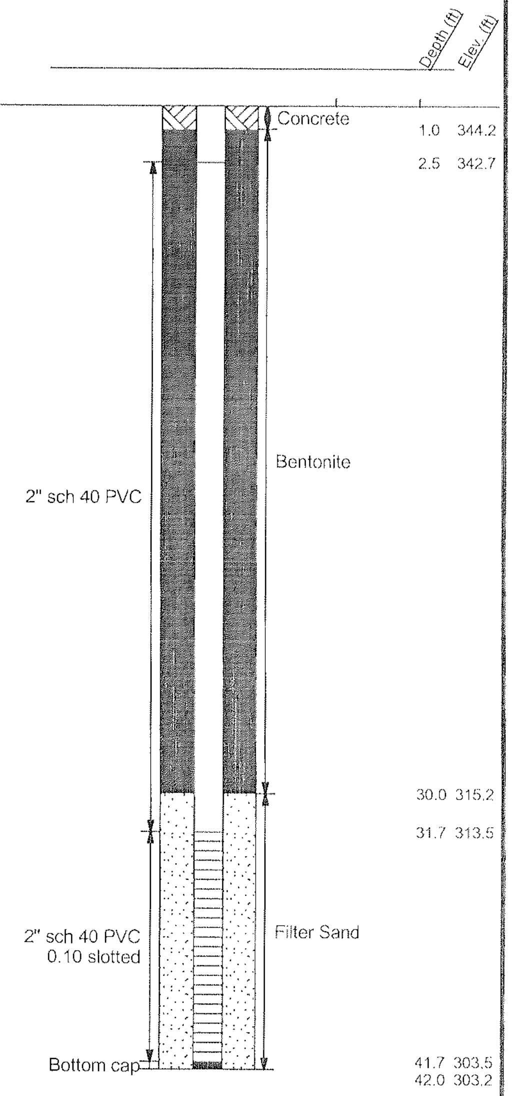
Surface Elevation: 345.16
Completion Date: 6/20/10
Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very stiff, brown silty CLAY - (CL)	▨	2-3-5-6	SS1
		▨	3-5-9-11	SS2
5		▨	3-6-11-11	SS3
		▨	4-11-14 -15	SS4
10		▨	6-8-9-10	SS5
		▨	2-5-5-6	SS6
		▨	2-5-5-7	SS7
15		▨	2-5-6-7	SS8
	k = 9.2 x 10^{-9}cm/s	▨	2-3-4-5	SS9
20	with coal	▨	2-4-5-4	SS10
		▨	2-3-4-4	SS11
		▨	1-2-3-4	SS12
25		▨	1-3-4-4	SS13
		▨	1-3-4-5	SS14
30		▨	1-2-3-4	SS15
		▨	2-3-4-5	SS16
	Soft to medium stiff, brown silty CLAY - CL	▨	1-2-2-4	SS17
35		▨	2-2-4-5	SS18
		▨	0-1-1-2	SS19
40		▨	2-2-2-2	SS20
		▨	2-4-4-8	SS21
	Boring terminated at 42 feet.			
45				
50				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

WELL DIAGRAM

Flushmount



GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM
WASHBORING FROM __ FEET
PH DRILLER JPC LOGGER
__ DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJP	App'vd. by: RJP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-112b

Project No. J017150.02

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

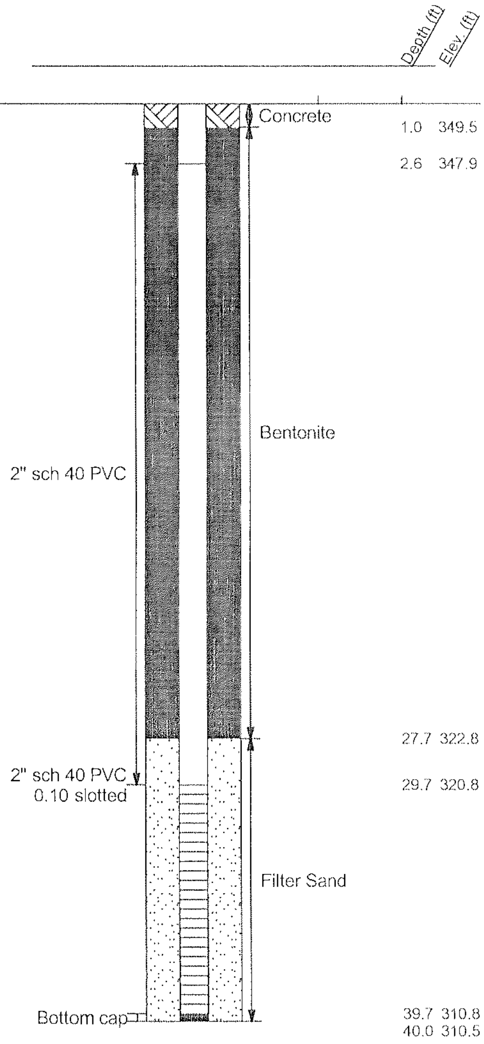
Surface Elevation: 350.46 Completion Date: 6/25/10

Datum msl

WELL DIAGRAM

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL	▨	2-2-3-4	SS1
	Medium stiff to stiff, brown CLAY - CH	▨	2-5-6-7	SS2
5		▨	2-2-4-3	SS3
	Soft, brown to brown and gray CLAY - CH	▨	2-1-2-3	SS4
		▨	1-1-1-3	SS5
10	Medium stiff to stiff, brown and gray CLAY - CH	▨	3-3-4-5	SS6
		▨	2-3-4-6	SS7
15		▨	2-3-4-5	SS8
		▨	2-2-4-5	SS9
		▨	4-5-7-8	SS10
20		▨	4-5-7-7	SS11
		▨	2-5-6-10	SS12
25		▨	2-8-10-10	SS13
	Stiff, gray and brown, silty CLAY - CL k = 3.7 x 10^{-9}cm/s	▨	3-6-8-9	SS14
		▨	4-6-8-11	SS15
30		▨	4-4-7-19	SS16
	Hard to very stiff, gray and brown, sandy CLAY - CL	▨	8-17-16-20	SS17
35		▨	6-8-9-9	SS18
	Stiff, brown and gray, silty CLAY, trace sand - (CL)	▨	3-4-6-8	SS19
	Boring terminated at 40 feet.	▨	4-4-6-9	SS20
40				
45				
50				

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KOP	App'vd. by: KOP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-113

Project No. J017150.02

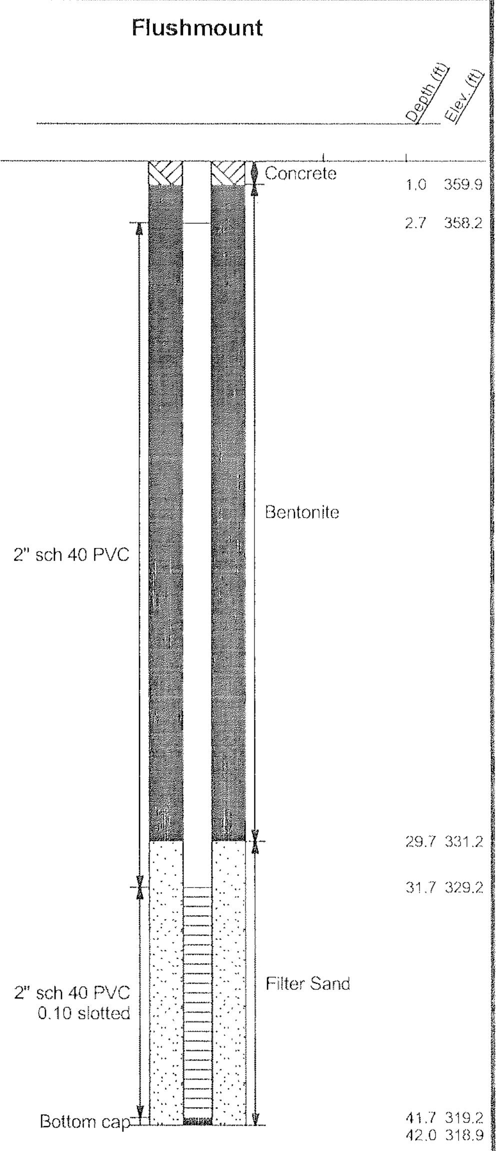
Surface Elevation: 360.9
Completion Date: 6/19/10
Datum msl

DESCRIPTION OF MATERIAL

DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
GRAVEL	●		SS1
Medium stiff to stiff, brown and gray, silty CLAY - (CL)	▨	3-4-4-5	SS2
	▨	2-3-3-5	SS3
	▨	3-3-4-4	SS4
k = 1.6 x 10^{-8}cm/s	▨	1-2-3-5	SS5
	▨	3-5-5-6	SS6
	▨	2-4-5-6	SS7
	▨	2-3-4-5	SS8
Medium stiff to stiff, brown and gray, silty CLAY, trace sand - CL	▨	3-4-6-7	SS9
	▨	3-4-6-6	SS10
	▨	3-5-7-8	SS11
	▨	3-5-7-9	SS12
	▨	2-3-5-6	SS13
	▨	3-5-7-6	SS14
	▨	3-5-8-8	SS15
	▨	4-7-9-4	SS16
	▨	4-4-6-7	SS17
	▨	2-4-3-5	SS18
Medium stiff to very stiff, brown and gray, sandy CLAY with silt - CL	▨	5-5-7-14	SS19
	▨	13-13-10-8	SS20
	▨	2-4-6-7	SS21
Boring terminated at 42 feet.			

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER BGF LOGGER
___ DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RBP	App'vd. by: RBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-151

Project No. J017150.02

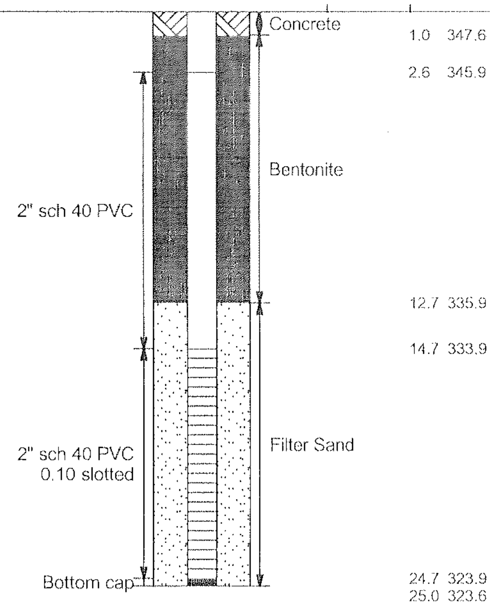
Surface Elevation: 348.56 Completion Date: ____

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown CLAY with organics - CH		2-3-3-4	SS1
	Medium stiff, brown and gray, silty CLAY - (CL)		1-1-2-3	SS2
5			1-2-3-5	SS3
			2-3-4-5	SS4
			1-3-4-4	SS5
10			2-3-5-5	SS6
	becoming stiff		2-5-8-9	SS7
15			2-5-3-6	SS8
			3-5-5-7	SS9
	trace sand to 25 feet		3-4-7-6	SS10
20	k = 1.1 x 10^{-8}cm/s	⊽	3-6-10-9	SS11
			2-4-5-5	SS12
25	Boring terminated at 25 feet.			
30				
35				
40				
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ⊽

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KBP	App'vd. by: KBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-152

Project No. J017150.02

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

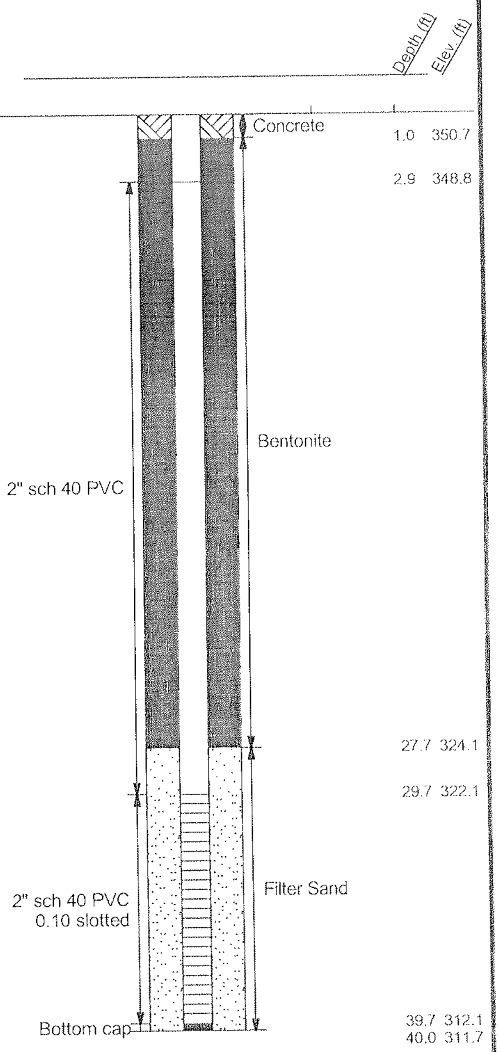
Surface Elevation: 351.73 Completion Date: 6/18/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown and gray CLAY - CH	▨	2-2-3-4	SS1
	Soft, brown and gray CLAY - CH	▨	1-1-2-1	SS2
5	Medium stiff to stiff, brown, silty CLAY, trace sand - (CL)	▨	1-2-4-4	SS3
		▨	2-4-4-5	SS4
		▨	2-3-6-6	SS5
10		▨	3-5-5-6	SS6
		▨	1-4-4-8	SS7
15	k = 1.2 x 10^{-8}cm/s	▨	2-4-5-8	SS8
		▨	2-6-6-7	SS9
		▨	3-5-7-7	SS10
20		▨	2-5-7-8	SS11
		▨	3-5-6-7	SS12
25		▨	4-4-6-6	SS13
	Very stiff to stiff, brown, silty CLAY - CL	▨	4-8-8-11	SS14
		▨	3-4-7-9	SS15
30		▨	4-6-8-10	SS16
	Stiff, brown, sandy CLAY with silt - CL	▨	5-6-6-8	SS17
35		▨	3-4-6-8	SS18
		▨	5-5-7-7	SS19
	Stiff, brown clayey SILT - ML	▥	2-3-6-7	SS20
40	Boring terminated at 40 feet.			
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KBP	App'vd. by: KBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-153

Project No. J017150.02

NATURAL
RESOURCE
TECHNOLOGY

SOIL BORING LOG INFORMATION

Page 1 of 2

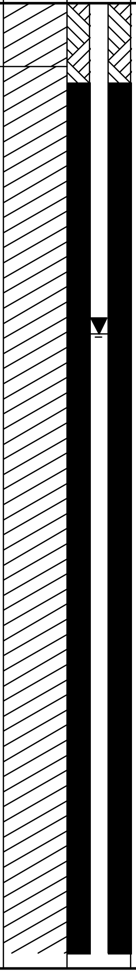
Facility/Project Name: Joppa Power Station (EEI)
License/Permit/Monitoring Number:
Boring Number: G112C

Boring Drilled By: Name of crew chief (first, last) and Firm: Matt Cooper, Bulldog Drilling, Inc.
Date Drilling Started: 1/28/2013
Date Drilling Completed: 1/28/2013
Drilling Method: hollow stem auger

Common Well Name: G112C
Final Static Water Level: 319.4 Feet (NAVD88)
Surface Elevation: 323.6 Feet (NAVD88)
Borehole Diameter: 7.8 inches

Local Grid Origin ☒ (estimated: ☐) or Boring Location ☐
State Plane Illinois East Zone N, E S / C / [✓ N]
1/4 of 1/4 of Section , T N, R
Lat ____° ____' ______"
Long ____° ____' ______"
Local Grid Location: 198552.26 Feet ☒ N ☐ S 829088.33 Feet ☒ E ☐ W

Facility ID:
County: Massac
State: Illinois
Civil Town/City/ or Village: Joppa



Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
1	48 20			0 - 0.8' **SILTY CLAY** CL, LOAM, dark brown, high plasticity, soft, moist.	CL									soil samples collected with 1.5" diameter macro core sampler with liners
			1	0.8 - 24' **SILTY CLAY** CL, light yellowish brown (10YR 6/4), high plasticity, very soft to soft.					1.25					
			2											
			3											
2	60 46		4				▼							
				4.5' stiff to very stiff, low to medium plasticity, light gray (10YR 7/1) with 10-25 % yellowish brown (10YR6/8) mottling..					4					
			5											
									3.5					
			6											
					CL				3.5					
			7											
									3.5					
			8	8' light gray with <10% mottling, hard, dry.					4					
									4					
3	60 51		9											
				9.5' stiff, medium plasticity, moist.					2					
			10											
									2.5					
			11											
									2.25					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

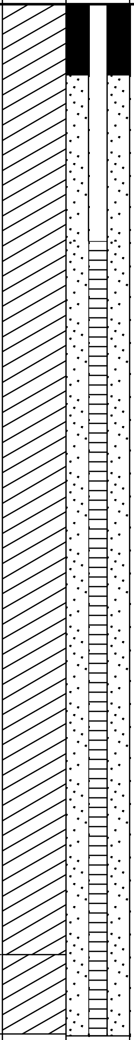
Signature:

Firm: Natural Resource Technology
23713 W. Paul Road Suite D, Pewaukee, WI 53072
Tel: (262) 523-9000
Fax: (262) 523-9001

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL
RESOURCE
TECHNOLOGY

Boring Number G112C



Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
				0.8 - 24' **SILTY CLAY** CL, light yellowish brown (10YR 6/4), high plasticity, very soft to soft. *(continued)*					3					
			13	12.5' gray (10YR 5/1), no mottling.										
				13.5' very stiff silty clay.					3.25					
4	60 52		14	14' medium to stiff, medium to high plasticity, gray (10YR 6/1) with trace mottling.					2.5					
			15						3.25					
			16	16' no mottling.					1.75					
			17	17.5' light gray (10YR 7/1), no mottling.					1.5					
			18	18.5' very stiff silty clay.	CL				4					
5	60 50		19	19' wet, soft to very soft, high plasticity.					1					
			20						2					
			21						2.5					
			22	22.5' very stiff to hard, low plasticity, light gray (10YR 7/1), no mottling.					3					
			23											PP 3.5 - 4.0
NR ○	12 0		24	24 - 25' CL.	CL									Auger and Clean hole 24' to 25'
			25	25' End of Boring.										

NATURAL
RESOURCE
TECHNOLOGY

SOIL BORING LOG INFORMATION

Page 1 of 3

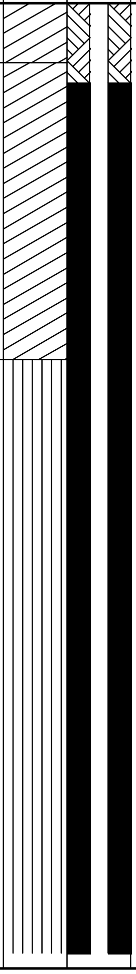
Facility/Project Name Joppa Power Station (EEI)	License/Permit/Monitoring Number	Boring Number G152B

Boring Drilled By: Name of crew chief (first, last) and Firm Matt Cooper Bulldog Drilling, Inc.	Date Drilling Started 1/28/2013	Date Drilling Completed 1/30/2013	Drilling Method hollow stem auger

Common Well Name G152B	Final Static Water Level 312.3 Feet (NAVD88)	Surface Elevation 345.2 Feet (NAVD88)	Borehole Diameter 7.8 inches

Local Grid Origin ☒ (estimated: ☐) or Boring Location ☐
State Plane Illinois East Zone N, E S / C / [✓ N]
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
198094.58 Feet ☒ N ☐ S 832931.61 Feet ☒ E ☐ W

Facility ID	County Massac	State Illinois	Civil Town/City/ or Village Joppa

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	42 19			0 - 0.75' **SILTY CLAY** CL, disturbed with gravel, tree limbs, wood from clearing activities; dark brown, wet.	CL									PP 2 - 2.25
			1	0.75 - 4.5' **SILTY CLAY** CL, light yellowish brown (10YR 6/4), high plasticity, very soft to soft, silty clay with organics (roots), soft, high plasticity, light yellowish brown (10YR 6/4), moist.										
			2											
			3		CL									
2	60 56								3.25					
			4	4' Silty Clay grading to a Clayey Silt, low plasticity, stiff, light gray (10YR 7/1), with 50% reddish brown mottling, moist.										
			5	4.5 - 12.5' **SILT:** ML, non plastic, stiff, very pale brown (10YR 8/2), dry.					3					
			6						3					
			7						2					
				7.3' soil horizon with small rootlets, 50% reddish brown mottling.										
			8	7.5' very pale brown (10YR 8/2), non plastic, stiff, dry.	ML				1.75					
3	60 58								4					
			9	9' silt with clay, very stiff, non plastic, very pale brown (10YR 7/3) with 10-25% reddish brown mottling.										
			10						3.5					
			11						2					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm Natural Resource Technology 23713 W. Paul Road Suite D, Pewaukee, WI 53072 Tel: (262) 523-9000 Fax: (262) 523-9001

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

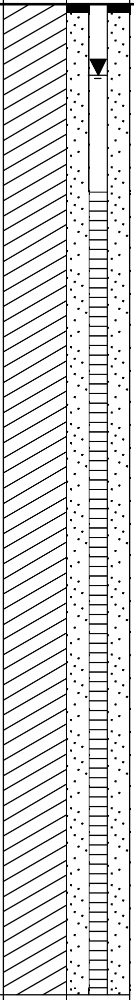
Boring Number G152B

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
									2					
			13	12.5 - 28.5' **SILTY CLAY** CL, medium to stiff, low to medium plasticity, light gray (10YR 7/1), with 50% mottling, moist.					2					
4	60 60			13.5' 10-50% reddish brown mottling.										
			14						2.5					
			15	15' light gray (10YR 7/1).					2.25					
			16						2.25					
			17						3.25					
			18	18' yellowish brown (10YR 6/8) mottling, moist.										PP 2.5 - 3.5
5	60 60		19	18.5' medium to stiff, medium to high plasticity, light gray (10YR 7/1), with 10-25% reddish brown mottling, moist.					2.25					
			20						2.5					
					CL									
			21						1.75					
			22						1.75					
			23						1.75					
6	60 60		24	23.5' medium to stiff, high plasticity, light gray (10YR 7/1), with 25-50% reddish brown mottling, moist.					2					
			25						1.5					
			26						1.5					
			27						2.5					
			28						2					
NR ○	12 0		29	28.5 - 29.5' CL.	CL									stopped sampling for the day (1/28/13), cleaned hole with augers to 29.5' resumed sampling on 1/30/2013
7	60 44		30	29.5 - 44.5' **SILTY CLAY** CL, stiff, medium to high plasticity, gray with >75% light yellowish brown (10YR 6/4) mottling, moist.					2.75					
			31		CL				3.25					
			32	31.5' 25-75% mottling.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number G152B



Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				29.5 - 44.5' **SILTY CLAY** CL, stiff, medium to high plasticity, gray with >75% light yellowish brown (10YR 6/4) mottling, moist. *(continued)*					3.5					
			33	33' very stiff to hard, gray (10YR 6/1), with < 25% yellowish brown (10YR 6/8) mottling.					4.5					
			34						2.5					
8	60 57			34.5' stiff to very stiff, high plasticity.										
			35						3.5					
			36						2.5					
			37						4.25					
			38	38' hard, < 10% mottling.	CL				2.5					
			39											PP is >4.5
9	60 55			39.5' very stiff to hard, high plasticity, gray (10YR 6/1) with < 10% yellowish brown (10YR 5/6) mottling, moist.										
			40						3					
			41						3					
			42						3					
			43						4.5					
			44						3.75					
				44.5' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station (EEI)

Local Grid Location of Well: 198552.26 ft. ☒ N. ☐ S. 829088.33 ft. ☒ E. ☐ W.

Well Name: G112C

Facility License, Permit or Monitoring No.

Local Grid Origin ☒ (estimated: ☐) or Well Location ☐

Lat. ____ ° ____ ' ____ " Long. ____ ° ____ ' ____ " or

St. Plane Illinois East Zone ft. N, ____ ft. E. S / C / [✓ N]

Facility ID

Date Well Installed: 01/29/2013

Section Location of Waste/Source

____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Type of Well: Well Code 11/mw

Well Installed By: (Person's Name and Firm)
Matt Cooper
Kelron Environmental

Distance from Waste/Source ____ ft.

State: Illinois

Location of Well Relative to Waste/Source
u ☐ Upgradient s ☐ Sidegradient
d ☐ Downgradient n ☐ Not Known

Gov. Lot Number

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 325.82 ft. (NAVD88)

C. Land surface elevation 323.6 ft. (NAVD88)

D. Surface seal, bottom 322.6 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☒
Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☒ Yes ☐
Describe N

17. Source of water (attach analysis, if required):
n/a

E. Bentonite seal, top 322.6 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 310.7 ft. (NAVD88) or 12.9 ft.

H. Screen joint, top 308.6 ft. (NAVD88) or 15.0 ft.

I. Well bottom 298.3 ft. (NAVD88) or 25.3 ft.

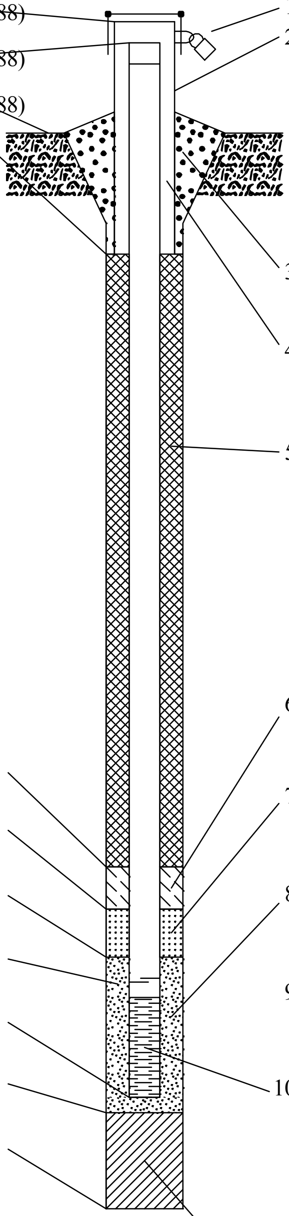
J. Filter pack, bottom 298.6 ft. (NAVD88) or 25.0 ft.

K. Borehole, bottom 298.6 ft. (NAVD88) or 25.0 ft.

L. Borehole, diameter 7.8 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



Casing depth (well bottom) is greater than borehole bottom because the bottom well cap was pushed into the soft material at the base of the borehole.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒
   Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe:

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Other ☐

5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 3.5 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐
   Tremie pumped ☐
   Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐
   c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
   a.
   b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil Silica
   b. Volume added 6 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒
   Continuous slot ☐
   Other ☐
   b. Manufacturer
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/19/2013

Signature

Firm: Natural Resource Technology
23713 W. Paul Road Suite D, Pewaukee, WI 53072

Tel: (262) 523-9000
Fax: (262) 523-9001

NATURAL RESOURCE TECHNOLOGY

Electronic Filing: Received, Clerk's Office 05/11/2021 **AS 2021-005**

MONITORING WELL CONSTRUCTION

Facility/Project Name: Joppa Power Station (EEI)

Local Grid Location of Well: 198094.58 ft. ☒ N. ☐ S. 832931.61 ft. ☒ E. ☐ W.

Well Name: G152B

Facility License, Permit or Monitoring No.

Local Grid Origin ☒ (estimated: ☐) or Well Location ☐

Lat. ° ' " Long. ° ' " or

St. Plane Illinois East Zone ft. N, ft. E. S / C / [✓ N]

Facility ID

Date Well Installed: 01/30/2013

Section Location of Waste/Source

Type of Well: Well Code 11/mw

1/4 of 1/4 of Sec. , T. N, R. ☐ E ☐ W

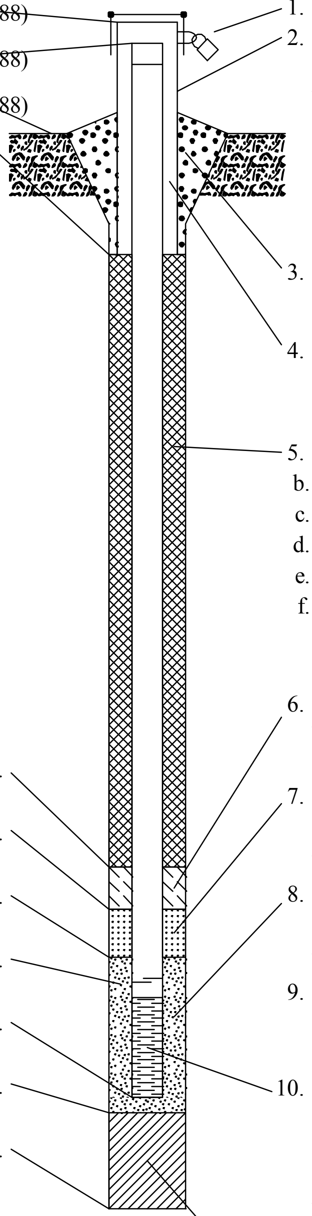
Well Installed By: (Person's Name and Firm) Matt Cooper, Kelron Environmental

Distance from Waste/Source ft.

State: Illinois

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number



A. Protective pipe, top elevation ft. (NAVD88)

B. Well casing, top elevation 347.48 ft. (NAVD88)

C. Land surface elevation 345.2 ft. (NAVD88)

D. Surface seal, bottom 344.2 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:

GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☒ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☒ Yes ☐

Describe N

17. Source of water (attach analysis, if required): n/a

E. Bentonite seal, top 344.2 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ft. (NAVD88) or ft.

G. Filter pack, top 313.1 ft. (NAVD88) or 32.1 ft.

H. Screen joint, top 310.8 ft. (NAVD88) or 34.4 ft.

I. Well bottom 300.6 ft. (NAVD88) or 44.6 ft.

J. Filter pack, bottom 300.7 ft. (NAVD88) or 44.5 ft.

K. Borehole, bottom 300.7 ft. (NAVD88) or 44.5 ft.

L. Borehole, diameter 7.8 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.

Casing depth (well bottom) is greater than borehole bottom because the bottom well cap was pushed into the soft material at the base of the borehole.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: in.
   b. Length: ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe:

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Other ☐

5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. Lbs/gal mud weight . . . Bentonite slurry ☐
   d. % Bentonite . . . Bentonite-cement grout ☐
   e. 14.5 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite chips ☐
   c. Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
   a.
   b. Volume added ft^3

8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil Silica
   b. Volume added 7 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 2/19/2013

Signature

Firm: Natural Resource Technology
23713 W. Paul Road Suite D, Pewaukee, WI 53072
Tel: (262) 523-9000
Fax: (262) 523-9001

Print Form

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 W. JEFFERSON ST.
SPRINGFIELD, IL 62761

WATER WELL SEALING FORM

PDF FILLABLE/SAVABLE

RETURN ALL COPIES TO IDPH OR LOCAL HEALTH DEPARTMENT

This form shall be submitted to this Department or the local health department not more than 30 days after a water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Illinois Water Well Construction Code. THE LOCAL HEALTH DEPARTMENT OR REGIONAL PUBLIC HEALTH DEPARTMENT MUST BE NOTIFIED AT LEAST 48 HOURS PRIOR TO SEALING.

1. Ownership (Name of Controlling Party) Electric Energy, Inc.

2. Well Location: Well Site Address 2100 Portland Rd City Joppa Zip 62953

Lot # Land I.D.# County Massac Township 15S

Range 3E Section Quarter of the Quarter of the Quarter

GPS: North Degrees 37 Minutes 12 Seconds 42.4 West Degrees 88 Minutes 51 Seconds 59.3

Report decimal minutes to minutes and seconds by multiplying the decimal part of the minutes by 60, e.g. latitude 38 degrees 46.07 minutes N would be latitude 38 degrees 46 minutes 4.2 seconds (0.07 x 60 = 4.2) N. Report GPS coordinates to the nearest 0.1 second.

3. Year Drilled 6/2010 4. Drilling Permit Number (and date, if known G-112B

5. Type of Well Monitoring 6. Total Depth (ft.) 42 Diameter (in.) 2

7. Formation clear of obstruction Yes

8. Detains of Plugging (bentonite, neat cement or other materials)

Filled with	Chip Bentonite	From (ft.)	42	to (ft.)	3
Kind of plug	Soil	From (ft.)	3	to (ft.)	0
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	

9. CASING RECORD Upper 2 feet of casing removed Yes 10. Date well was sealed Jan 28, 2013

11. Licensed water well driller or other person approved by the Department performing well sealing

Name John Thomas Marlo Complete License Number 092-006857

Address 411 Transpoint Dr, Suite A City Dupo State Illinois Zip Code 62239

This state agency is requesting discolsure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center. IL 482-0631- Revised 5/09

Questions regarding the completion of this form should be directed to the local health department or the Illinois Department of Public Health 217-782-5830, TTY (for hearing impaired only) 800-547-0466.

Print Form

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 W. JEFFERSON ST.
SPRINGFIELD, IL 62761

WATER WELL SEALING FORM

PDF FILLABLE/SAVABLE

RETURN ALL COPIES TO IDPH OR LOCAL HEALTH DEPARTMENT

This form shall be submitted to this Department or the local health department not more than 30 days after a water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Illinois Water Well Construction Code. THE LOCAL HEALTH DEPARTMENT OR REGIONAL PUBLIC HEALTH DEPARTMENT MUST BE NOTIFIED AT LEAST 48 HOURS PRIOR TO SEALING.

1. Ownership (Name of Controlling Party) Electric Energy, Inc.
2. Well Location: Well Site Address 2100 Portland Rd City Joppa Zip 62953

Lot # Land I.D.# County Massac Township 15S

Range 3E Section Quarter of the Quarter of the Quarter

GPS: North Degrees 37 Minutes 12 Seconds 39 West Degrees 88 Minutes 51 Seconds 17.7

Report decimal minutes to minutes and seconds by multiplying the decimal part of the minutes by 60, e.g. latitude 38 degrees 46.07 minutes N would be latitude 38 degrees 46 minutes 4.2 seconds (0.07 x 60 = 4.2) N. Report GPS coordinates to the nearest 0.1 second.

3. Year Drilled 6/21/2010 4. Drilling Permit Number (and date, if known G-152

5. Type of Well Monitoring 6. Total Depth (ft.) 25 Diameter (in.) 2

7. Formation clear of obstruction Yes

8. Detains of Plugging (bentonite, neat cement or other materials)

Filled with	Chip Bentonite	From (ft.)	25	to (ft.)	3
Kind of plug	Soil	From (ft.)	3	to (ft.)	0
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	

9. CASING RECORD Upper 2 feet of casing removed Yes 10. Date well was sealed Jan 29, 2013

11. Licensed water well driller or other person approved by the Department performing well sealing

Name John Thomas Marlo Complete License Number 092-006857

Address 411 Transpoint Dr, Suite A City Dupo State Illinois Zip Code 62239

This state agency is requesting discolsure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center. IL 482-0631- Revised 5/09

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APPENDIX C

GROUNDWATER QUALITY DATA SUMMARY
AUGUST 2010 – MAY 2013

Appendix C. Groundwater Quality Results for August 2010 to May 2013

Hydrogeologic Assessment
Joppa Generating Station, Joppa, IL
Electric Energy Inc. and Ameren Energy Generating Company

Monitoring Well	Date	Depth to GW[2] (ft)	35 IAC 620 Standard[1]	pH (SU)	TDS	Nitrogen, Nitrate	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Manganese	Nickel	Selenium	Silver	Zinc	Antimony	Lead	Thallium	Mercury	Cyanide	Sulfate	Fluoride	Chloride
				6.5-9.0	1200	100	0.20	2.0	0.5	2.0	0.050	1.0	1.0	0.65	5.0	10.0	2.0	0.05	ns	10.0	0.024	0.10	0.020	0.010	0.60	400	4.0	200
G101	8/17/2010	45.25		7.13	344	2.1	<0.0250	0.103	<0.0010	<0.0200	<0.00200	<0.0100	<0.0100	<0.0100	1.34	0.0556	<0.010	<0.050	<0.010	<0.010	<0.0050	0.0026	<0.0020	<0.00020	<0.0070	32	0.26	7.0
G101	11/5/2010	dry																										
G101	03/15/11	44.88		6.63	294	1.72	<0.0250	0.09	<0.0010	<0.020	<0.0020	<0.0100	<0.0100	<0.0100	0.172	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	32	0.27	6.0
G101	06/16/11	39.64		7.18	276	1.6	<0.025	0.64	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	34	0.26	5.0
G101	09/13/11	46.24		6.88	222	1.6	<0.025	0.061	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	28	0.32	3.0
G101	11/29/11	46.32		7.19	268	1.1	<0.025	0.072	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	35	0.28	4.0
G101	02/14/12	48.12		6.88	216	0.28	<0.025	0.58	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	35	0.30	4.0
G101	05/15/12	45.59		7.31	208	0.82	<0.025	0.044	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	22	0.31	4.0
G101	08/07/12	dry																										
G101	03/06/13	47.40		7.06	214	1.7	<0.010	0.069	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	33	0.33	<5.0
G101	05/13/13	49.68		6.81	272	1.4	<0.010	0.076	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0060	<0.0070	<0.0020	<0.00020	<0.0070	33	0.28	5.0
G111	8/17/2010	8.00		7.30	342	0.092	<0.025	0.15	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.45	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	25	0.62	8.0
G111	11/5/2010	9.77		6.70	330	0.72	<0.025	0.15	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	0.013	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	22	0.70	6.0
G111	03/15/11	4.90		7.07	322	0.10	<0.025	0.16	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	0.018	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	23	0.67	7.0
G111	06/16/11	6.42		7.11	372	0.17	<0.025	0.16	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	27	0.63	6.0
G111	09/13/11	8.45		7.10	330	0.13	<0.025	0.18	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	24	0.63	6.0
G111	11/29/11	4.68		7.05	376	0.15	<0.025	0.18	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	19	0.62	6.0
G111	02/14/12	4.55		7.23	354	0.093	<0.025	0.16	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	27	0.67	7.0
G111	05/15/12	6.68		7.14	324	0.12	<0.025	0.17	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	30	0.67	7.0
G111	08/07/12	9.22		7.02	394	0.052	<0.025	0.15	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	26	0.69	5.0
G111	03/07/13	5.20		7.28	390	0.37	<0.010	0.17	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	20	0.63	6.0
G111	05/14/13	4.68		7.05	374	<0.050	<0.010	0.17	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0060	<0.0070	<0.0020	<0.00020	<0.0070	19	0.71	7.0
G112C	03/07/13	5.25		6.79	412	0.34	<0.010	0.062	<0.0010	3.3	<0.0020	<0.010	<0.010	<0.010	0.048	0.18	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	63	0.74	<5.0
G112C	04/17/13	5.31		6.92	476	<0.050	<0.010	0.059	<0.0010	3.1	<0.0020	<0.010	<0.010	<0.010	0.039	0.17	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.040	<0.0020	<0.00020	<0.0070	66	0.80	<5.0
G112C	05/14/13	2.64		6.73	432	<0.050	<0.010	0.062	<0.0010	3.1	<0.0020	<0.010	<0.010	<0.010	<0.020	0.15	<0.010	<0.050	<0.010	<0.010	<0.0060	<0.0070	<0.0020	<0.00020	<0.0070	60	0.81	<5.0
G113	8/17/2010	15.40		6.89	542	0.84	<0.025	0.35	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.040	0.092	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	61	0.43	27
G113	11/5/2010	15.80		6.57	524	0.14	<0.025	0.40	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.025	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	35	0.45	29
G113	03/15/11	11.80		6.57	540	0.33	<0.025	0.46	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.0064	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	36	0.44	29
G113	06/16/11	13.66		6.60	590	0.35	<0.025	0.45	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	32	0.39	29
G113	09/13/11	14.90		6.54	554	0.40	<0.025	0.49	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	30	0.40	29
G113	11/29/11	11.50		6.44	636	0.68	<0.025	0.51	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	34	0.39	28
G113	02/14/12	12.05		6.56	590	0.48	<0.025	0.50	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	35	0.42	31
G113	05/15/12	14.25		6.71	586	0.57	<0.025	0.53	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	32	0.43	34
G113	08/07/12	16.65		6.50	666	0.48	<0.025	0.47	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	30	0.45	29
G113	03/07/13	12.65		6.82	606	0.53	<0.010	0.54	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.0076	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	37	0.42	32
G113	05/14/13	12.12		6.65	706	0.38	<0.010	0.55	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	50	0.44	30
G151	8/17/2010	42.70		6.70	348	1.0	<0.025	0.52	0.0025	8.3	<0.0020	0.023	0.033	0.028	18	0.47	0.021	<0.050	<0.010	0.061	<0.0050	0.027	<0.0020	<0.00020	<0.0070	93	0.17	16
G151	11/5/2010	dry																										
G151	03/16/11	38.10		5.89	236	1.1	<0.025	0.11	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.062	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	100	<0.10	6.0
G151	06/17/11	36.83		6.13	242	1.1	<0.025	0.79	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.038	0.036	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	103	<0.10	5.0
G151	09/13/11	41.45		5.99	228	1.2	<0.025	0.086	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.032	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	103	0.10	5.0
G151	11/29/11	42.20		6.20	256	1.1	<0.025	0.28	<0.0010	0.052	<0.0020	<0.010	<0.010	0.011	1.8	0.045	<0.010	<0.050	<0.010	0.017	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	98	0.95	5.0
G151	02/14/12	37.80		6.03	254	0.62	<0.025	0.074	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.022	<0.010	<0.050	<0.010	0.017	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	110	<0.10	5.0
G151	05/15/12	41.82		6.00	232	0.63	<0.025	0.081	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.060	0.011	<0.010	<0.050	<0.010	0.014	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	111	<0.10	5.0
G151	08/07/12	dry																										
G151	03/06/13	39.49		6.02	288	2.0	<0.010	0.069	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.015	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	99	<0.10	6.0
G151	05/13/13	37.13		5.96	282	1.6	<0.010	0.068	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.011	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	102	<0.10	6.0
G152B	03/07/13	33.80		6.81	478	0.87	<0.010	0.51	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	0.015	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	18	0.58	48
G152B	05/14/13	17.08		6.81	488	0.82	<0.010	0.51	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	16	0.60	49
G153	8/17/2010	38.13		6.90	462	0.30	<0.025	0.63	0.0024	0.034	<0.0020	0.025	0.025	0.019	13	0.22	0.012	<0.050	<0.010	0.025	<0.0050	0.019	<0.0020	<0.00020	<0.0070	102	0.64	18
G153	11/5/2010	dry																										
G153	03/16/11	37.82		6.70	434	0.46	<0.025	0.31	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	110	0.82	20
G153	06/17/11	32.62		6.94	484	0.37	<0.025	0.27	<0.0010	0.047	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	104	0.76	20
G153	09/13/11	39.55		6.91	408	0.31	<0.025	0.28	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.029	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	104	0.75	20
G153	11/29/11	40.17		6.92	432	0.27	<0.025	0.24	<0.0010	0.055	<0.0020	<0.010	<0.010	<0.010	0.029	0.056	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	107	0.77	20
G153	02/14/12	32.9		6.92	434	0.29	<0.025	0.24	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	99	0.82	22
G153	05/15/12	38.92		6.95	406	0.21	<0.025	0.21	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	111	0.87	24
G153	08/07/12	dry																										
G153	03/06/13	39.95		6.98	392	0.28	<0.010	0.23	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.040	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	94	0.87	21
G153	05/13/13	33.37		6.93	454	0.28	<0.010	0.23	<0.0010	<0.020	<0.0020	<0.010	<0.010	<0.010	0.022	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0070	<0.0020	<0.00020	<0.0070	93	0.94	23

Notes:

Unless otherwise noted, all results are in mg/L.

[1] 35 IAC 620.420 Groundwater Quality Standards for Class II Potable Resource Groundwater.

ns indicates no standard for the listed parameter

[2] Depth to water as measured from top of well casing (in feet).

Yellow highlighted cells represent results exceeding 35 IAC 620.420 Groundwater Quality Standards for Class II General Resource Groundwater.

Appendix C. Groundwater Quality Results for August 2010 to May 2013

Hydrogeologic Assessment
Joppa Generating Station, Joppa, IL
Electric Energy Inc. and Ameren Energy Generating Company

Monitoring Well	Date	Depth to GW^2 (ft)	35 IAC 620 Standard[1]	pH (SU) ns*	TDS ns*	Nitrogen, Nitrate 100	Arsenic 0.20	Barium ns*	Beryllium 0.5	Boron ns*	Cadmium 0.05	Chromium 1.0	Cobalt 1.0	Copper ns*	Iron ns*	Manganese ns*	Nickel ns*	Selenium ns*	Silver ns	Zinc ns*	Antimony 0.024	Lead 0.1	Thallium 0.020	Mercury 0.010	Cyanide 0.60	Sulfate ns*	Fluoride 4.0	Chloride ns*
G112B	8/17/2010	26.42		6.05	744	0.95	<0.025	0.086	<0.0010	3.5	<0.0020	<0.010	0.065	<0.010	13	4.3	0.035	<0.050	<0.010	0.055	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	298	0.29	56
G112B	11/5/2010	26.18		6.33	754	<0.050	<0.025	0.12	<0.0010	1.6	<0.0020	<0.010	0.032	<0.010	22	4.1	0.020	<0.050	<0.010	0.015	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	129	0.49	49
G112B	03/15/11	15.50		5.80	856	0.055	0.037	0.082	<0.0010	4.4	<0.0020	<0.010	0.081	<0.010	53	5.5	0.043	<0.050	<0.010	0.043	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	352	0.29	56
G112B	06/16/11	22.03		6.60	776	0.12	<0.025	0.10	<0.0010	3.5	<0.0020	<0.010	0.067	<0.010	45	5.1	0.037	<0.050	<0.010	0.022	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	302	0.28	55
G112B	09/13/11	26.05		6.51	778	0.15	0.058	0.20	<0.0010	0.44	<0.0020	<0.010	0.020	<0.010	75	4.6	0.013	<0.050	<0.010	0.022	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	37	0.63	40
G112B	11/29/11	20.80		6.35	804	<0.050	0.054	0.17	<0.0010	2.0	<0.0020	<0.010	0.037	<0.010	68	4.3	0.024	<0.050	<0.010	0.014	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	176	0.46	56
G112B	02/14/12	9.72		6.33	860	<0.050	0.058	0.17	<0.0010	1.9	<0.0020	<0.010	0.042	<0.010	71	4.7	0.025	<0.050	<0.010	0.020	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	147	0.52	50
G112B	05/15/12	24.01		6.64	778	<0.050	0.066	0.21	<0.0010	0.35	<0.0020	<0.010	0.016	<0.010	77	4.5	<0.010	<0.050	<0.010	0.020	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	21	0.78	52
G112B	08/07/12	28.45		6.50	860	<0.050	0.060	0.20	<0.0010	0.051	<0.0020	<0.010	0.010	<0.010	62	4.2	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	15	0.83	67
G152	8/17/2010	9.21		6.41	1110	0.92	<0.025	0.019	<0.0010	12	<0.0020	<0.010	<0.010	<0.010	0.045	0.19	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	768	0.12	21
G152	11/5/2010	5.42		6.03	1090	0.070	<0.025	0.017	<0.0010	12	<0.0020	<0.010	<0.010	<0.010	<0.020	0.17	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	692	0.16	22
G152	03/16/11	2.20		5.98	1080	<0.050	<0.025	0.015	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	731	0.12	22
G152	06/17/11	3.92		5.97	1020	<0.050	<0.025	0.012	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	0.0068	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	593	0.11	21
G152	09/13/11	5.34		5.91	922	<0.050	<0.025	0.013	<0.0010	12	<0.0020	<0.010	<0.010	<0.010	<0.020	0.014	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	570	0.14	21
G152	11/29/11	22.50		6.04	910	0.10	<0.025	0.016	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	0.0083	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	565	0.12	20
G152	02/14/12	18.20		6.25	878	<0.050	<0.025	0.012	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	605	0.14	24
G152	05/15/12	5.07		6.03	866	0.14	<0.025	0.012	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	572	0.13	25
G152	08/07/12	8.03		5.81	956	<0.050	<0.025	0.011	<0.0010	11	<0.0020	<0.010	<0.010	<0.010	<0.020	0.014	<0.010	<0.050	<0.010	<0.010	<0.0050	<0.0020	<0.0020	<0.00020	<0.0070	451	0.15	21

Notes:

Unless otherwise noted, all results are in milligrams per Liter (mg/L).

[1] 35 IAC 620.420 Groundwater Quality Standards for Class II Potable Resource Groundwater.

ns indicates no standard for the listed parameter

ns* indicates no standard for monitored points meeting criteria of 35 IAC 620.420(a)(3): applies to G112B and G152

[2] Depth to water as measured from top of well casing (in feet).

Yellow highlighted cells represent results exceeding 35 IAC 620.420 Groundwater Quality Standards for Class II General Resource Groundwater.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 10

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 · (217) 782-3397
JB PRITZKER, GOVERNOR
JOHN J. KIM, DIRECTOR

February 11, 2021

Via Electronic Filing: http://www.regulations.gov
Copy to Michelle Long at long.michelle@epa.gov

Acting Administrator Jane Nishida
U.S. Environmental Protection Agency
Attn: DOCKET ID No. EPA-HQ-OLEM-2020-0107
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Illinois Environmental Protection Agency Comments on Advanced Notice of Proposed Rulemaking for Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities: Legacy CCR Surface Impoundments

Dear Administrator Nishida:

In response to the U.S. Environmental Protection Agency's ("USEPA") publication in 85 Fed. Reg. 65015 (Oct 14, 2020) requesting comments on the definition of legacy coal combustion residual ("CCR") surface impoundments, the Illinois Environmental Protection Agency ("Illinois EPA") provides the following comments and experience with closing CCR surface impoundments under State rules in Illinois for the USEPA's consideration.

All three of USEPA's proposed definitions for legacy ponds include a requirement that liquids be present in the impoundment by a date certain. For the reasons provided below, Illinois EPA asserts that all unlined CCR surface impoundments designed to hold CCR and liquids pose a threat and should be regulated and required to provide proof of proper closure, even if no liquids remain.

To be considered a CCR surface impoundment under 40 CFR Part 257.53, the area must be designed to hold CCR and liquids. However, an "inactive CCR surface impoundment" is defined at 40 CFR 257.53 as a CCR surface impoundment that no longer received CCR on or after October 19, 2015 and still contained both CCR and liquids on or after October 19, 2015. The Illinois EPA believes that the definition of legacy CCR surface impoundments must extend beyond impoundments that meet the strict definition of inactive CCR surface impoundments pursuant to 40 CFR 257.53. In Illinois EPA's experience, unlined CCR surface impoundments that were designed and intended to hold liquids but were constructed over highly permeable geologic materials often leak to the extent that they are dry, with no apparent free liquids. These conditions may exist at either active or inactive generating facilities if the impoundment has not received sluiced CCR for some time.

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2309 W. Main Street, Suite 116, Marion, IL 62959 (618) 993-7200
412 SW Washington Street, Suite D, Peoria, IL 61602 (309) 671-3022
4302 N. Main Street, Rockford, IL 61103 (815) 987-7760

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The Illinois EPA has approved closure plans under State law for several impoundments. Some of these impoundments leaked into the subsurface to such an extent that the operator stated the impoundment never had surface discharges from their NPDES outfalls during operation. These circumstances are evident because at the time of closure there were no visible liquids, yet exceedances of State groundwater quality standards existed in down gradient monitoring wells. These circumstances illustrate why impoundments that leak and leach to such an extent that they will not retain liquid within them should also be closed with a cover system that will prevent future impoundment of liquids and minimize infiltration to the extent feasible. Therefore, the Illinois EPA urges the USEPA to consider the inclusion of all unlined impoundments designed to contain an accumulation of CCR and liquids at both inactive and active generating facilities in its definition of legacy CCR surface impoundments, even if the liquids have leaked out or have been intentionally removed. An unlined impoundment that has leaked dry and continues to leach contaminants in an uncontrolled manner with each precipitation event poses no less risk to human health and the environment at an active facility than it does at an inactive facility. To provide a comprehensive set of rules for CCR surface impoundments, all unlined surface impoundments initially designed to accumulate CCR and liquids, but that may now only store or dispose of CCR due to leakage or intentional drainage intended to circumvent the definition of an inactive CCR surface impoundment, at both active and inactive generating facilities, should be included in the definition of legacy CCR surface impoundments.

The Illinois EPA notes that a legacy CCR surface impoundment that is designed and intended to hold CCR and liquids but does not meet the definition of an inactive CCR surface impoundment simply because it no longer contains water but has not been closed in compliance with 40 CFR 257.102, is an open dump pursuant to 40 CFR 257.1. Inclusion of dry impoundments containing CCR would provide owners and operators a means to achieve compliance with 40 CFR 257 Subpart D, without the need for enforcement and penalties for operating an illegal open dump. At 80 Fed. Reg. 21342 (Apr 17, 2015), USEPA makes clear that the only inactive CCR surface impoundments that do not require regulatory oversight are those that have been properly closed: "The sole exception is for 'inactive' CCR surface impoundments that have completed dewatering and capping operations (in accordance with the capping requirements finalized in this rule)…". If all inactive CCR surface impoundments require regulatory oversight, even composite lined CCR surface impoundments, then certainly unlined CCR surface impoundments that have leaked dry at both active and inactive facilities should be required to close in compliance with 40 CFR 257.102.

At 80 Fed. Reg. 21343, (Apr 17, 2015), USEPA states a position that "….the final rule does not impose any requirements on any CCR surface impoundments that have in fact 'closed' before the rule's effective date-i.e. those that no longer contain water and can no longer impound liquid" (emphasis added). Section 40 CFR 257.102(d) provides the criteria that must be met to ensure that a CCR surface impoundment no longer contains water and can no longer impound liquid. In order to know that a CCR surface impoundment has in fact "closed" and should not, therefore, be regulated by 40 CFR 257 Subpart D, the definition of a legacy CCR surface impoundment should require a demonstration certified by a licensed professional engineer that any "closed" CCR surface impoundment was in fact closed with at least the minimum criteria required by 40 CFR 257.102(d). If such a demonstration cannot be made, the CCR surface impoundment should also be considered and regulated as a legacy CCR surface impoundment.

The Illinois EPA has attached a table containing information about CCR surface impoundments located in Illinois that demonstrate the bases for Illinois EPA's comments. All of the impoundments in the table were designed to hold an accumulation of CCR and liquids. The first ten CCR surface impoundments in the table are at legacy sites, which ceased all generation prior to October 2015. Of these 10 impoundments, based on aerial photos, 30% were dry before October 2015, but that includes impoundments that had some type of liner to restrict leaching, though the liner was not compliant with 40 CFR 257.71(a)(1)(ii). Of the legacy impoundments with no lining, 50% were dry before October 2015. The next group of nine impoundments are located at existing generating facilities, which either converted fuel, stopped generating after October 2015 or are still generating today. These nine impoundments store CCR, have had no CCR or liquids other than precipitation added since October 2015, but have no apparent liquids based on 2015 aerial photos. As a result, they do not meet the definition of an inactive CCR surface impoundment in 40 CFR Part 257.53. The Illinois EPA notes that some of these impoundments have been reported as CCR surface impoundments on an owner's or operator's public website under 40 CFR Part 257.107, though there does not appear to have been a requirement to do so, since they are undefined. These undefined impoundments at active facilities represent 12% of all the CCR surface impoundments Illinois EPA has identified. The Illinois EPA also notes that one of these impoundments had grown large trees, even though no cover had been placed on the CCR at the time the impoundment was closed under State regulations.

The last group of four CCR surface impoundments are impoundments that had some type of cover on them before October 2015, and therefore, were not expected to participate in the requirements of 40 CFR Part 257 Subpart D, when it was adopted in October 2015. However, the Illinois EPA notes that one of the impoundments is being re-covered because the initial cover installed without regulatory oversight failed to control groundwater contamination, causing exceedances of groundwater protection standards (GWPS), which may impact the closure of other existing CCR surface impoundments at the facility. Groundwater monitoring at another of the facilities indicates exceedances of GWPS, which may also impact the closure of existing CCR surface impoundments at that facility. The status of GWPS at the other two has not been adequately evaluated at this time. Note that only one of these "closed" impoundments is located at a legacy site (those no longer generating as of October 2015).

In summary, by applying the requirement that an inactive CCR surface impoundment must contain both CCR and liquids to any of USEPA's proposed definitions of a legacy CCR surface impoundment, it could be anticipated that:

- Fifty percent (50%) of impoundments with no lining at legacy facilities will be exempt from 40 CFR Part 257 Subpart D because they are dry and, therefore, may never have any type of cover system installed;
- Upwards of 10% of all "inactive" CCR surface impoundments (including those at active facilities) will be undefined by 40 CFR Part 257 Subpart D, because they are dry and therefore, may never have any type of cover system installed; and
- Fifty percent (50%) or more of impoundments which were "closed" with no verification that there is a cover system or that the cover system meets the minimum requirements of 40 CFR Part 257.102(d), can be expected to leak to the extent that GWPS are being exceeded.

Assuming that the geology of Illinois is similar to other portions of the United States that were subject to glaciation, and that alluvial geology along streams, where many generating facilities are located, is similar throughout the United States, a large number of CCR surface impoundments could remain threats to human health and the environment, unless the definition of "legacy CCR surface impoundment" is broadened beyond USEPA's current proposals.

The Illinois EPA does not believe there should be any size limitation in the definition, because as displayed in the attached table, impoundment sizes vary considerably. The Illinois EPA also suggests a very simple applicability and timing for closure of legacy ponds. Legacy CCR surface impoundments should become subject to the requirements imposed upon them on the effective date of the proposed rule. Those requirements should at a minimum correspond to the requirements of 40 CFR 257.102. Since these legacy ponds are not in use, they should be required to initiate closure within six months of the effective date of the rule and then complete closure within five years of initiating closure. There should be no mechanism to extend the time to initiate closure, and the time to complete closure should only be eligible for an extension under force majeure circumstances.

The Illinois EPA appreciates the opportunity provided by USEPA to participate in this rulemaking, as legacy CCR surface impoundments are an important subset of the universe of CCR surface impoundments that may threaten public health and the environment.

Respectfully Submitted,

John J. Kim
Director
Illinois EPA

Facility	Pond Description	Illinois County	Size Acres	Plant Retirement Year	Unit Status (holds water)	Closure Status	Other Informationm
Hutsonville	Pond A	Crawford	12	2011	Single synth liner, wet @ closure	closure Nov. 2016, State Regs, soil over geomembrane, GW remediation ongoing	subject to Part 257 per USWAG, closed under State Reg
Hutsonville	Pond B	Crawford	5	2011	Single synth liner, wet @ closure	removal Nov. 2016, State Regs, GW remediation ongoing	subject to Part 257 per USWAG, closing under State Reg
Hutsonville	Pond C	Crawford	2	2011	Single synth liner, wet @ closure	removal Nov. 2016, State Regs, GW remediation ongoing	subject to Part 257 per USWAG, closing under State Reg
Hutsonville	Pond D	Crawford	23	2011	unlined, dry before 10/2015	closure, Jan. 2013, under State Regs, soil over geomembrane, GW remediation ongoing	dry, not defined by 257.53, closed under State Reg
Hutsonville	Bottom Ash	Crawford	2	2011	unlined, wet @ closure	removal Nov. 2016, State Regs, GW remediation ongoing	subject to Part 257 per USWAG, closing under State Reg
Meredosia	Bottom Ash Pond	Morgan	12	2011	unlined, dry before 10/2015	closure, Jan 2019, State Regs, plastic turf over geomembrane, MNA	dry, not defined by 257.53
Meredosia	Fly Ash	Morgan	40	2011	unlined, some water @ closure	closure, Aug 2019, State Regs, plastic turf over geomembrane, MNA	subject to Part 257 per USWAG, closed under State Reg
Vermilion	North Pond Cell 1 & 2	Vermilion	38	2011	unlined, wet	no closure plan, pending litigation	subject to Part 257 per USWAG
Vermilion	Old East Pond	Vermilion	21	2011	unlined, dry before 10/2015	no closure plan, pending litigation	dry, not defined by 257.53
Vermilion	New East Pond Cell 1 & 2	Vermilion	28	2011	Clay lined, wet	no closure plan, pending litigation	subject to Part 257 per USWAG
Venice	N. Pond	Madison/St. Claire	30	active, 2012 gas fire	unlined, dry w/trees before 10/2015	closure Nov. 2012, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Hennepin	West Ash Pond 1	Putnam	12	2019	unlined, dry before 10/15	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Hennepin	West Ash Pond 3	Putnam	17	2019	unlined, dry before 10/15	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Hennepin	East Ash Pond 2	Putnam	17	2019	unlined, dry before 10/15	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Hennepin	East Pond 4	Putnam	8	2019	unlined, dry before 10/15	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Wood River	West Ash Pond 1	Madison	21	June 2016	unlined, dry before 10/2015	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Wood River	West Ash Pond 2E	Madison	11	June 2016	Composite lined dry before 10/2015	closure underway, Jan 2021, State Regs, soil over geomembrane, MNA	dry, not defined by 257.53
Will County	Pond 1 North	Will County	2	active	unlined, dry before 10/2015	no closure plan, sumps to drain and reduce head 2013	dry, not defined by 257.53
Will County	Pond 1 South	Will County	2	active	unlined, dry before 10/2015	no closure plan, sumps to drain and reduce head 2013	dry, not defined by 257.53
Waukegan	Old Pond	Lake County	12	active	unlined, unspecified soil cover w/grass	no closure plan	covered, not regulated by 257.53, GW monitoring indicates exccedances of GWPS
Joppa	West Pond 1	Massac	102	active	unlined, unspecified soil cover w/trees	no closure plan	covered, not regulated by 257.53
Meredosia	Old Ash Pond	Morgan	17	2011	unlined, unspecified soil cover w/trees	no closure plan	covered, not regulated by 257.53
Coffeen	Ash Pond 2	Montgomery	60	2019	unlined, dry w/unspecified cover 1980s	re-closure complete Nov. 2020, State Regs, soil over geomembrane, MNA	1980's cover didn't prevent infiltration, not regulated by 257.53, GWPS exceedances

Attachment: USEPA Comments Table Legacy Pond

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 11

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
)
STANDARDS FOR THE DISPOSAL OF) **R20-19**
COAL COMBUSTION RESIDUALS) **(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:)
PROPOSED NEW 35 ILL. ADM. CODE 845)

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board **Dynegy's Prefiled Testimony**, copies of which are herewith served upon you.

Respectfully submitted,

/s/ Ryan C. Granholm
Ryan C. Granholm

Dated: August 27, 2020

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	**)**	
	)	
	)	
STANDARDS FOR THE DISPOSAL OF	**)**	**R20-19**
COAL COMBUSTION RESIDUALS	**)**	**(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:	**)**	
PROPOSED NEW 35 ILL. ADM. CODE 845	**)**	

Dynegy's Prefiled Testimony

1. Prefiled Testimony of Cynthia Vodopivec, Vice President, Environmental Health and Safety, Dynegy Midwest Generation, LLC & IPH, LLC
2. Prefiled Testimony of Lisa Bradley, Ph.D., DABT, Principal Toxicologist, Haley & Aldrich, Inc.
3. Prefiled Testimony of Melinda Hahn, Ph.D, Senior Managing Consultant, Ramboll
4. Prefiled Testimony of David Hagen, Principal Consultant, Haley & Alrich, Inc.
5. Prefiled Testimony of Andrew Bittner, P.E., Principal, Gradient
6. Prefiled Testimony of Mark Rokoff, P.E., Senior Vice President, AECOM
7. Prefiled Testimony of Rudolph Bonaparte, Ph.D, P.E., NAE, Senior Principal, Geosyntec Consultants, Inc.

Respectfully submitted,

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Testimony 7:

Dr. Rudolph Bonaparte

specification of any criteria makes Part 845.710 more stringent than the corresponding requirement in the federal rule.

Opinion 9: Explicitly including the cost of closure in the closure alternatives analysis required by Section 845.710 better enables the owner or operator to propose, and IEPA to approve as appropriate, a closure alternative that not only satisfies all applicable performance criteria of Part 845, but that is also cost effective. The importance of making this factor explicit is reflected by the substantial potential differences in cost associated with the available closure methods.

- Working with engineers at Geosyntec Consultants, I conducted a comparison of the cost and time duration to close a representative Illinois CCR surface impoundment using Closure by Removal and Closure with a Final Cover System. The representative impoundment is 60 acres in size and contains 2,700,000 CY of CCR. The final cover system considered in the comparison satisfies the prescriptive minimum design requirements of Part 845.[22] For Closure by Removal, CCR is trucked to a commercial MSW landfill 20 miles from the site.[23] The estimated cost and duration for Closure with a Final Cover System are $28 million and 20 months, respectively. The estimated cost and duration for Closure by Removal are $152 million and 140 months, respectively. Based on these estimates, the cost and duration for Closure by Removal are roughly five and seven times higher, respectively, than the cost and duration for Closure with a Final Cover System. These estimates are based on standard sources for construction cost estimating information (i.e., RS Means) and Illinois closure construction contractor bids received in 2019.

4. *ASSESSMENT, INSPECTION, AND REPORTING REQUIREMENTS (Part 845 Subpart D: Design Criteria and Subpart E: Operating Criteria)*

Opinion 10: Section 845.540(b) requires that a CCR surface impoundment undergo annual inspections by a qualified professional engineer. Unlike Section 845.540(a) that addresses annual inspections by a qualified person and requires regular inspections during the post-closure care period, Section 845.540(b) does not provide a clear statement as to whether the annual qualified professional engineer inspection requirement applies during the 30-year post-closure period. I suggest that Part 845 be clarified in this regard. Moreover, annual

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[22] Low permeability layer is 36 inches thick; final protective layer is 36 inches thick.

[23] The tipping fee for off-site disposal is estimated to be $29/ton; this fee was obtained through a telephone survey of several landfill owners/operators and the first-hand knowledge of Geosyntec's solid waste professionals; CCR unit weight estimated as 90 pounds per cubic foot; daily off-site disposal rate estimated as 1,000 CY/day based on waste acceptance rate at off-site disposal facility.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 12

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:)
)
STANDARDS FOR THE DISPOSAL OF) R 2020-19
COAL COMBUSTION RESIDUALS IN) (Rulemaking -Land)
SURFACE IMPOUNDMENTS:)
PROPOSED NEW 35 ILL. ADM.)
CODE PART 845)

PRE-FILED TESTIMONY OF GARY KING

I. QUALIFICATIONS

My name is Gary King. I am employed by the consulting firm Arcadis U.S. I have been employed with Arcadis U.S. since February 2012. Prior to joining Arcadis U.S. I was employed by the Illinois Environmental Protection Agency ("Illinois EPA") as the Manager of the Division of Remediation Management for the Bureau of Land. From 1990 through 2011, I was the senior manager for the Illinois EPA site cleanup programs: the voluntary cleanup program (also known as the Site Remediation Program), federal and Superfund cleanup programs, the Department of Defense cleanup program and the Leaking Underground Storage Tank program. Prior to 1990 I managed the Illinois EPA land enforcement programs. From 2001 to 2008, I served as the Chair of the CERCLA and Brownfields Subcommittee for the Association of State and Territorial Solid Waste Management Officials, and I was a recipient of the Association's "Lifetime Achievement Award" in 2012.

While at Illinois EPA I led the development of multiple regulatory programs concerning the cleanup and closure of sites. I have testified in numerous regulatory proceedings before the Board. I lead the development of the original 35 Ill. Adm. Code Part 742; Tiered Approach to Corrective Action Objectives, or TACO. I testified at all the subsequent Board rulemakings on TACO until 2011. I testified in R08-18 with regards to interaction between Part 620 and TACO.

impoundments) since it did not close prior to October 19, 2015. As a result, according to proposed 845.100(d), the requirements that apply to existing surface impoundments apply to these Meredosia Ponds. This means that the characterization and closure requirements of Subpart G would now apply to these sites even though Ameren completed their closure under an Illinois EPA approved plan in 2019—at a cost of $12 million.

Ameren disputes the Illinois EPA's characterization, as it is unsupportable factually and legally. The Board's adoption of an Illinois EPA proposed rule that would deem these ponds not closed on the effective date of its rules would constitute a retroactive application of law. The Illinois EPA makes this distinction based on the effective date of 40 C.F.R. Part 257—October 19, 2015—without valid justification. As of October 19, 2015, Part 257 was not applicable to any of the Meredosia ponds because it had ceased being a power generating facility. There is no reason given why an Illinois EPA approved closure completed before the effective date of Part 845 should not have the same status as an Illinois EPA approved closure completed before the effective date of 40 CFR Part 257. Ameren should not be required to re-initiate closure or any closure activities, in a construction permit or otherwise in an operational permit, for already closed sites that have been closed pursuant to a closure plan approved by the Illinois EPA. The portion of the Illinois EPA's proposed definition of "closed inactive" that requires completion of closure by October 19, 2015 should not be accepted by the Board. Ameren would not object to the Board's inclusion of the Fly Ash Pond, which continues to contain CCR, as an "inactive closed CCR surface impoundment" subject to Section 845.170 of the proposed rules.

D. Status of Meredosia Old Ash Pond

The Old Ash Pond originally consisted of three ponds, which were constructed in 1948 and removed from service in 1972. The Old Ash Pond was capped in the early 1970's with native materials. At that time, there were no requirements in the Illinois Environmental Protection Act or regulations under the Act specifying requirements for closure of ash ponds. There was no Illinois EPA program engaged in the regulation or approval of ash pond closures. The Old Ash Pond stopped receiving wastes before October 21, 1976. As such, it falls outside of the federal regulatory system (RCRA) for the disposal of wastes. The Old Ash Pond currently has a forest of trees growing on it. It is not a "pond" at all and poses little to no environmental risk—certainly nothing like the risks related to "legacy ponds" that the D.C Circuit Court referenced in the *USWAG* decision. Old Meredosia is not among the inventory of sites discussed in that case.

Further, the area encompassing the pond is within the groundwater management zone that is in place at Meredosia for the closed surface impoundment there. Any risks from the area will be identified and addressed. The Illinois EPA never asked Ameren to address any issues at the Old Ash Pond, nor did it ever seek to include it in the closure plan upon review and approval.

E. Status of Venice Ponds

The Illinois EPA approved the Closure Plan for the North and South Ponds on May 6, 2011. Cap construction was completed on October 3, 2012. The final cover system included a 40 mil geomembrane liner and double-sided geo-composite panels on top of the liner.

Ameren sent a letter to the Illinois EPA on November 5, 2012 documenting completion of closure under the Illinois EPA approved closure plan, including the CQA Report. Pursuant to the approved closure plan, Ameren began submitting Annual Reports on March 31, 2013 documenting post-closure activities. Ameren has continued to report to the Illinois EPA on post-closure activities annually.

Under the Illinois EPA proposal the North and South Ponds are classified as Inactive Closed CCR surface impoundments, subject to Section 845.170. Ameren does not dispute that characterization.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 13

Ash Pond Hydrogeologic Assessment Plan

Electric Energy, Inc.
Joppa Power Station

revised March 2010

Prepared for:
Electric Energy, Inc. –
Joppa Power Station
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Joppa, Illinois 62953

Prepared by:
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Springfield, Illinois 62703

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Hydrogeologic Assessment Plan

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Hydrogeologic Assessment Plan

1. Introduction

This Hydrogeologic Assessment Plan (Plan) for the Ash Impoundments (Ponds) at the Electric Energy, Inc. (EEI) Joppa Power Station (Plant) has been prepared to satisfy the request of the Illinois Environmental Protection Agency's (Illinois EPA or Agency) Bureau of Water Division of Water Pollution Control in a letter to EEI dated April 10, 2009. Per this letter, which referenced Title 35 of the Illinois Administrative Code, Section 620 (35 IAC 620), the Plan addresses the following for the two ash ponds located at the site:

A) Subsurface Hydrogeology Characterization

B) Potential Contaminant Migration Evaluation

C) Groundwater Monitoring Plan

D) Plan to Identify Potable Wells

1.1 Location

The Plant is located in the northeast quarter of Section 15 and the west half of Section 14, Township 15 North, Range 3 East of the 3rd PM, west of the Village of Joppa and northeast of the Ohio River in Massac County Illinois, and includes two ash ponds, one retired and one active. The location of the Plant and the approximate ash pond limits are shown on Figure 1.

1.2 West Ash Pond

The West Ash Pond (West Pond) is the original ash impoundment for the Plant. This pond was placed into service during the early-1950's, when the Joppa Plant was first put into operation and was taken out of service (retired) in the 1970's.

1.3 East Ash Pond

The East Ash Pond (East Pond) is currently being used as the ash sluice basin at the Plant. The East Pond was constructed in two phases. Phase I was placed in service late in 1973. Phase II permitting of the southern portion of the East Pond was completed in May 1985, with completion of construction activities occurring later that year. Operation of the East Pond is in accordance with current IEPA Permit No. IL0004171.

2. Subsurface Hydrogeology Characterization

The characterization of the site's subsurface hydrogeology is based on available data for the region. Appendix A details data collected for the region on climate, geology and groundwater.

Available subsurface information from published sources on regional and local geology, from ISGS and ISWS boring and well logs is summarized in Appendix A. Based on the available information, the upper-most aquifer is expected to be at approximately elevation 300 ft National Geodetic Vertical Datum (NGVD). As indicated in Appendix A, groundwater flow toward the southwest and the Ohio River is expected.

3. Potential Contaminant Migration Evaluation

As discussed in Section 4, below, the installation of new monitoring wells is proposed around the ash ponds. Samples of the subsurface materials will be obtained during the drilling necessary to install the wells, and potential contaminant migration evaluation will be augmented utilizing physical property data from soil samples analyzed in the lab per ASTM standards. Field tests on the monitoring wells will also be conducted to determine site-specific hydraulic conductivity values. Procedures for completing borings and monitoring wells and for collecting samples are included in Appendix B. The procedures for groundwater testing are included in Appendix D.

Using the regional hydrogeological characteristics and the analysis of groundwater and other information collected from borings and wells installed at the site, the site may be evaluated with respect to migration of potential contaminants. Methods for analyzing potential contaminant migration are discussed in Appendix C.

4. Groundwater Monitoring Plan

4.1 Proposed Monitoring Wells

Seven new monitoring wells are proposed for the Plant. Figure 2 shows the layout of the proposed groundwater monitoring plan. The new monitoring wells will be completed in accordance with the Hydrogeologic Investigation Methodology included as Appendix B. Monitoring well locations will be as close as practical to the toe of the ash pond berm; however some wells may be further from the berm due to utilities and/or site conditions. Final monitoring well location decisions will be made in the field prior to installation.

The elevation of the screened intervals of the new wells will be determined from the information obtained during the drilling and installation process. The target elevation is expected to be in the range of elevation 300 ft NGVD (±10 ft), based on the available information discussed in Section 2.

4.2 Groundwater Sampling and Analysis

Upon completion of the monitoring well installation, the new wells will be sampled following the low-flow sampling protocol described in Appendix D. Table 1 and Table 2 contain the list of the parameters proposed for field and laboratory testing, respectively. Note that only the inorganic portion of the 35 IAC 620.410 list is proposed. Monitoring for organic compounds is not proposed as the heat generated during the coal combustion process would destroy any organic chemical compounds and no organic compounds should exist in the ash ponds. Samples for the parameters listed in Table 1 and Table 2 will be obtained at all seven proposed monitoring well locations on a quarterly basis for two (2) years. Results will be forwarded to the Illinois EPA as data becomes available. Results of the quarterly analyses will be compared with the applicable groundwater standards. A report summarizing the quarterly groundwater data, a trend analysis, and a comparison to the applicable standards will be forwarded to Illinois EPA within 90 days of completion of the 4th round of sampling for each of the two 12-month sampling periods proposed.

TABLE 1: Field Parameter List

Constituent	Units	Standard
pH	SU	6.5-9.0
Specific Conductance	uS/cm	n/a
Temperature	°F	n/a
Depth to Water	Ft (bls)	n/a
Depth to Water	Ft (bmp)	n/a
Elevation of MP	Ft NGVD	n/a
Elevation of Water Surface	Ft NGVD	n/a

TABLE 2: Inorganic Parameter List

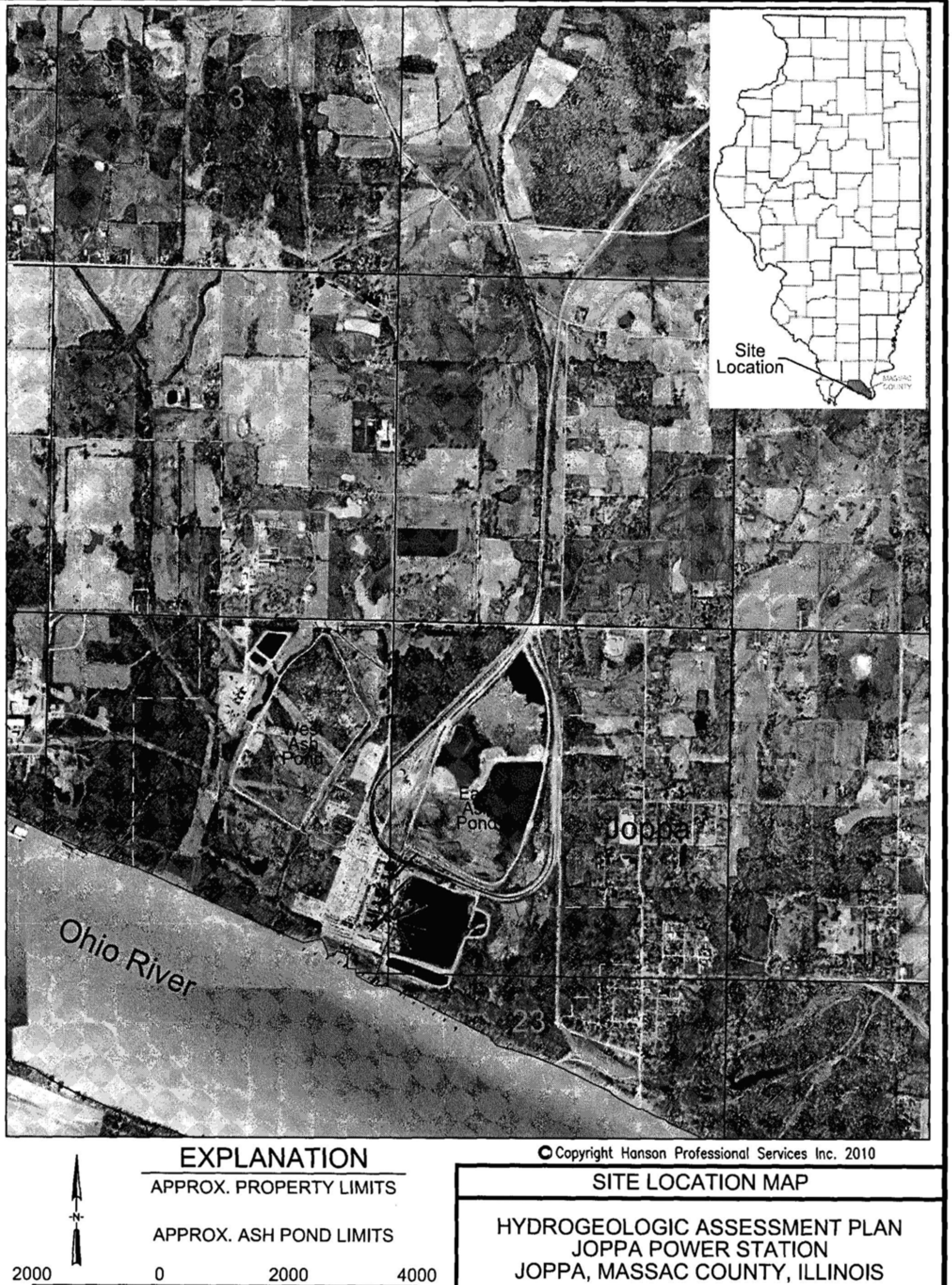
Constituent	Units	Standard
Antimony, dissolved	mg/L	0.006
Arsenic, dissolved	mg/L	0.05
Barium, dissolved	mg/L	2.0
Beryllium, dissolved	mg/L	0.004
Boron, dissolved	mg/L	2.0
Cadmium, dissolved	mg/L	0.005
Chloride, dissolved	mg/L	200
Chromium, dissolved	mg/L	0.1
Cobalt, dissolved	mg/L	1
Copper, dissolved	mg/L	0.65
Cyanide, total	mg/L	0.2
Fluoride, dissolved	mg/L	4.0
Iron, dissolved	mg/L	5.0
Lead, dissolved	mg/L	0.0075
Manganese, dissolved	mg/L	0.15
Mercury, dissolved	mg/L	0.002
Nickel, dissolved	mg/L	0.1
Nitrate (as N), dissolved	mg/L	10
Selenium, dissolved	mg/L	0.05
Silver, dissolved	mg/L	0.05
Sulfate, dissolved	mg/L	400
Thallium, dissolved	mg/L	0.002
Total Dissolved Solids (TDS)	mg/L	1,200
Zinc, dissolved	mg/L	5.0

5. Identification of Potable Water Wells

Illinois State Geological Survey (ISGS) [as the Illinois Water Inventory Program (IWIP) database] and Illinois State Water Survey (ISWS) records have been reviewed and tabulated for this report (see Appendix A and Appendix E). Figure A-6 indicates the approximate locations of water wells that may lie within 2,500 feet of the two ash ponds, based on an internet search of the ISGS and ISWS databases. Table A-2 lists all the water supply wells in the south-half of Section 10 and 11, and all of Section 14, 15, and 23 of Tier 15N, Range 3E of the 3rd PM. ISGS and ISWS data may not be adequate to reliably determine whether all the wells listed are, in fact, within 2,500 feet of the ponds.

To augment the records search, Plant Staff contacted the City of Joppa on March 9, 2010 to determine water usage within the City's limits. The City indicated that they were unaware of any residential water wells within the city limits. The City's water well is located near the very southern end of the City of Joppa (see Figure A-6).

On March 10, 2010, the Fort Massac Water District (FMWD) was contacted to determine the water district's service in the vicinity of Portland Road. David Travis, of the FMWD indicated that there were two locations still using well water along and north of Portland Road. A small trucking firm located just east of the East Ash Pond (ISGS well ID 00158) and a residence northwest of the West Ash Pond (ISGS well ID 20255) were identified by FMWD as not connected to their system and likely on well water (ID numbers can be found in Table A-2 and Figure A-6).



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EXPLANATION

APPROX. PROPERTY LIMITS

APPROX. ASH POND LIMITS

N

2000 0 2000 4000

SCALE: 1" = 2000'

SITE LOCATION MAP

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

HANSON NO. 09E0078A

FIGURE 1

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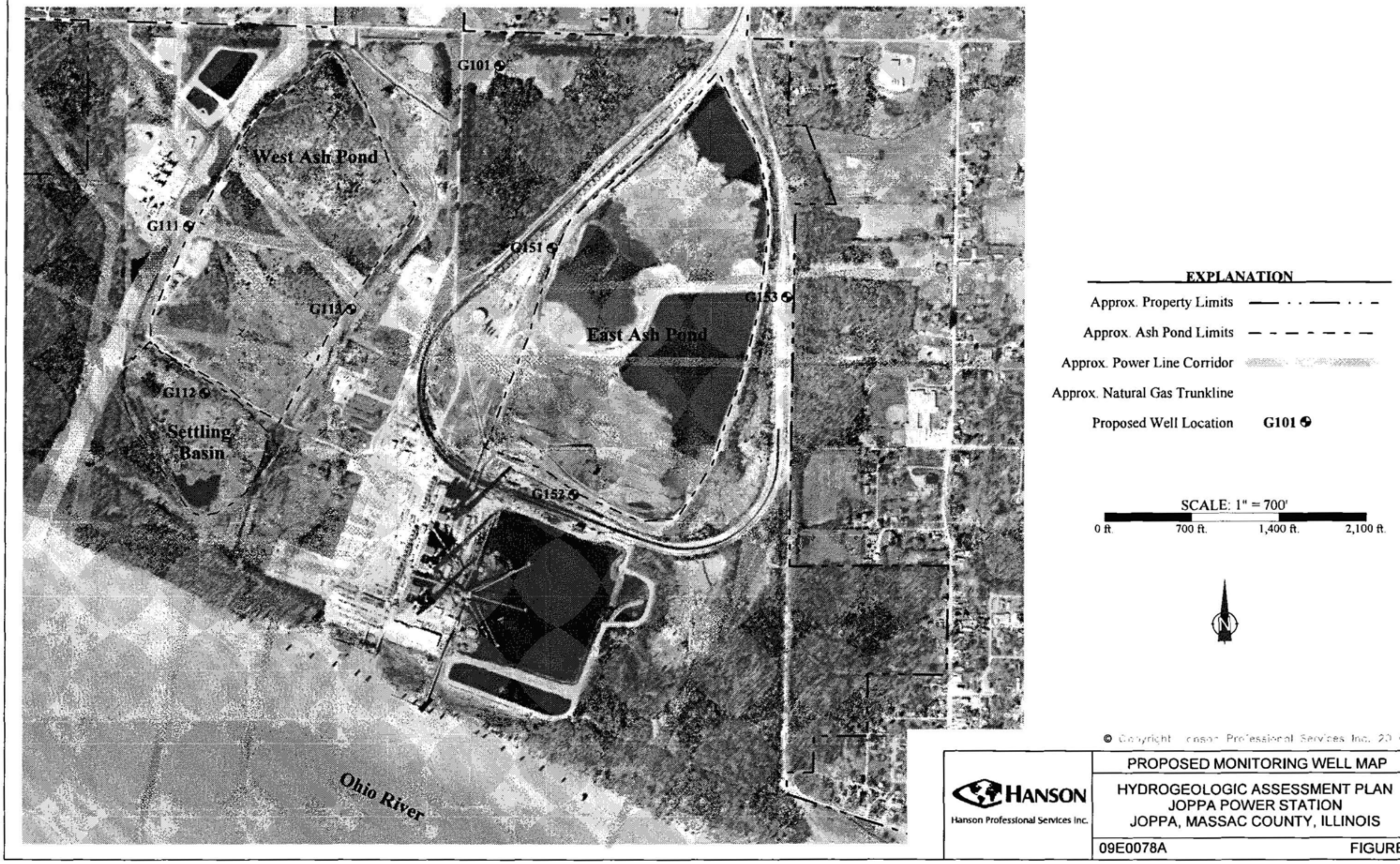

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PROPOSED MONITORING WELL MAP

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

09E0078A

FIGURE 2

6. References

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Appendix

Appendix A – Geologic/Hydrogeologic Background

Appendix A. Geologic/Hydrogeologic Background

A.1. Physical Setting

The study area is located on the southern boundary of the Illinois Basin and the northern edge of the Mississippi Embayment, a relatively low lying area that is part of the Coast Plain Physiographic Province. The existing topography consists of generally gently sloping to steep agricultural lands. The Plant's surficial deposits consists of Wisconsian-stage deposits, including clays, silts, sands, and gravels. The Site relationship to Illinois' physiographic divisions is shown in Figure A-3.

Per the "Stack-unit Map" of Illinois Geology, much of the Site consists of greater than 6 m (>19.7 ft) of silts, sands and gravels of the Henry Formation. The northeast quadrant of the Site has less than 6 m (< 19.7 ft) of silty and clayey diamictons of the Equality Formation, overlying Cretaceous age sediments, silts, sands, etc. between a depth of 6 m and 15 m (19 ft to 50 ft). The unconsolidated material rests on Mississippian age bedrock (Berg et al., 1987).

A.2. Climate Data

Average climatic data was obtained from the Illinois State Water Survey. The data was recorded between 1958 and 2008 from Brookport, Illinois, which is located approximately fifteen miles southeast of the Plant. The data includes monthly maximum and monthly minimum daily temperatures and average rainfall for each month calculated from daily values collected over the 50 year period. The data is summarized in Table A-1.

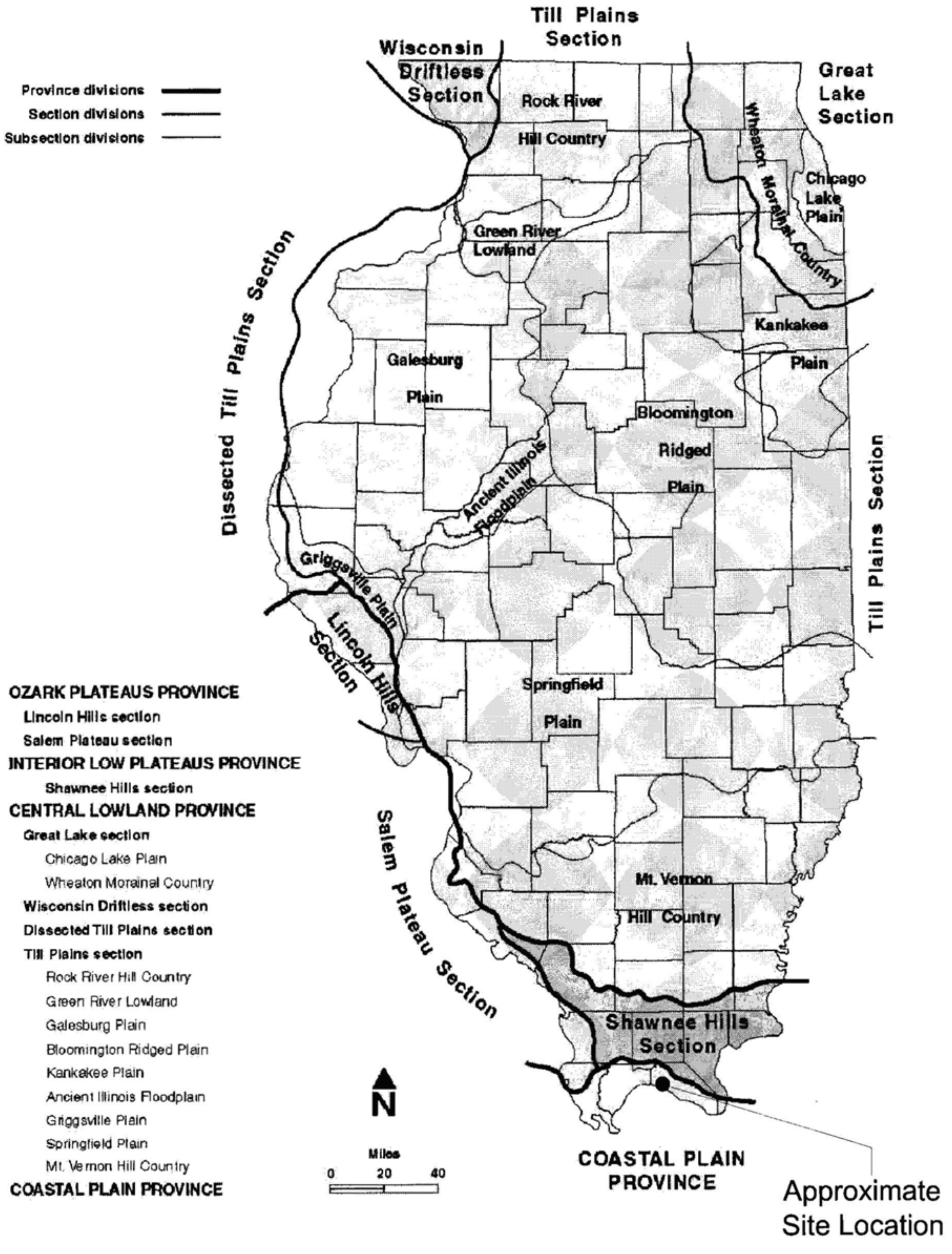
TABLE A-1: Average Monthly Temperature Extremes and Precipitation for Brookport, IL

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Max Temp - °F	43.1	47.5	58.0	69.4	77.9	85.8	89.4	88.5	81.7	71.2	58.0	46.5	68.1
Min Temp - °F	25.3	28.4	37.2	47.2	56.1	64.2	68.1	66.2	58.8	47.1	38.1	29.0	47.2
Precip - inches	3.55	3.71	4.46	4.66	4.70	4.01	4.10	3.18	3.57	3.16	4.02	4.26	47.39

Source: http://www.isws.illinois.edu/data/climatedb/choose.asp?stn=110993

A.3. Regional Hydrogeology

The regional hydrogeology was investigated to provide an understanding of the Plant's geological character and groundwater conditions. The regional geology and the groundwater conditions were evaluated using the available subsurface boring logs obtained from the Illinois State Geologic Survey (ISGS) and the Illinois State Water Survey (ISWS) on file as of June 2009 along with published literature on area soil and bedrock conditions. Copies of the logs are provided in Appendix E. A Generalized Stratigraphic Column (Figure A-4), summarizing the Plant geology, was prepared based on the available boring information.



after Leighton et al., 1948

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PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

HANSON NO. 09E0078A

FIGURE A-3

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A.4. Bedrock Stratigraphy

Hundreds of feet of sedimentary rock deposited and consolidated prior to the Cretaceous Period underlie this region. The bedrock in the study area dips gently northward toward the center of the Illinois Basin. The upper-most bedrock near the Plant generally consists of limestone.

The regional bedrock surrounding the Plant consists of a sequence of Mississippian System sedimentary rocks. The total thickness of the Mississippian System in southern Illinois is greater than 3,200 ft. The following describes bedrock (after Willman et al., 1975) found in the area.

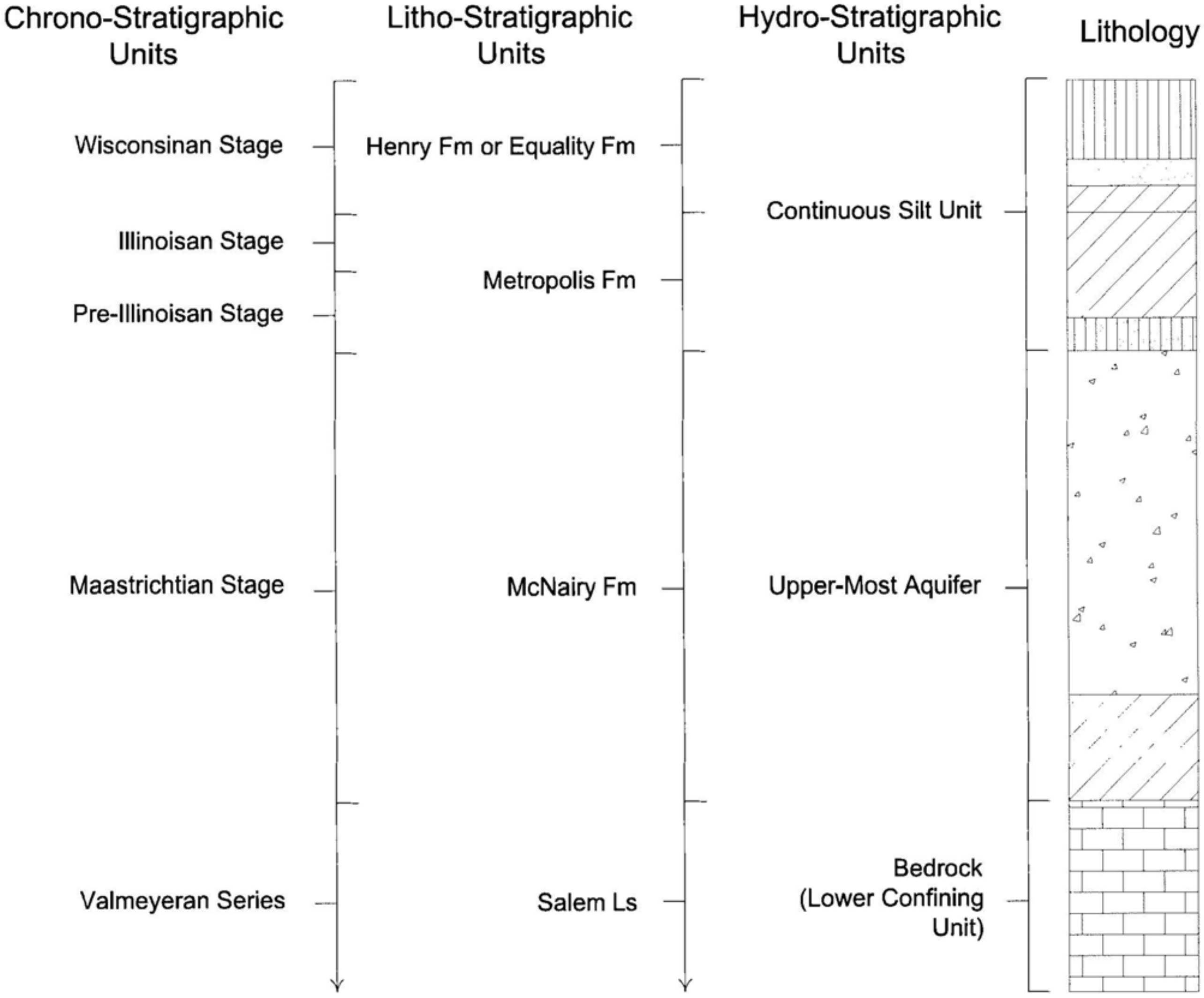
The Mississippian System units in the area include the Salem Limestone, the Ullin Limestone, and the Fort Payne Formation. The uppermost unit of the Mississippian System encountered near the Plant is the Salem Limestone. The Salem Limestone is described as fine-grained, fossiliferous limestone, and is approximately 200 ft thick to 500 ft thick in the study area. The Salem Limestone overlies the Ullin Limestone; the Ullin Limestone is described as a light-colored fine- to coarse-grained limestone. The overall thickness of the Ullin Limestone near the project Plant is approximately 200 ft. The Fort Payne Formation, which is overlain by the Ullin Limestone, is described as a very fine-grained, siliceous, cherty limestone, and is approximately 200 ft thick to 600 ft thick in the study area (Willman et al., 1975).

A.5. Unconsolidated Deposits

Cretaceous deposits of unconsolidated sediments, comprising the McNairy Formation, are encountered directly above the bedrock over the study area. The McNairy Formation is described as a sand, silt, and clay unit. The sands are very fine- to medium-grained, mostly highly micaceous, and range from white and light-gray to bright orange, red and yellow in color. The silts and clays are light to dark gray and may be mottled in yellow, gray, and magenta. The lower contact is unconformable (Nelson, 2007).

Regionally, the unconsolidated deposits consist of diamictons, and lacustrine/alluvial deposits. These deposits are approximately 60 ft thick. The Quaternary units are described briefly below and in detail later in this section.

The encountered Quaternary deposits at the Plant include the Henry, the Equality and the Metropolis Formations. Mapping by the ISGS indicates Quaternary deposit thickness in the project area is less than 75 ft. The Equality Formation is generally medium to dark gray to brown clay, silt, and minor sand and gravel in the Plant area. The Metropolis Formation is comprised of silt, sand, clay and gravel and is generally gray, yellowish brown, and yellowish orange (Nelson, 2007).



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GENERALIZED STRATIGRAPHIC COLUMN

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

HANSON NO. 09E0078A FIGURE A-4

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I:\09JOBS\09E0078\14-REPORTS\FIGA4_GENSTRATCOLUMN.DWG

A.6. Structural Geology

The regional structural geology of the area is presented on Figure A-5. The principal structure is the Lusk Creek Fault Zone, located directly east of the project area. The Lusk Creek Fault Zone is composed of sub-parallel, high-angle normal and reverse faults which have been inactive since the early Mesozoic. To the southeast and southwest of the project area are faults in Paleozoic rock beneath the Mississippi Embayment, associated with the Reelfoot Rift. There have been no Pleistocene displacements (i.e., within the last 1.8 million years) along faults in the Mississippi Embayment in Illinois (Nelson, 1995).

A.7. Groundwater

The available well records within one mile of the facility were obtained from the ISWS and ISGS, and reviewed. The specific capacities and the potentiometric elevations of the water levels in the wells were also estimated, as described below. Figure A-6 shows the locations of the ISGS-supplied water wells (ISWS does not give locations). Copies of the ISGS and ISWS summary sheets are provided in Appendix E. The result of the review indicates potable water near the Plant may be obtained from unconsolidated materials or from deep bedrock.

Well production test results, located on the logs in Appendix E[†], were used to approximate the specific capacity of the formations screened. Specific capacity is a rough approximation of the transmissivity of a formation. High specific capacities usually indicate high transmissivities or the ability of a formation to produce significant quantities of water. Further, high specific capacities usually indicate high hydraulic conductivities. Specific capacity is estimated from well production tests by the following equation (Driscoll, 1986):

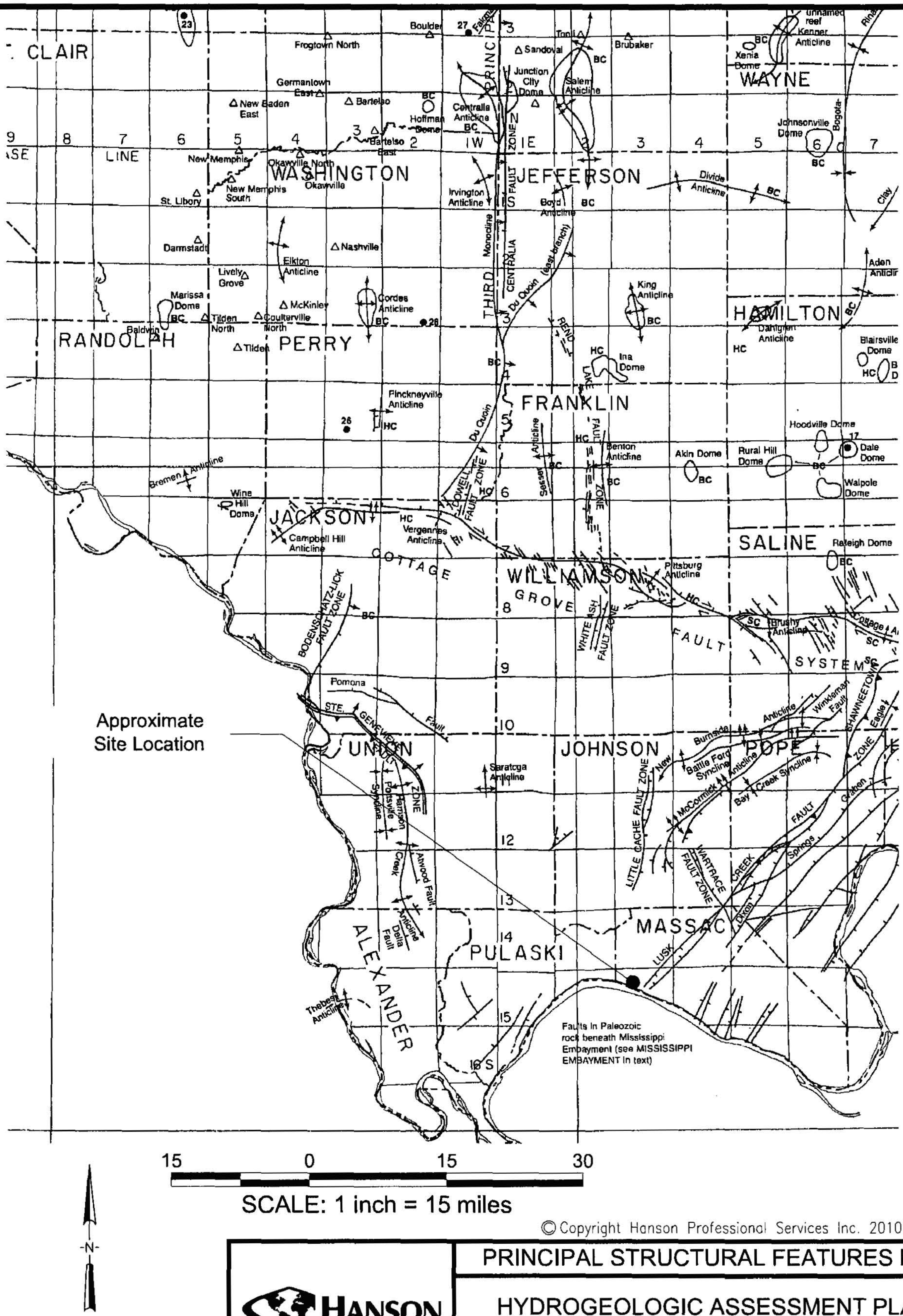
$$S_c = Q/s$$

Where;
S_c = specific capacity (gpm/ft)
Q = well discharge (gpm)
s = drawdown (ft)

The specific capacities from the data provided on the nearby private well logs are summarized in Table A-2. None of the shallow wells had specific capacity data to evaluate the groundwater flow characteristics in the unconsolidated formations surrounding the Plant.

Water level data inferred from the ISGS and ISWS records indicate that groundwater flow is toward the southwest and the Ohio River. The Ohio River is the regional groundwater divide, and flow in this direction is expected. An estimate of the groundwater flow gradient is not possible at this time as the available water level readings are from different times.

[†] The well ID numbers on Figure A-6 are the same as the county number of the ISGS logs in Appendix E.



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Source: Nelson, W. J., 1993,
"Structural Features in Illinois"
ISGS Bulletin 100, Plate 1.

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PRINCIPAL STRUCTURAL FEATURES MAP

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

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FIGURE A-5

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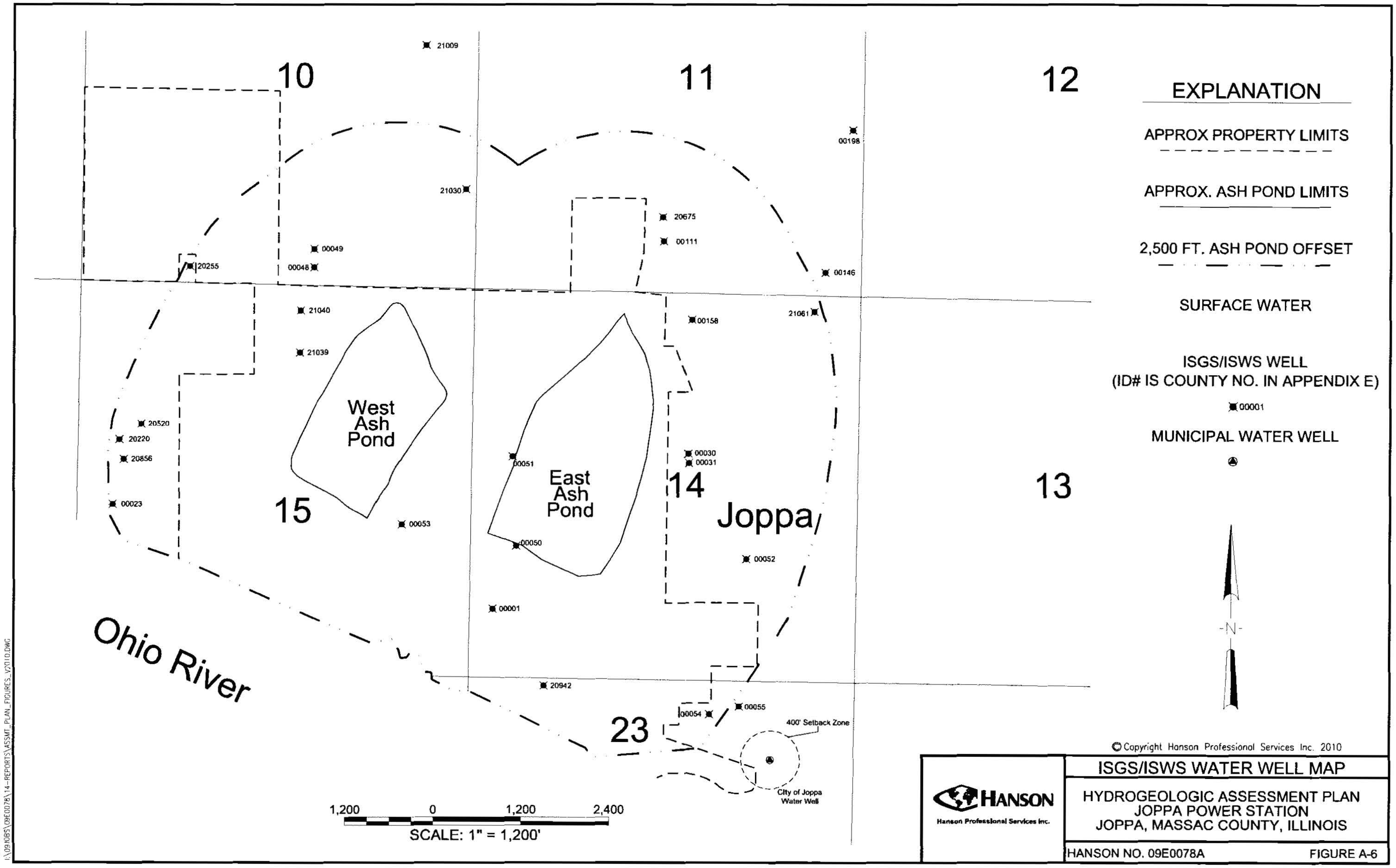
TABLE A-2: Water Wells and Available Specific Capacities

County Log No.	Owner	Material Screened	Depth (ft)	Specific Capacities (gpm/ft)
#00146*	H. Kapley	Gravel	150	Insufficient Data
#00198*	R. Brewer	Limestone	283	5.0
#00030	A. Bunchman	No Data	153	No Data
#00031	M. Roberts	No Data	156	No Data
#00052	Joppa Grade School	No Data	138	No Data
#00158*	D. Mathes	No Data	160	Insufficient Data
#21061*	R. Terbrak	Gravel	92	3.33
#00054	Joppa Colored School	No Data	137	No Data
#00055*	M. Wilson	No Data	65	No Data
#21009	A. Snell	No Data	202	No Data
#21030*	A. Snell	Limestone	202	0.6
#00049	Joppa Compressor Station #7	No Data	166	No Data
#00048	Joppa Compressor Station #7	No Data	150	No Data
#20255*	G. Sielbeck	No Data	52	No Data
#00111*	G. Adams	Sand & Gravel	78	0.5
#20675*	W. Jewel	Gravel	94	1.11
#00001	Bechtel Corp	No Data	304	No Data
#20942	Electric Energy Inc.	No Data	90	No Data
#00051	Electric Energy Inc.	No Data	403	No Data
#00050	Electric Energy Inc.	No Data	350	No Data
#00053	Electric Energy Inc.	No Data	235	No Data
#21039	Midwest Electric Power Co.	Limestone	238	60
#21040	Midwest Electric Power Co.	Limestone	277	150
#20856	Lafarge Corp.	Sand & Gravel	98	13
#20520	Missouri Portland Cement	Alluvial	110	13
#00023	Missouri Portland Cement	No Data	140	No Data
#20220	Missouri Portland Cement	No Data	110	No Data

Note: Tabulated information is derived from ISWS and ISGS water well logs.
* Indicates well included in ISWS database.



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ISGS/ISWS WATER WELL MAP

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

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FIGURE A-6

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Appendix

Appendix B – Hydrogeologic Investigation Methodology

Appendix B. Hydrogeologic Investigation Methodology

B.1. Drilling and Field Procedures

An experienced geologist or engineer under the direction of an Illinois Licensed Professional Geologist shall direct the field investigation. Prior to drilling, the location of each boring will be determined, surveyed and staked. The geologist or engineer will maintain a daily drilling record, log the soil samples, select representative samples for laboratory testing, and observe the installation of the monitoring wells.

B.1.1 Soil Sampling

Soil samples will be collected using either a direct push (e.g., Geoprobe®) drill, or using a conventional auger drill with split spoon or split barrel sampler. Continuous sampling will be performed at all boring locations. Boreholes needed for monitoring wells installation will be drilled with minimum 4¼-inch inner diameter hollow stem augers.

Representative soil samples obtained during drilling will be saved in 8-oz. clear glass jars and sealed with air tight, screw top lids. When a change in the soil stratigraphy is logged within a sample interval, the sample will be split and portions above and below the break will be collected. After sealing the jars, individual samples will be labeled, boxed and transported to the laboratory for analysis. Relatively undisturbed thin-walled tube samples may also be taken of representative materials, for laboratory testing including those for unit weight and hydraulic conductivity determination. The ends of the tubes shall be sealed prior to transport to the testing lab.

B.1.2 Borehole Abandonment Procedures

Any boreholes not used for monitoring well installation will be abandoned in accordance with the applicable Illinois Department of Public Health (IDPH) regulations. The boreholes will be tremie grouted from the bottom of the borehole to the ground surface with high-solids bentonite grout (borings below the water table) or backfilled with bentonite chips (borings above the water table). The geologist or engineer shall include documentation of the abandonment on the field boring log.

B.1.3 Monitoring Well Installation

Monitoring wells will consist of 2-inch diameter, schedule 40 PVC pipe with 10-ft long, 0.010-inch slotted well screen. A quartz sand (grain size 10/20) filter medium will be used to construct the filter pack around each well screen. The depth of the screen and the depth to the top of the filter pack will be measured and recorded in the field by the geologist or engineer. For each monitoring well, the annular space above the sand pack will be tremie grouted to within approximately 3 ft of the ground surface with a high-solids bentonite grout (e.g., CETCO® Pure Gold® or Baroid® Quik-Grout®, or equivalent). Optionally, a bentonite chip or pellet seal will be placed above the sand pack, with the high-solids bentonite grout used to fill the annular space.

A steel, locking, protective outer casing will be installed for each well. A concrete seal will be installed around the outer casing with the concrete extending from the ground surface to the top of the bentonite seal. The space between the outer (protective) and inner (well pipe) casing shall be filled with quartz filter sand. A drainage hole will be drilled into the outer casing. Padlocks will be used to control access to the monitoring well. After installation of the monitoring wells, the locations and elevations of the wells will be surveyed. Well construction/completion reports will be prepared for each monitoring well.

B.1.4 Monitoring Well Development

After installation, the monitoring wells will be developed using a surge block and a submersible pump. Each well will be surged to improve connection between the filter pack and the aquifer. Wells will then be pumped to remove fines, and to further enhance flow from the aquifer into the well. Typically, the wells are developed until the purge water is no longer turbid.

B.1.5 Surveying

All surveying work shall be performed by a survey crew under the direction of an Illinois Licensed Professional Land Surveyor. The locations and elevations of all the borings and monitoring wells installed during the investigation will be surveyed and reported in reference to State Plane or Plant coordinate systems. The coordinates for each boring shall be included on the Field Boring Log and the boring location shall be plotted on a base map of the Plant. The elevations of all borings and monitoring wells shall be based on the NOAA national geodetic vertical datum (NGVD). Horizontal locations should be accurate to ±0.10 ft. Ground surface elevations should be accurate to ±0.1 ft. Monitoring well casing elevations shall be accurate to ±0.01 ft.

B.2. Hydrogeologic Testing

B.2.1 Water Level Measurement

Water level measurements will be obtained from each new monitoring well. The depth to water from the top of the well riser should be collected using an electronic water level indicator. The water levels are converted to NGVD elevations using survey data provided for the top of the riser pipes at each well. The water level measurements and well horizontal coordinates will be used to create a groundwater (potentiometric) surface map. This map will be used to evaluate groundwater flow direction and gradient and to further evaluate the performance of the groundwater monitoring system.

B.2.2 Hydraulic Conductivity Testing

Field hydraulic conductivity tests will be performed in the new monitoring wells to evaluate the hydraulic conductivity of the unconsolidated deposits that comprise the upper-most aquifer. Laboratory permeameters may also be used to evaluate vertical hydraulic conductivity in soil samples obtained with thin-walled tube samples.

B.2.3 Additional Laboratory Soil Testing

The purpose of the laboratory testing is to classify and determine the properties of the materials encountered during the investigation and to aid in characterizing different hydrogeologic units present in the investigation area. The laboratory tests proposed for this investigation are as follows:

- Moisture Content Test (ASTM D 2216).
- Atterberg Limits Tests (ASTM D 4318).
- Grain Size Analyses (ASTM D 422).
- Triaxial Hydraulic Conductivity Tests (ASTM D 5084).

Testing will generally be performed in accordance with the ASTM standard procedures and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846 3rd Edition (U.S. EPA, 2007).

Appendix

Appendix C – Contaminant Migration Evaluation

Appendix C. Contaminant Migration Evaluation

C.1. Groundwater Classification – Class I: Potable Resource Groundwater

The groundwater in the vicinity of the Plant is classified as a Class I (Potable Resource) groundwater, pursuant to 35 IAC 620.210, as set forth by the Illinois Pollution Control Board.

C.2. Groundwater Quality and Statistical Evaluation

Site groundwater quality will be evaluated from samples collected from the proposed monitoring wells. These wells lie within the Joppa Power Station's property, and will be used for groundwater quality calculations.

The raw groundwater analytical data, and statistical calculations for the aquifer(s) will be calculated using four quarters of groundwater quality data and analyzed. Two US EPA documents will be used as a guide for the statistical evaluation of the groundwater data. The specific documents to be used are Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities - Interim Final Guidance (US EPA, 1989) and Statistical Analysis of Ground-Water Monitoring at RCRA Facilities - Addendum to Interim Final Guidance (US EPA, 1992).

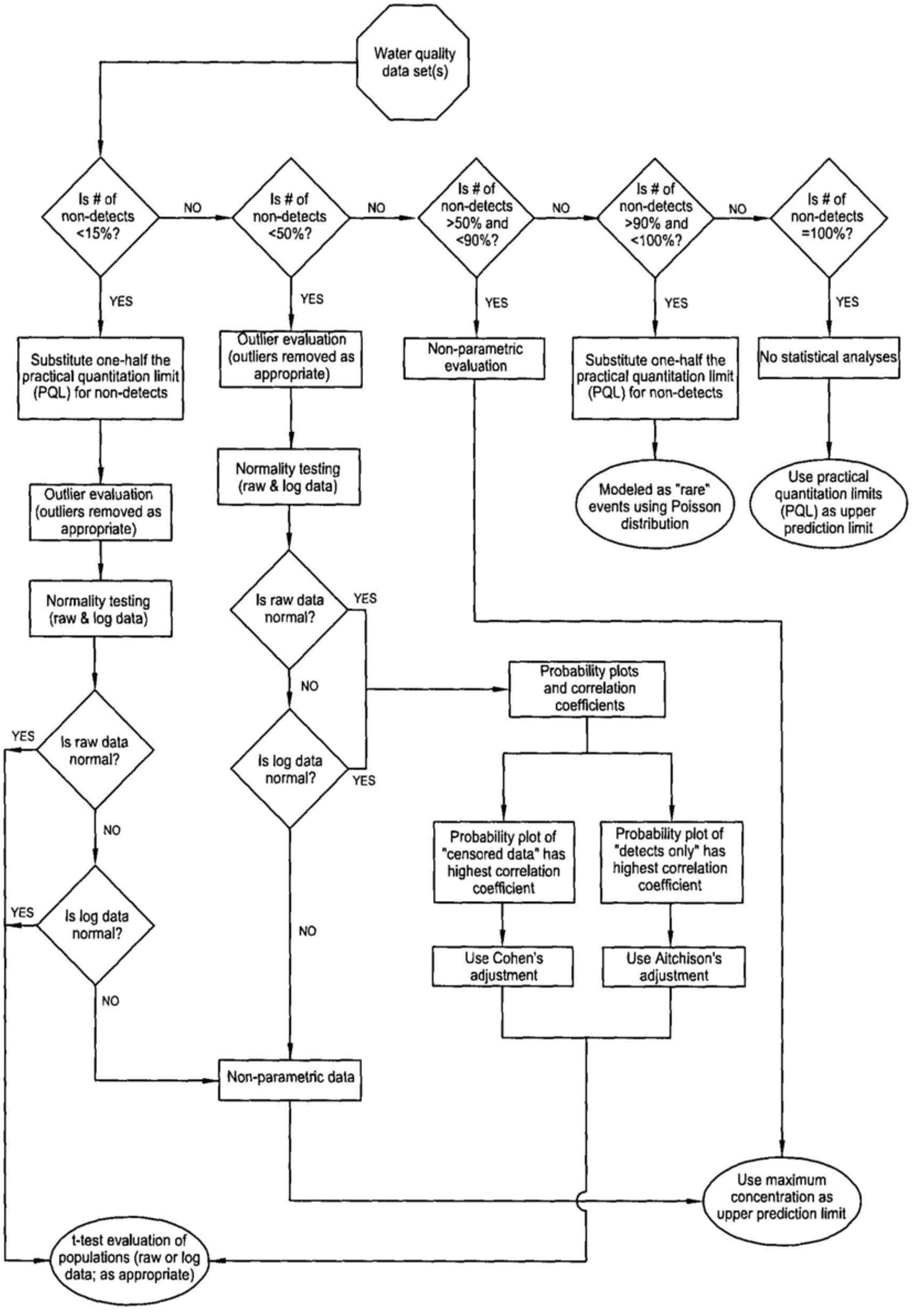
The goal of statistically evaluating the groundwater quality data is to determine an upper tolerance limit as compared to background levels for the various constituents, which will be analyzed. Establishing the tolerance limit was accomplished by using either a parametric or non-parametric procedure based on the percentage of non-detects and the distribution of the sample population. If the statistical data for a constituent had less than 50 percent non-detects and was normally or lognormally distributed, a parametric procedure was used. If the data was not normally or lognormally distributed or had more than 50 percent non-detects, a non-parametric procedure was used. Figure C-1 is a flow chart which illustrates the process followed to determine the appropriate statistical procedure to be used for each constituent based on its statistical characteristics. Equal numbers of samples from each well will be used so as not to bias the tolerance limit toward any single well.

C.2.1 Handling Non-Detects

Due to the variability of the groundwater quality, constituents may be detected in some samples but not others. The guidance documents recommend several ways to handle these non-detected values, based on the percentage of analyses for a constituent resulting in non-detects.

C.2.2 Statistical Analysis Results

The results of the statistical analyses for the proposed wells will be forwarded to the Agency upon completion of the four quarterly sample events. A listing of the applicable groundwater quality standards, the sampling results, and the results of the statistical analyses will be presented, in a report as discussed in Section 4 of this Plan.



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STATISTICAL ANALYSIS FLOWCHART

HYDROGEOLOGIC ASSESSMENT PLAN
JOPPA POWER STATION
JOPPA, MASSAC COUNTY, ILLINOIS

HANSON NO. 09E0078A
FIGURE NO. C-1

Appendix

Appendix D – Groundwater Sampling Protocol

Appendix D. Groundwater Sampling Protocol

D.1. Sampling Schedule

Sampling for routine analysis shall be conducted in accordance with current Illinois EPA requirements. The schedule for quarterly sampling is listed in Table D-1.

TABLE D-1: Quarterly Groundwater Monitoring Schedule

Sampling Period	Report Due Date
January - March (1)	May 31
April - June (2)	August 31
July - September (3)	November 30
October - December (4)	February 28

D.2. Parameter Lists

Routine sample collection will be conducted quarterly on the schedule outlined above, for the constituents listed in Table 2 of this Plan. Field parameters as listed in Table 1 will be collected and recorded at the time of sampling. Reporting of the monitoring results will have a submittal due date at the end of the second month following the end of the quarterly monitoring period.

D.3. Sampling Procedures

The following procedures shall be used in sampling groundwater at the Plant. This sampling protocol shall apply to the routine sampling and any comprehensive annual or biennial organic sampling, if necessary. A sample collector's worksheet may be used for noting relevant information in regard to each well.

If conditions exist at the time of sampling that could obviously influence the results, (e.g., farmers applying herbicides/pesticides nearby) it may be necessary to postpone sampling until a later date.

D.4. Preparation

Prior to the site visit, the sampling team should prepare all necessary equipment for the trip. Several days before, sample bottles/containers should be ordered from the laboratory that will conduct the analyses. Coolers and/or ice chests should be delivered with the sample containers and early enough so that the sampling team can inspect the containers and determine if the correct number and type of containers are present. The sampling team should also note if the sample containers come from the laboratory pre-preserved, or if preservative vials are included with the sample containers. Laboratory trip blanks should be included for each sample cooler.

Equipment needed for the sampling trip should be collected, inspected, and verified to be in operating condition. Sample meters should have an adequate supply of fresh buffer and standard solutions. An ample supply of de-ionized or distilled water should be available for decontamination of equipment while on-site.

At a minimum, the following equipment should be included in a sampling kit that will be taken on the sampling trip:

- Gloves (nitrile, polyethylene, or equivalent);
- Decontamination (DeCon) water (de-ionized and/or distilled);
- Depth to water meter (capable of reading in 0.01 ft. increments);
- Thermometer or thermocouple (in degrees Fahrenheit [ºF] with ±1° accuracy);
- Specific conductance meter (in micromhos per centimeter [µmhos/cm] or micro Siemens per centimeter [µS/cm] accurate to ±0.5 percent);
- pH meter (in 0.1 Standard Units [SU] with ±0.2 SU accuracy);
- at least one of;
    - dissolved oxygen meter (in milligrams per liter [mg/L] with ±0.5 mg/L accuracy);
    - redox potential meter (in milli-volts [mV] with ±50 mV accuracy);
    - turbidity meter (in nephelometric turbidity units [NTU] with ±0.1 NTU accuracy);
- Buffer solutions and standard for sample meters;
- Ice and/or cold packs;
- A supply of clean, disposable containers for field parameter testing;
- Bubble pack or foam insets to protect sample containers;
- At least one factory packaged, clean, disposable bailer and new, clean rope;
- Forms (chain of custody, purging forms, sampling forms, etc.);
- Spare batteries for sample equipment;
- A map showing (at a minimum) sampling locations, major landmarks, and topographic features; and
- Instructions for locating a set of keys for site entry and monitoring point access. (Keys should be with the sampling kit, or obtained once on-site.)

The site owner, operator, or manager should be notified at least 24 hours before the sampling team arrives at the Plant. If not part of the sampling kit, arrangements should be made to obtain the keys for the monitoring devices, and inquiries should be made as to the conditions at the Plant (access, weather, operations that may affect sampling, etc.).

When the sample team arrives at the Plant, the team should check in with Plant personnel, obtain the monitoring device keys (if necessary), and receive a conditions update.

D.5. Water Levels

Water levels shall be taken in each well and piezometer prior to any purging and/or sampling. Water levels should be taken as close together in time, as to prevent any temporal distortion of the water surface data. The following steps should be followed to obtain accurate water level readings:

1. Note the general condition of the well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the well. Note the condition of the casing and the condition of the well cap and riser. Open the cap, taking care not to introduce dirt or foreign material into the well.

3. The technician shall rinse the probe and cable of the water level meter with DeCon water.
4. Slowly lower the probe into the well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet.
7. Slowly remove the probe from the well. Rinse the probe and line with DeCon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

D.6. Purging of Well – Pump Method

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample from the surrounding formation. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a "low-flow" or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 L/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits.

Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available for sampling.

- pH (in SU),
- Specific Conductance (in μmhos/cm or μS/cm),
- Temperature (in °F), and at least one of the following:
  - Redox Potential (in mV),
  - Dissolved Oxygen (in mg/L), and/or
  - Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- pH .... ±0.2 SU
- Specific Conductance .... ±3 percent
- Temperature .... ±0.5°F
- Redox Potential .... ±10 percent
- Dissolved Oxygen .... ±10 percent
- Turbidity .... ±10 percent

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.

D.7. Purging of Well – Bailer Method

Purging and sample collection with a bailer shall only be performed in the event of a damaged / non-functioning pump or from a sample point that does not have a dedicated sample pump. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

1. Calculate the number of bailers needed to remove one (1) well volume of water.

   Well Volume Calculations (2-inch well):
   Schedule 40 PVC has an inside diameter of 2.067 inches.
   $\therefore$ ((2.067 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0233 ft^3/ft of water.
   0.0233 ft^3/ft • 7.48 gallons/ft^3 = 0.174 gallon/ft

   Schedule 5 Stainless Steel (304 or 316) has an ID of 2.245 inches.
   $\therefore$ ((2.245 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0275 ft^3/ft of water.
   0.0275 ft^3/ft • 7.48 gallons/ft^3 = 0.206 gallon/ft

   Volume of well (in gallons) = well type gallon/ft • (DTB - DTW)
   Where DTB ≡ depth to bottom of well (from measuring point), and
   DTW ≡ depth to water (from measuring point)

   Bailer Volumes: Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer has a volume of approximately 1085 cc or 0.287 gallon.

2. Open well, being careful that no potential contaminant enters the well.
3. Remove one (1) bailer volume of water from the well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)
4. Remove one (1) well volume of water from the well. Test pH, specific conductance and temperature. Note values on worksheet.
5. Remove 0.5 to 1.0 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.
6. Repeat Number 5 until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.
7. If the well becomes dry, or there is insufficient water to obtain all necessary samples, the well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.
8. If there is sufficient water volume in the well to obtain all samples, sample collection shall begin at this time.

D.8. Sample Collection Order

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination. Since there are no known contaminants on-site, the progression shall be from upgradient wells to downgradient wells.

D.9. Field Measurements

D.9.1 General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: Any observers shall need at a minimum, the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liquinox®, or equivalent), and thoroughly rinsed in DeCon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

D.9.2 Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer, wait until the thermometer has stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1.0°F). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1°F). The thermometer or probe shall be cleaned and rinsed with DeCon water after use.

D.9.3 pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with DeCon water. Obtain a sample from the well, and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

D.9.4 Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with DeCon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest µmhos/cm or µS/cm.

D.10. Sample Collection Procedures

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

a. Metals and Minerals (totals)
b. Anions (totals)
c. Cyanides
d. Metals and Minerals (dissolved)
e. Anions (dissolved)
f. Alkalinity
g. Chemical Oxygen Demand (COD)
h. Phenolics (total recoverable)
i. Oil & Grease

Not all samples will necessarily be required on each sampling trip, but those not sampled should be skipped. The order should remain consistent.

D.10.1 Filtered Samples

Dissolved parameters include dissolved metals and minerals, dissolved dissolved solids (TDS), and nitrogen. Samples may be filtered using a 0.45-micron filter attached to the pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water. Bottles should be filled in a manner consistent with the SVOCs subsection.

D.10.2 Special Handling

Some of the samples require additional handling or preservation techniques.

1. Metals and minerals (total and dissolved) shall be acidified to a pH of less than two by addition of nitric acid (HNO_3).
2. Oils & grease, Phenolics, TOC, TOX, and ammonia samples must be acidified by the addition of sulfuric acid (H_2SO_4).
3. Cyanides samples must be preserved in an alkaline environment by addition of sodium hydroxide (NaOH).
4. All samples should be stored and shipped in a manner to maintain the samples at a temperature of 4° ±2° C (39° ±3.6 F).

Appendix

Appendix E – Private Water Well Data

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 14

MAY 0 4 2021

INDIANA OFFICE OF ENVIRONMENTAL ADJUDICATION

Mary Davidsen
Chief Environmental Law Judge

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STATE OF INDIANA)
) BEFORE THE INDIANA OFFICE OF ENVIRONMENTAL ADJUDICATION
COUNTY OF MARION)

IN THE MATTER OF:

OBJECTION TO THE ISSUANCE OF PARTIAL
APPROVAL OF CLOSURE/POST CLOSURE PLAN
DUKE GALLAGHER GENERATING STATION
ASH POND SYSTEM
DUKE ENERGY INDIANA LLC
FLOYD COUNTY, INDIANA

CAUSE NO. 20-S-J-5095

Hoosier Environmental Council
Petitioner
Duke Energy Indiana LLC
Permittee/Respondent
Indiana Department of Environmental Management
Respondent

FINDINGS OF FACT, CONCLUSIONS OF LAW AND FINAL ORDER

The parties filed motions for summary judgment. The presiding Environmental Law Judge (the ELJ), having read the motions, responses and replies and examined the evidence, now enters the following findings of fact, conclusions of law and order:

Findings of Fact

1. Gallagher Generating Station (Gallagher Station or Station) is a two-unit coal-fired power plant located in Floyd County, New Albany, Indiana. There are two active units, Units 2 and 4, that began operating in 1958 and 1961, respectively. There are also two retired units, Units 1 and 3. The station is located along the west bank of the Ohio River and across from Louisville, Kentucky.

2. Duke Energy Indiana LLC (Duke or Duke Energy) submitted its closure/post closure application for the coal combustion residuals (CCR) ponds in December 2016.

3. The Indiana Department of Environmental Management's (IDEM) review process for the Closure Plan took more than three years to complete and involved more than a dozen agency subject matter experts. IDEM issued several detailed "Requests for Additional

Information," and Duke Energy filed its responses. There were a number of technical meetings between IDEM and Duke Energy. And IDEM solicited public comments on the Closure Plan, received comments from several third-party environmental interest groups, including Petitioner, and responded to all comments on the Closure Plan.

4. On December 10, 2019, the Indiana Department of Environmental Management (IDEM) issued the Partial Approval of the Closure/Post Closure Plan (the Partial Approval) to Duke Energy Indiana LLC (Permittee or Duke) for the Ash Pond System at the Gallagher Generating Station. The ash ponds subject to this Approval, are the North Ash Pond, Primary Pond Ash Fill Area, Ash Pond A, Secondary Settling Pond, and Coal Pile Ash Fill Area.

5. The Station has two other ash ponds, the Primary Pond and Ash Pond B. The Primary Pond has not received closure approval. The Primary Pond contained both CCR and liquid until at least October 19, 2015. It was identified as a separate water treatment unit in the Station's NPDES permit.

6. The closure plan for Ash Pond B was approved in the Restricted Waste Site Type I facility (Solid Waste Program ID 22-01) minor modification dated November 1, 2016. Neither the Primary Pond nor Ash Pond B are at issue in this litigation.

7. The Approval authorizes the closure of surface impoundments containing CCR as follows:

   a. North Ash Pond - closure in place and is subject to 329 IAC 10-3-1(9).
   b. Primary Pond Ash Fill Area - closure in place and is subject to 329 IAC 10-3-1(9).
   c. Ash Pond A - closure by removal of CCR material and one additional foot of underlying soil. This pond is subject to 329 IAC 10-3-1(9) and 329 IAC 10-9-1(c) with 40 CFR 257.
   d. Secondary Settling Pond - closure in place with removal of only CCR material. This pond is subject to 329 IAC 10-3-1(9) and 329 IAC 10-9-1(c) with 40 CFR 257.
   e. Coal Pile Ash Fill Area -- closure by removal of CCR material and one additional foot of underlying soil. This pond is subject to 329 IAC 10-3-1(9). Upon removal of CCR material and one foot of underlying soil, this pond will be re-purposed to serve as a geomembrane lined (non-CCR) pond to store leachate and industrial storm water from the permitted Restricted Waste Site (RWS) Type 1 landfill and other runoff from the Gallagher Station.

8. Petitioner, Hoosier Environmental Council (Petitioner or HEC), filed its Petition for Administrative Review on January 27, 2020[1]. Petitioner has challenged the closures of

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[1] On May 5, 2020, the presiding ELJ issued Findings of Fact, Conclusions of Law and Order denying Duke's Motion to Dismiss, finding that Petitioner had timely filed its petition for review.

five of the former ash ponds in this litigation – Ash Pond A, the Secondary Settling Pond, the Coal Pile Ash Fill, the North Ash Pond, and the Primary Pond Ash Fill.

9. HEC filed its Amended Petition for Administrative Review on March 6, 2020 and alleges that the Approval violates the following regulations: 329 IAC 10-30-1; 40 CFR 257.102 and 329 IAC 10-9-1; CCR Rule at 40 CFR 257 Subpart D; 40 CFR 257.101; 329 IAC 10-3-1(9); and I.C. § 13-30-2-1(1).

10. HEC requests the following relief[2]:

    a. complete excavation of all CCR in the Ash Pond System at the Gallagher facility including CCR in the North Ash Pond, Ash Pond A, Primary Pond, Primary Pond Ash Fill, and Coal Pile Ash Fill; and
    b. proper disposal of this CCR in a safe, dry CCR landfill that complies with the construction and siting requirements for new CCR landfills found in 40 CFR 257 Subpart D and is at least as protective as the CCR excavation and management activities being undertaken by Duke Energy at its CCR facilities in North Carolina.

11. IDEM determined that Ash Pond A and the Secondary Settling Pond are governed by, and must be closed pursuant to, the Federal CCR Rule requirements at 40 C.F.R. § 257, subpart D[3] (hereafter referred to as the Federal CCR Rule). IDEM determined that the Coal Pile Ash Fill, the North Ash Pond, and the Primary Pond Ash Fill are not subject to the regulations set forth in the Federal CCR Rule but are subject to 329 IAC 10-3-1(9).

12. Between approximately 1958 until 1987, coal ash was sluiced to an unlined area called the Original Ash Pond. Duke stopped using this area in approximately 1987 and covered it with approximately six (6) inches of soil and seeded it. The Primary Pond was formed within the footprint of the Original Ash Pond. The North Ash Pond and the Primary Pond Ash Fill Area are also located in the footprint of the Original Ash Pond. The bottom elevation of North Ash Pond and Primary Pond Ash Fill lie beneath the elevation of groundwater. No CCR was excavated from the Original Ash Pond. There are no underground barriers between these 3 ponds in the Original Ash Pond. No portion of the Original Ash Pond is lined.

13. The Station is located within the 1% annual chance flood area (commonly referred to as 100-year flood).

14. Ash Pond A:

    a. In approximately 1973, the Station constructed Ash Pond A, an area of about 36 acres, and began operating the impoundment to provide ash management and water

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[2] Amended Petition for Administrative Review, filed March 6, 2020, pg. 7.

[3] 40 C.F.R. Part 257, subpart D (Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,301 (April 17, 2015)).

treatment needed for Station operation. Ash Pond A ceased receiving sluiced ash for initial settling in the pond around November 15, 2020.

b. After 2016, the decant water from Ash Pond A was eventually discharged directly to the Ohio River through the Station's National Pollutant Discharge Elimination System (NPDES) permitted outfall.
c. Groundwater beneath Ash Pond A generally flows east toward the Ohio River.
d. To date, Ash Pond A has not been dewatered. Therefore, it still has significant hydraulic head pressure.
e. The CCR material and one foot of underlying soil will be excavated. Closure must be conducted in accordance with to 329 IAC 10-3-1(9) and 329 IAC 10-9-1(c) with 40 CFR 257, including 18 inches of soil cover and 6 inches of vegetative cover.
f. CCR excavated from Ash Pond A may be used as structural fill for the subgrade of the engineered cover system at the North Ash Pond and the Primary Pond Ash Fill.

15. Secondary Settling Pond:

a. The Secondary Settling Pond, an area of approximately 4 acres, was constructed and began operating as an ash management and water treatment unit in approximately 1973. The Secondary Settling Pond received decant water from Ash Pond A so that additional settling of ash could occur. The decant water from the Secondary Settling Pond was discharged to the Ohio River in accordance with applicable laws.
b. Groundwater beneath the Secondary Settling Pond generally flows northeast toward the Ohio River.
c. CCR from the Secondary Settling Pond was completely excavated in 2016.
d. This pond will be closed in place with removal of only CCR material. This pond is subject to 329 IAC 10-3-1(9) and 329 IAC 10-9-1(c) with 40 CFR 257.
e. The cover components include:
    - Compacted soil structural fill
    - 18 inches of compacted soil layer with a hydraulic conductivity of not greater than 1x10-5 centimeter/second
    - 6 inches of vegetative cover

16. Primary Pond Ash Fill:

a. The Primary Pond Ash Fill occupies approximately 7.5 acres within the footprint of the Original Ash Pond. It was dewatered in approximately 1987 as part of the Original Ash Pond. It ceased being a water treatment unit at that time. No CCR was placed in this pond after 1987. Later, some of the CCR that was excavated from the construction of the Primary Pond (discussed above) was also placed on top of the Primary Pond Ash Fill.
b. Following the construction of the Primary Pond, the surface of the Primary Pond Ash Fill was covered with a soil veneer, vegetated, and maintained in its current condition.
c. There are perimeter roads around the Primary Pond Ash Fill.
d. The average groundwater elevation beneath the Primary Pond Ash Fill is presently at approximately 435 ft. The base of the ash in the Primary Pond Ash Fill is at an elevation of approximately 413 ft. Therefore, under current conditions, groundwater,

in general terms, flows laterally east toward the Ohio River and is in contact with the ash at the bottom of the Primary Pond Ash Fill as the groundwater proceeds through the site.

e. This pond will be closed in place, subject to 329 IAC 10-3-1(9).

f. The final cover system must include:
  - 30 -mil PVC or 40 -mil LLDPE or 60 -mil HDPE geomembrane liner or equivalent installed over structural fill
  - Geotextile cushion or geocomposite drainage layer
  - 30 inches of uncompacted cover soil
  - 6 inches of vegetative cover

17. North Ash Pond:

g. In 1987, the approximately 40-acre area of the Original Ash Pond to the north of the Primary Pond (called the "North Ash Pond") was dewatered and a soil veneer and vegetation was placed over it. It ceased being a water treatment unit at that time. No CCR was placed in this pond after 1987. Over the last 30 years, this former ash pond area has often been used as a construction lay down area, and it is crossed by multiple active transmission lines and other utility infrastructure. There are perimeter roads around the North Ash Pond.

h. The average groundwater elevation for the majority of the area beneath the North Ash Pond is presently at approximately 437 ft. The base of the ash at the bottom of the North Ash Pond is at an approximate elevation of 413 ft. Therefore, groundwater, in general, flows laterally toward the Ohio River and is in contact with the ash at the bottom of the North Ash Pond as the groundwater proceeds through the site.

i. This pond will be closed in place, subject to 329 IAC 10-3-1(9).

j. The final cover system must include:
  - 30 -mil PVC or 40 -mil LLDPE or 60 -mil HDPE geomembrane liner or equivalent installed over structural fill
  - Geotextile cushion or geocomposite drainage layer
  - 30 inches of uncompacted cover soil
  - 6 inches of vegetative cover

18. Coal Pile Ash Fill:

a. The former Coal Pile Ash Fill was constructed in 2001 and is located in the southern half of the original limits of the Station's coal pile. At that time, an embankment was constructed to isolate an approximately 11-acre area from the active coal pile on the north. The Coal Pile Ash Fill was filled with ash excavated from other on-site ash ponds. The area was then covered with soil and vegetated, and generally utilized as a construction lay-down area.

b. Groundwater beneath the Coal Pile Ash Fill generally flows east toward the Ohio River.

c. CCR from the Coal Pile Ash Fill was excavated in 2020.

d. This will be closed by removal of CCR material and one additional foot of underlying soil. This pond is subject to 329 IAC 10-3-1(9). Upon removal of CCR material and one foot of underlying soil, this pond will be re-purposed to serve as a geomembrane lined (non-CCR) pond to store leachate and industrial storm water from the permitted Restricted Waste Site (RWS) Type 1 landfill and other runoff from the Gallagher Station.

19. The Approval authorizes the use of CCR material from Ash Pond A as structural fill for the subgrade for the engineered cover system involving the closure of the North Ash Pond and the Primary Pond Ash Fill. This structural fill will be used to provide proper drainage for the cover system. The ash to be used as structural fill will have at least 10 – 43 feet of separation from groundwater.

20. There is an extensive network of groundwater monitoring wells that have been sampled over the years to identify any potential groundwater impacts involving the Station's current and decommissioned ash ponds as well as the Station's Landfill.

21. As part of the development and implementation of the Closure Plan, Duke Energy has been submitting monitoring well sampling data to IDEM since 2017. In accordance with Section D.23 of the Closure Plan, Duke Energy continues to conduct semi-annual groundwater sampling and submits that data to IDEM.

22. Duke Energy is required to follow the standard practices for well installation for the monitoring well networks, which are set forth in 329 IAC 10-21-4 and 312 IAC 13. As noted in Section D.3 of the Closure Plan, the location of the Station's groundwater monitoring well system was analyzed during IDEM's review of the Closure Plan application and approved as part of the Closure Plan.

23. Groundwater sampling events for the ash impoundments at Gallagher Station were conducted in accordance with the Station's Sampling and Analysis Plan for the Station's approved on-site restricted waste site ("RWS") Type I Landfill (SW ID 22-01), ensuring that high quality data was collected for evaluation, until IDEM approved the Sampling and Analysis Plan for the Station's Ash Pond System on June 30, 2020, in accordance with Section F.1 of the Closure Plan.

24. Pursuant to Section F.3 of the Closure Plan, IDEM approved the Statistical Evaluation Plan for the Station's Ash Pond System on June 11, 2020.

25. Section D.3 of the Closure Plan outlines the requirements for the monitoring well system and the changes that will be made to the current monitoring well system due to construction activities.

26. In accordance with the Closure Plan, Duke Energy submitted its Monitoring Well Installation Work Plan to IDEM on June 5, 2020, which contained industry standard practices consistent with 329 IAC 10-21-4 and 312 IAC 13 for the method of well installation. This Monitoring Well Plan sets out the location for the installation of the remaining five (5) monitoring wells that will be installed after closure activities are completed. IDEM approved this Monitoring Well Work Plan on August 14, 2020.

27. Pursuant to 329 IAC 10-15-5(7), wells must have a well spacing of (500) feet.

28. 329 IAC 10-24-4 requires a minimum number of monitoring wells based on the acreage of the units being assessed. In this case, pursuant to Section D.3 of the Closure Plan, Gallagher Station's final, post-closure monitoring well system related to the ponds at issue has approximately 26 monitoring devices compared to the minimum of approximately 17 monitoring devices required by this regulation.

29. In mid-2020, Duke Energy also installed Monitoring Wells T-1 and T-2, which are being added to the Station's Monitoring Well Network. According to Duke Energy, MWs T-1 and T-2 were installed so that Duke Energy could better understand the groundwater quality at Gallagher Station, particularly the groundwater quality downgradient from the former North Ash Pond near where such groundwater interfaces with the Ohio River.

30. To date, the sampling results from MWs T-1 and T-2 have not exceeded any drinking water standards ("Maximum Contaminant Levels" or "MCLs") or other enforceable health-based standards.

31. The Station has used, and continues to use, an on-site groundwater well screened in the sand and gravel aquifer on the eastern portion of the Site (near the Ohio River) to supply its drinking water. To date, the sampling results from this drinking water well have not exceeded any MCL or health-based standards.

32. The Closure Plan imposes requirements regarding the construction of an engineered cover system that exceeds all state and federal requirements for the reduction of infiltration from surface water that could come into contact with ash under the closure cap. This advanced geomembrane cover system will result in a highly effective 99.8% reduction of surface water infiltration into the ash pond after closure. This 99.8% reduction of surface water infiltration (amounting to a reduction of 774 million gallons over the monitoring period) is, by design, a post-closure leachate control mechanism.

33. Section D of the Closure Plan requires Duke Energy to implement and operate an extensive post-closure monitoring network to conduct groundwater sampling for at least 30 years after the closure work is completed. If post-closure monitoring identifies any defined groundwater exceedances, then Duke Energy must conduct assessment monitoring and, if applicable, conduct corrective action in accordance with regulatory requirements. This is another mechanism to control post-closure leachate.

34. Section C.3 of the Closure Plan requires Duke Energy to correct and control any post-closure nuisance conditions, eliminate any threat to human health and the environment, and perform all appropriate remedial action. This Closure Plan provision imposes requirements to further "control" any post-closure leachate when warranted.

35. Section C.2 of Closure Plan provides that in order for Duke Energy "to be released from its post-closure monitoring requirements, the owner or operator must submit a post-

closure certification statement signed by both the owner/operator and a registered professional engineer stating that the post-closure care requirements have been met and the surface impoundments are stabilized." IDEM must review the post-closure certification, and if it is found to be deficient, require Duke Energy to address those deficiencies including but not limited to any additional monitoring beyond the 30 years already required by the Closure Plan.

36. Duke Energy Indiana LLC filed a Motion for Summary Judgment on January 29, 2021. The Indiana Department of Environmental Management (IDEM) filed its Concurrence on January 29, 2021. Petitioner filed its Motion for Summary Judgement and Brief of Hoosier Environmental Council in Response to the Motion of Duke Energy Corp. and Indiana Department of Environmental Management for Summary Judgment and In Support of Hoosier Environmental Council's Motion for Summary Judgment on March 1, 2021. Duke filed its Reply Duke Energy's Reply Brief in Support of Its Motion for Summary Judgment and Response in Opposition to HEC's Cross Motion for Summary Judgment on March 15, 2021. IDEM filed its Concurrence with Duke Energy's Reply in Support of Its Motion for Summary Judgment and Response in Opposition to HEC's Cross Motion for Summary Judgment on March 15, 2021. HEC filed its Reply in Support of Its Cross Motion for Summary Judgment on March 30, 2021. Oral argument was held on April 6, 2021.

Conclusions of Law

1. The Office of Environmental Adjudication ("OEA") has jurisdiction over the decisions of the Commissioner of the Indiana Department of Environmental Management ("IDEM") and the parties to this controversy pursuant to Ind. Code § 4-21.5-7, et seq.

2. Findings of Fact that may be construed as Conclusions of Law and Conclusions of Law that may be construed as Findings of Fact are so deemed.

3. This office must apply a *de novo* standard of review to this proceeding when determining the facts at issue. *Indiana Dept. of Natural Resources v. United Refuse Co., Inc.*, 615 N.E.2d 100 (Ind. 1993). Findings of fact must be based exclusively on the evidence presented to the ELJ, and deference to the agency's initial factual determination is not allowed. *Id.;* I.C. 4-21.5-3-27(d). "*De novo* review" means that "all issues are to be determined anew, based solely upon the evidence adduced at that hearing and independent of any previous findings. *Grisell v. Consol. City of Indianapolis*, 425 N.E.2d 247 (Ind. Ct. App. 1981).

4. The OEA and IDEM, as state agencies, only have the authority to take those actions that are granted by the law. "An agency, however, may not by its rules and regulations add to or detract from the law as enacted, nor may it by rule extend its powers beyond those conferred upon it by law." *Lee Alan Bryant Health Care Facilities, Inc. v. Hamilton*, 788 N.E.2d 495, 500 (Ind. Ct. App. 2003). IDEM can only determine whether a permit should be issued by applying the relevant statutes and regulations and may only consider those factors specified in the applicable regulations in deciding whether to issue a permit.

As the ultimate authority for the IDEM, the OEA's authority is limited by statute (I.C. §4-21.5-7-3) to determining whether the IDEM decision complies with the applicable statutes and regulations. OEA is an impartial litigation forum, not a body which formulates or advises as to public policy or regulatory content.

5. The OEA shall consider a motion for summary judgment "as would a court that is considering a motion for summary judgment filed under Trial Rule 56 of the Indiana Rules of Trial Procedure." I.C. § 4-21.5-3-23. Ind. Trial Rule 56 states, "The judgment sought shall be rendered forthwith if the designated evidentiary matter shows that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law."

6. The Indiana Supreme Court in *Hughley v. State*, 15 N.E.3d 1000, 1003-1004 (Ind. 2014) held:

> The initial burden is on the summary-judgment movant to "demonstrate [] the absence of any genuine issue of fact as to a determinative issue," at which point the burden shifts to the non-movant to "come forward with contrary evidence" showing an issue for the trier of fact. *Williams v. Tharp*, 914 N.E.2d 756, 761 (Ind. 2009).
>
> ...
>
> We have therefore cautioned that summary judgment "is not a summary trial," id. (internal quotation marks omitted); and the Court of Appeals has often rightly observed that it "is not appropriate merely because the non-movant appears unlikely to prevail at trial." *Tucher v. Brothers Auto Salvage Yard, Inc.*, 564 N.E.2d 560, 564 (Ind. Ct. App. 1991), trans. denied; see also *LaCava v. LaCava*, 907 N.E.2d 154, 166 n.9 (Ind. Ct. App. 2009) (recognizing that the decedent's "claim should withstand summary judgment" despite counsel's "conce[ssion] . . . that he will be unlikely to prevail" at trial). In essence, Indiana consciously errs on the side of letting marginal cases proceed to trial on the merits, rather than risk short-circuiting meritorious claims.

7. The moving party carries the burden of establishing summary judgment to be appropriate. *Gibson v. Evansville Vanderburgh Building Commission, et al.*, 725 N.E.2d 949 (Ind. Ct. App. 2000). All facts and inferences must be construed, and issues of doubt resolved by the court in the fashion most favorable to the non-moving party. *City of Indianapolis v. Buschman*, 988 N.E.2d 791 (Ind. 2013) see also; *Town of Avon v. W. Cent. Conservancy Dist.*, 957 N.E.2d 598, 602 (Ind. 2011). After the burden of proof regarding summary judgment has been established by the moving party, the burden shifts to the non-moving party to demonstrate through specific evidence that there lies a genuine issue of material fact. *Bushong v. Williamson*, 790 N.E.2d 467, 474 (Ind. 2003). "[I]t is well-settled that speculation may not be used to manufacture a genuine issue of fact." *Amadio v. Ford Motor Co.*, 238 F.3d 919, 927 (7th Cir. 2001); see also *Borcky v. Maytag Corp.*, 248 F.3d 691, 695 (7th Cir. 2001) ("The mere existence of some alleged factual dispute will not defeat an otherwise properly supported motion for summary judgment . . .. Speculation

will not suffice."). Further, "Finally, we note that mere speculation cannot create questions of fact. *Briggs v. Finley*, 631 N.E.2d 959, 964-65 (Ind. Ct. App. 1994). Opinions expressing a mere possibility with regard to a hypothetical situation are insufficient to establish a genuine issue of material fact. Id. Put another way, "guesses, supposition and conjecture are not sufficient to create a genuine issue of material fact to defeat summary judgment." *Midwestern Indem. Co. v. Sys. Builders, Inc.*, 801 N.E.2d 661, 666 (Ind. Ct. App. 2004)." *Beatty v. LaFountaine*, 896 N.E.2d 16, 20 (Ind. Ct. App. 2008) "The law is well settled, neither arguments of counsel nor allegations in memoranda qualify as evidentiary materials for purposes of a motion for summary judgment." *Richards-Wilcox, Inc. v. Cummins*, 700 N.E.2d 496, 499 n.3 (Ind. Ct. App. 1998) (citing *J.A.W. v. Roberts*, 627 N.E.2d 802, 808 (Ind. Ct. App. 1994), rev"d on other grounds).

8. Each party has requested summary judgment in this matter. "The fact that both parties requested summary judgment does not alter our standard of review. Instead, we must separately consider each motion to determine whether there is a genuine issue of material fact and whether the moving party is entitled to judgment as a matter of law. " *Laudig v. Marion County Bd. of Voters Registration*, 585 N.E.2d 700, 703-704, (Ind. Ct. App. 1992) see also; *Five Star Concrete, L.L.C. v. Klink, Inc.*, 693 N.E.2d 583, 585 (Ind. Ct. App. 1998).

9. If a court determines that the statute or rule is ambiguous, it may look to the agency's interpretation for evidence of the legislative intent. The Indiana Supreme Court, in *Shell Oil v. Meyer*, 705 N.E.2d 962, 976 (Ind. 1998) held, "However, administrative interpretation may provide a guide to legislative intent. "A long adhered to administrative interpretation dating from the legislative enactment, with no subsequent change having been made in the statute involved, raises a presumption of legislative acquiescence which is strongly persuasive upon the courts." *Board of Sch. Trustees v. Marion Teachers Ass'n,* 530 N.E.2d 309, 311 (Ind. Ct. App. 1988); accord *Baker v. Compton*, 247 Ind. 39, 42, 211 N.E.2d 162, 164 (1965)."

10. The Approval was issued pursuant to 329 IAC 10-9 and 40 CFR 257, Subpart D as incorporated in 329 IAC 10-9-1(c).

A. Secondary Settling Pond, Coal Pile Ash Fill, Ash Pond A

11. HEC initially challenged the closure plans for the Secondary Settling Pond and the Coal Pile Ash Fill. However, in the summary judgment briefing, HEC conceded that the closure plans for these units was acceptable.[4] HEC does not challenge the closure plan for Ash Pond A but does challenge the use of CCR from Ash Pond A as structural fill for the subgrade of the engineered cover system at the North Ash Pond and the Primary Pond Ash.

12. HEC has not presented any evidence to support its argument that the closure plans for the Secondary Settling Pond and the Coal Pile Ash Fill are deficient. There is no genuine dispute of material fact. Even without HEC's concession that the closure plans are

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[4] Footnote 7, pg. 8, Petitioner's Motion for Summary Judgment.

appropriate, summary judgment in Duke's and IDEM's favor regarding these two ash ponds is appropriate.

13. HEC also has not produced any evidence that the specific closure plan for Ash Pond A is deficient. Therefore, there is no genuine issue of material fact regarding Ash Pond A closure plan and summary judgment in IDEM's and Duke's favor regarding Ash Pond A's closure is appropriate. However, HEC challenges whether the use of CCR from Ash Pond A constitutes a beneficial use.

14. 40 CFR 257.50(g) provides that Subpart D does not apply to practices that meet the definition of a beneficial use of CCR. Pursuant to 40 CFR 257.53, "Beneficial use of CCR" means the CCR meet all of the following conditions:

> (1) The CCR must provide a functional benefit;
> (2) The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction;
> (3) The use of the CCR must meet relevant product specifications, regulatory standards or design standards when available, and when such standards are not available, the CCR is not used in excess quantities; and
> (4) When unencapsulated use of CCR involving placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCR, or that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.

15. HEC argues that this use of CCR constitutes "overfill". Overfill is defined in 40 CFR 257.53 as "a new CCR landfill constructed over a closed CCR surface impoundment."

16. The CCR from Ash Pond A will be used as structural fill for the subgrade of the engineered cover system at the North Ash Pond and the Primary Pond Ash. The North Ash Pond and the Primary Pond Fill Area are not new landfills. These areas have not received CCR since 1987 and are being closed. According to the plain language of 40 CFR 257.53, it is clear that the use of CCR from Ash Pond A for this purpose does not constitute overfill.

17. Further, the CCR removed from Ash Pond A will not be placed so as to come into contact with groundwater. Also, the cap will prevent infiltration of surface water and precipitation into the ash. Petitioners' concerns about the CCR becoming a source of groundwater contamination does not hold up to scrutiny and does not create a genuine issue of material fact.

18. Petitioners also cite to 40 CFR 257.101(a)(1), which states "Except as provided by paragraph (a)(3) of this section, as soon as technically feasible, but not later than April

11, 2021, an owner or operator of an existing unlined CCR surface impoundment must cease placing CCR and non-CCR wastestreams into such CCR surface impoundment and either retrofit or close the CCR unit in accordance with the requirements of § 257.102."

19. This section is not applicable because Duke stopped placing CCR in the North Ash Pond and the Primary Pond Ash Fill in 1987 and is seeking to close these CCR units.

20. There is no genuine issue of material fact in this matter. The closure plans for the Secondary Settling Pond, the Coal Pile Ash Fill and Ash Pond A meet all applicable requirements. Further, there is no genuine issue of material fact that the use of the CCR as subgrade for the cap constitutes a beneficial use. Summary judgment in Duke's and IDEM's favor as to this portion of the Partial Approval is appropriate.

B. North Ash Pond and Primary Ash Fill Pond

1. IDEM was correct in determining that the North Ash Pond and Primary Ash Fill Pond were not subject to the Federal CCR Rule.

21. IDEM has determined that the North Ash Pond and Primary Ash Fill Pond are not subject to the Federal CCR rule, but are governed by, and must be closed pursuant to, IDEM state rules and guidance.

22. There is no question of fact that the North Ash Pond and Primary Ash Fill Pond are distinct ponds separate from the Primary Pond. Neither received CCR or impounded water after 1987.

23. The federal rule applies to:

> (b) This subpart applies to owners and operators of new and existing landfills and surface impoundments, including any lateral expansions of such units that dispose or otherwise engage in solid waste management of CCR generated from the combustion of coal at electric utilities and independent power producers. Unless otherwise provided in this subpart, these requirements also apply to disposal units located off-site of the electric utility or independent power producer. This subpart also applies to any practice that does not meet the definition of a beneficial use of CCR.
>
> (c) This subpart also applies to inactive CCR surface impoundments at active electric utilities or independent power producers, regardless of the fuel currently used at the facility to produce electricity.
>
> 40 CFR 257.50

24. The rule gives the owner or operator of a CCR unit the option of closing in place or removing the CCR. 80 FR 21305.

25. It is clear that groundwater contamination is one of the factors behind the promulgation of this rule. The rule is specifically written to, among other things, address groundwater contamination from the improper management of CCR in landfills. 80 FR 21303. *See also*, the liner design criteria are designed to "help prevent contaminants in CCR from leaching from the CCR unit and contaminating groundwater". 80 FR 21304.

26. Duke contends that North Ash Pond and the Primary Ash Fill Pond are not subject to the Federal CCR Rule because the surface water was drained, and soil and grass were placed on top prior to 1987. HEC contends that they are subject to the rule because the CCR sits in groundwater and is subject to infiltration from the Ohio River.

27. Not all impoundments are regulated by the Federal CCR Rule. Rather, the Federal CCR Rule targets the regulation of only certain types of impoundments.

28. "CCR surface impoundment" or impoundment means a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR. 40 CFR 257.53. In order for a surface impoundment to be subject to the Federal CCR Rule, it must "hold an accumulation of CCR and liquids" as of the Rule's effective date of October 19, 2015. 40 C.F.R. § 257.53 (defining surface impoundment).

29. EPA statements are illustrative of what this phrase means and what impoundments were intended to be regulated under the Federal CCR Rule. For example, EPA indicated that the Federal CCR Rule only targets the regulation of units "that contain a large amount of CCR managed with water, under a hydraulic head, that promotes the rapid leaching of contaminants." 80 Fed. Reg at 21,342.

30. According to the preamble of the Federal CCR Rule, EPA considers surface impoundments that no longer held free liquids and were covered with soil before the Federal CCR Rule's effective date to be initially "closed" and did not require them to "reclose" under the new federal standards. See 80 Fed. Reg. 21,301, 21,343 ("By contrast, a 'closed' surface impoundment would no longer contain water, although it may continue to contain CCR (or other wastes) and would be capped or otherwise maintained."). Further, in the preamble to the Federal CCR Rule, EPA explicitly confirms that, "the final rule does not impose any requirements on any CCR surface impoundments that have in fact 'closed' before the rule's effective date—i.e., those that no longer contain water and can no longer impound liquid." Id.

31. EPA also stated, "CCR surface impoundments that have been dewatered and are no longer able to hold free liquids" and have "a soil, concrete, asphalt, or similar cover" before the Rule's effective date of October 19, 2015, "are not subject to [the Federal] regulations for CCR surface impoundments." See EPA, Vol. 3 (Scope and Purpose, Effective Dates, Applicability, Off-site Disposal & Definitions), Comment Summary and Response Document, at 74 (Dec. 2014) (emphasis added); see also 40 C.F.R. § 257.53.

32. The term "free liquids" is not a new term under RCRA and the Federal CCR Rule. EPA intentionally used the same definition of "free liquids" that is used in EPA's existing hazardous waste rules, such as the commonly used paint filter liquids test (EPA Method 9095B). This is a routine EPA test method for hazardous waste "used to determine the presence of free liquids in a representative sample of waste." EPA Method 9095B, Paint Filter Liquids Test (Rev. 2, Nov. 2004) (emphasis added).

33. EPA states that groundwater, and for that matter, any environmental medium containing contaminants, is not a solid waste in the first place. Therefore, because groundwater is not a solid waste, it is axiomatic that groundwater does not, and cannot, constitute a "free liquid" under RCRA. 40 C.F.R. § 257.53.

34. This legal conclusion is also confirmed by the language in the Federal CCR Rule itself, which defines "groundwater" as "water below the land surface in a zone of saturation." On the other hand, the Federal CCR Rule (like the paint filter liquids test) defines "free liquids" to mean "liquids that readily separate from the solid portion of a waste under ambient temperature and pressure." Id.

35. Consequently, for present purposes, "free liquids" in the Federal CCR Rule consists of the water that separates from sluiced ash and forms the surface water in an ash pond.

36. With respect to the North Ash Pond and Primary Pond Ash Fill, there were not any free liquids present when the Federal CCR Rule became effective. Moreover, there were no liquids or free liquids being "held" in or by those impoundments. The opposite is true, since groundwater at the site laterally flows to the Ohio River. Likewise, those impoundments did not have hydraulic head pressure (since they had been dewatered over thirty years ago).

37. As a result, the closures of the North Ash Pond and Primary Pond Ash Fill are governed by Indiana's established closure regulations; they are not governed by the Federal CCR Rule, which applies to other types of impoundments.

38. HEC attempts to escape this legal conclusion by asserting that: (a) groundwater freely flows underneath the site's impoundments; and (b) because a subsequently re-purposed portion of the Original Ash Pond (the "Primary Pond") is subject to the CCR Rule since it was actively being used in 2015, then the former North Ash Pond and Primary Pond Ash Fill (that were formerly in the footprint of the Original Ash Pond) must also somehow be subject to the Federal CCR Rule. These assertions are legally unavailing because an impoundment's regulatory status over three decades ago is not relevant to determining whether it is currently subject to the Federal CCR Rule. Likewise, EPA rejects any notion that potential groundwater interactions under or between impoundments have any relevance to defining the boundaries of a unit subject to the Federal CCR Rule.

39. As such, IDEM correctly applied its well-established state law regulations and requirements in its evaluation of the proposed Closure Plan for the North Ash Pond and Primary Pond Ash Fill.

40. EPA observed, "As noted, EPA's risk assessment shows that the highest risks are associated with CCR surface impoundments due to the hydraulic head imposed by impounded water. Dewatered CCR surface impoundments will no longer be subjected to hydraulic head so the risk of releases, including the risk that the unit will leach into the groundwater, would be no greater than those from CCR landfills." 80 FR 21342.

41. Inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments. 40 CFR 257.10. The US EPA stated that "the risks associated with inactive CCR surface impoundments do not differ significantly from the risks associated with active CCR surface impoundments; much of the risk from these units is driven by the hydraulic head imposed by impounded units." 80 FR 21342.

42. As defined in 40 CFR 257.53, "Inactive CCR surface impoundment" means a "CCR surface impoundment that no longer receives CCR on or after October 19, 2015 and still contains both CCR and liquids on or after October 19, 2015.

43. EPA explains, ""Inactive" surface impoundments are those that contain both CCR and water, but no longer receive additional wastes. By contrast, a "closed" surface impoundment would no longer contain water, although it may continue to contain CCR (or other wastes) and would be capped or otherwise maintained." 80 FR 21302, 21343.

44. It is clear from the definition; the North Ash Pond and the Primary Ash Fill Pond are not inactive CCR surface impoundments as neither received CCR after 1987 and neither impounded water after this year.

2. <u>IDEM properly applied the requirements of 329 IAC to the North Ash Pond and Primary Fill Ash Pond.</u>

45. 329 IAC 10-3-1 excludes certain solid waste management activities from Article 10. Subsection (9) states that:

> Except as provided in 329 IAC 10-9-1, coal combustion residuals impoundments subject to 40 CFR 257, Subpart D, the operation of surface impoundments; however, the final disposal of solid waste in surface impoundments at the end of their operation is subject to approval by the commissioner except as excluded under subdivisions (8) and (10). The commissioner's approval is based on management practices that are protective of human health and the environment.

46. 329 IAC 10-30-1 requires that the closure of a Restricted Waste Type I or II meet certain performance standards. These standards are:

> (1) minimizes the need for further maintenance;

> (2) controls post-closure escape of waste, waste constituents, leachate, contaminated precipitation, or waste decomposition products to the ground or surface waters or the atmosphere; and
> (3) at a minimum, is in compliance with applicable closure provisions and conditions imposed in the facility permit.

47. HEC alleges that the plans do not meet the standard because the plans do not control post-closure leachate because the groundwater is in contact with the CCR and will become contaminated and flow to the Ohio River.

48. Duke argues that HEC only speculates as to the harm to human health and the environment. OEA has decided frequently that speculation that a permittee will not comply with the terms and conditions of a permit does not provide sufficient basis for the revocation of a permit. OEA presumes that a permittee will comply with the permit. In this case, HEC is not alleging that Duke will not comply with the permit. HEC is alleging that there was not sufficient information available for IDEM to determine that this permit will protect human health and the environment. HEC presents evidence, namely in the form of expert testimony, relating to groundwater sampling done by Duke as the basis for its assertion that the closure is not protective of human health and the environment. The experts presented by HEC, while certainly qualified and credible, did not visit the Station or gather data. Dr. Indra Frank[5] offers her opinion of the deleterious effects of various pollutants associated with CCR. However, she only speculates that certain of these pollutants are present. This is the type of speculation that is insufficient to overcome the evidence provided by Duke regarding the contaminants present at the Station. Likewise, the opinion of Greg Bright[6] is speculative as to whether the groundwater flowing into the Ohio River is contaminated above the applicable standards. Speculation as to the potential to accumulate in sediments and the harm to human health from bioaccumulation in fish is certainly founded in science but if it cannot be traced specifically to the Station, it does not create an issue of fact.

49. Duke asserts that the exceedances in groundwater on site are not indicative of whether the closure plan is protective of human health and the environment because closure is not complete. The true test will be the groundwater levels after the closure (removal of ash and construction of the cap) has been implemented.

50. The Closure Plan incorporates requirements set forth in Indiana's solid waste management regulations related to the in-place closure of Type I and Type II non-municipal solid waste landfills. These provisions include requirements involving the impoundment's engineered cover system, minimum berm elevation, engineering design and stability, drainage, and maintenance.

51. The closure plans for these units require an engineered cover system which will reduce infiltration of surface water. Duke argues that this meets the standard for "control". The

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[5] Dr. Indra Frank, MD, Master of Public Health, Director of Environmental Health and Water Quality, Hoosier Environmental Council.

[6] Greg Bright, Qualified Environmental Professional.

cap is intended to meet requirements of 40 CFR 102(d)(2) by stopping infiltration. There is no genuine issue of material fact that the cap exceeds the standards and will stop infiltration.

52. The closure plans also require post-closure monitoring. If sampling discloses exceedances of groundwater limits, Duke must undertake assessment monitoring and, if necessary, corrective action.
53. In addition to the requirements above, the Closure Plan also imposes ongoing requirements in accordance with 40 C.F.R. § 257.102(d) and 329 IAC 10 to minimize the need for maintenance of the engineered cover system.
54. If monitoring well sampling or other conditions warrant, IDEM can require additional wells to be added to the Monitoring Well Network.
55. The Station's final groundwater monitoring system, as dictated by the Closure Plan and the approved Monitoring Well Work Plan, is consistent with the requirements imposed by 329 IAC 10-15-5(7).

Final Order

IT IS THEREFORE ORDERED, ADJUDGED AND DECREED that no genuine issues of material fact exist, and summary judgment is appropriate. Judgment is entered in favor of Duke Energy Indiana LLC and the Indiana Department of Environmental Management. The Petition for Review is dismissed. All further proceedings are vacated.

You are further notified that pursuant to provisions of I.C. § 4-21.5-7-5, the Office of Environmental Adjudication serves as the ultimate authority in administrative review of decisions of the Commissioner of the Indiana Department of Environmental Management. This is a Final Order subject to Judicial Review consistent with applicable provisions of I.C. § 4-21.5-5, *et seq.* Pursuant to I.C. § 4-21.5-5-5, a Petition for Judicial Review of a Final Order is timely only if filed with a civil court of competent jurisdiction within thirty (30) days after the date this notice is served.

IT IS SO ORDERED this 4th day of May 2021 in Indianapolis, IN.

Hon. Catherine Gibbs
Environmental Law Judge

DISTRIBUTION via email

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Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 15

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R 2020-019
STANDARDS FOR THE DISPOSAL	)	
OF COAL COMBUSTION RESIDUALS	)	(Rulemaking - Water)
IN SURFACE IMPOUNDMENTS:	)	
PROPOSED NEW 35 ILL. ADM.	)	
CODE 845	)	

STATEMENT OF REASONS

NOW COMES the Illinois Environmental Protection Agency ("Illinois EPA"), by and through its counsel, and hereby submits this Statement of Reasons to the Illinois Pollution Control Board ("Board") pursuant to Sections 13, 22, 27 and 28 of the Environmental Protection Act ("Act") (415 ILCS 5/13, 22, 27 and 28) and 35 Ill. Adm. Code 102.202 in support of the attached proposed regulations.

I. INTRODUCTION

The Illinois EPA has developed a rule of general applicability for coal combustion residual ("CCR") surface impoundments at power generating facilities. The proposal contains comprehensive rules for the design, construction, operation, corrective action, closure and post-closure care of surface impoundments containing CCR. CCR is commonly referred to as coal ash, and CCR surface impoundments are commonly referred to as coal ash ponds or coal ash pits. This proposed rule includes groundwater protection standards applicable to each CCR surface impoundment at the waste boundary and requires each owner or operator to monitor groundwater. Illinois EPA's proposed rule will include a permitting program as well as all federal standards for CCR surface impoundments promulgated by the United States Environmental Protection Agency ("USEPA") under the Solid Waste Disposal Act of 1970, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. 6901. In addition, the proposed rules

This Section generally describes the available financial assurance mechanisms and sets forth timeframes within which owners or operators must provide financial assurance. Further, this Section describes instances when owners or operators may use multiple mechanisms for a single CCR surface impoundment or when a single mechanism may be utilized for multiple CCR surface impoundments in Illinois.

Section 845.960: Trust Fund

This Section details the requirements applicable to the use of a Trust Fund for financial assurance pursuant to Subpart I.

Section 845.970: Surety Bond Guaranteeing Payment

This Section details the requirements applicable to the use of a Surety Bond Guaranteeing Payment for financial assurance pursuant to Subpart I.

Section 845.980: Surety Bond Guaranteeing Performance

This Section details the requirements applicable to the use of a Surety Bond Guaranteeing Performance for financial assurance pursuant to Subpart I.

Section 845.990: Letter of Credit

This Section details the requirements applicable to the use of a Letter of Credit for financial assurance pursuant to Subpart I.

V. TECHNICAL FEASIBILITY AND ECONOMIC REASONABLENESS

As mandated by P.A. 101-171, the proposed regulation must be as protective and comprehensive as Subpart D of 40 CFR 257.[4] Since owners and operators of CCR surface impoundments are already subject to 40 CFR 257, many of the technical and economic requirements applicable to owners and operators in the proposed Part 845 are already required

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[4] 415 ILCS 5/22.59(g)(1).

under federal law. For example, both 40 CFR 257 and the proposed Part 845 require groundwater monitoring systems and periodic groundwater monitoring, closure and post-closure care plans, corrective action, if necessary, to achieve groundwater protection standards, design criteria for any newly constructed CCR surface impoundments and the maintenance of publicly available records. The proposed regulation requires the owner or operator of CCR surface impoundments to complete a thorough alternatives analysis for corrective action and closure, the technical feasibility and economical reasonableness of which, will be a facility-specific determination based on multiple factors, including constructability, long and short term effectiveness, reliability and protection of human health and the environment. Therefore, the Illinois EPA believes proposed Part 845 is technically feasible and economically reasonable.

Public Act 101-171 also mandated fees and financial assurance for all CCR surface impoundments regulated by the proposed regulations.[5] Unlike P.A. 101-171, 40 CFR 257 is a self-implementing program. Therefore, documentation to demonstrate compliance are certified by a professional engineer and posted on a public website, relying on citizen lawsuits for enforcement. In contrast, the Illinois EPA, through the mandate of P.A. 101-171, proposes a permitting program administered by the Illinois EPA. As such, the documentation submitted to the Illinois EPA by the owners and operators of CCR surface impoundments is reviewed and approved by Illinois EPA staff during the operation, corrective action, and, if necessary, closure and post-closure care of every CCR surface impoundment in the state. The fees are set in P.A. 101-171, with higher initial fees for CCR surface impoundments that have not completed closure and lower fees for CCR surface impoundments that have completed closure.

In addition to the initial fee, annual fees are required by P.A. 101-171, again with CCR

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[5] 415 ILCS 5/22.59 (f); (g); (j)(1).

surface impoundments that have not completed closure paying a higher annual fee than those that have completed closure. CCR surface impoundments that close with the CCR left in place have a 30-year minimum post-closure care period, which may be longer if the groundwater protection standards that are protective of human health and the environment have not been achieved. However, CCR surface impoundments that close by removing CCR do not have a specified post-closure care period. Once the owner or operator of a CCR surface impoundment that has closed by removing CCR demonstrates that they have achieved the groundwater protection standards, which will assure protection of human health and the environment, annual fees cease, since all work required by the proposed rule will be completed. While the time required to achieve the groundwater protection standards will vary depending on hydrogeologic conditions at each facility, the potentially reduced post-closure care period when closure is by removal of CCR, offsets to some extent the potentially higher costs associated with closure by removal. Because the fee system is designed to support the Illinois EPA's administrative work for the review of documents and permitting associated with CCR surface impoundment operation, corrective action, and, if necessary, closure and post-closure care, the fees are reduced as work progresses and the potential higher costs associated with closing CCR surface impoundments may be offset by a shorter period over which fees are collected, the proposed regulations are economically reasonable.

The financial assurance requirements of P.A. 101-171 also create economic considerations in the proposed regulation that do not exist in 40 CFR 257. Each CCR surface impoundment must have and maintain financial assurance to cover the costs of corrective action, and, if necessary, closure and the post-closure care period. The proposed regulations allow the use of several different financial instruments, or combinations thereof, to provide financial assurance. Because CCR surface impoundments that close with the CCR left in place have a 30-year minimum post-closure care period, financial assurance must necessarily extend at least 30 years past closure. The period for which financial assurance must be maintained is longer if the corrective action to meet groundwater protection standards is still ongoing at the end of the 30-year post-closure care period. However, CCR surface impoundments that close by removing CCR do not have a specified post-closure care period. Once the owner or operator of a CCR surface impoundment that has closed by removing CCR demonstrates that they have achieved the groundwater protection standards, the requirement for financial assurance ends. While the time required to achieve the groundwater protection standards will vary depending on hydrogeologic conditions at each facility, the potentially reduced post-closure care period when closure is by removal of CCR, offsets to some extent the costs associated with maintaining financial assurance. Financial assurance is required to guarantee that in the event of financial default by the owner or operator of a CCR surface impoundment, adequate funds will be available to complete corrective action, and, if necessary, closure and post-closure care, and the burden of those costs do not fall on the State, the local citizenry, or worse, the facilities set derelict for many years. Because financial assurance is designed to guarantee that corrective action, if necessary, closure and post-closure care will be completed in the event of financial default of an owner or operator and the term of financial assurance may be shorter when closure is by removal of CCR, the proposed regulations are economically reasonable.

VI. AFFECTED FACILITIES

Power generating facilities with CCR surface impoundments may be affected by the Illinois EPA's proposed rule. These facilities include:

NAME OF FACILITY	CCR SURFACE IMPOUNDMENTS
Ameren MO /UE	
Venice	2
Ameren Energy Generating	
Hutsonville	5
Meredosia	3
City Water Light and Power	
City Water Light and Power	2
Commercial Liability Partners, LLC	
Wood River Station	4
Grand Tower Energy Center, LLC	
Grand Tower	1
NRG	
Will County Station	4
Waukegan Station	3
Lincoln Stone Quarry	1
Joliet 29	3
Powerton	5
Prairie Power Inc	
Prairie Power	1
Southern Illinois Power Co-op	
Southern Illinois Power Co-op	9
Vistra	
Baldwin Energy Center	4
Coffeen Station	4
Duck Creek Station	5
Edwards Station	1
Havana Station	3
Hennepin Station	6
Joppa Station	2

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 16

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
	)	
STANDARDS FOR THE DISPOSAL OF	)	**R20-19**
COAL COMBUSTION RESIDUALS	)	**(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:	)	
PROPOSED NEW 35 ILL. ADM. CODE 845	)	

Dynegy's First Post-Hearing Comment

NOW COMES Dynegy Midwest Generation, LLC; Electric Energy Inc.; Illinois Power Generating Company; Illinois Power Resources Generating, LLC; and Kincaid Generation, LLC (collectively, "Dynegy") by their attorneys, pursuant to 35 Ill. Adm. Code 102.108 and the Hearing Officer's October 2, 2020 Order, and submits this Prehearing Comment. Dynegy appreciates the Illinois Environmental Protection Agency's ("IEPA" or "Agency") and the Illinois Pollution Control Board's ("Board") careful work in drafting and reviewing proposed Part 845. Dynegy agrees with much of IEPA's proposal, which builds on U.S. EPA's CCR Rule to establish a site-specific approach for closure and corrective action of CCR surface impoundments. This approach will allow owners/operators to develop plans that are best suited to the specific conditions of each site.

Dynegy presented testimony from seven different witnesses in this matter, however, to provide evidence regarding a number of discrete provisions that should be changed to ensure that the Part 845 regulations are supported by the record, technically feasible, and economically reasonable. Dynegy submits this Comment to provide a summary of the key aspects of the proposed Part 845 regulations that it recommends the Board change. First, in Part II, this Comment highlights six key revisions that Dynegy requests. Each of these revisions is intended to ensure the proposal is economically reasonable, technically supported, and protective of

Not only are Dynegy's proposed standards technically supported, more stringent than the CCR Rule, and consistent with IEPA past practice, they are also more economically reasonable than IEPA's proposed standards. As both Cynthia Vodopivec and Dr. Rudy Bonaparte testified, the additional cover materials required by IEPA would cost tens of thousands of dollars per acre, totaling up to \$50-\$100 million for Dynegy's facilities in Illinois. Vodopivec Prefiled Testimony at 18, Hrg. Ex. 21; Bonaparte Prefiled Testimony at 9-13, Hrg. Ex. 31. Further, there may be environmental costs and safety hazards associated with excavating additional materials, transporting them, and placing them on a CCR surface impoundment—including greenhouse gas, particulate matter, and NO_X emissions. *See* Bittner Prefiled Testimony at 22 (Aug. 27, 2020), Hrg. Ex. 37 (noting that increased construction activity results in increased safety and emissions concerns). To avoid these financial, environmental, and safety costs, while continuing to ensure the protectiveness of final cover systems, Dynegy recommends the following revisions to the proposed rule:

> **Section 845.750(c)(1)(A)(i):**
>
> The minimum allowable thickness must be ~~0.91 meter~~ ~~(3 feet)~~18 inches; and . . .
>
> **Section 845.750(c)(2)(B):**
>
> Be at least three feet thick, when used in combination with a low permeability layer meeting the requirements of Section 845.750(c)(1)(A); or 18 inches thick, when used in combination with a low permeability layer meeting the requirements of Section 845.750(c)(1)(B), and must be sufficient to protect the low permeability layer from freezing and minimize root penetration of the low permeability layer.

B. The definition of "inactive CCR surface impoundments" must be corrected to avoid a conflict with the Illinois Legislature's definition of "CCR surface impoundment."

As Dynegy noted in its Prehearing Comment (Sept. 25, 2020), IEPA has created confusion as to whether units that did not contain liquids as of the date the CCR Rule became effective may be regulated under Part 845. Dynegy recommends that the Board resolve this confusion by correcting the definition of "inactive CCR surface impoundment" to match the definition that was used in the CCR Rule.

Copying the CCR Rule, the Illinois Legislature defined "CCR surface impoundment" as a unit "which is designed to hold an accumulation of **CCR and liquids**, and the unit treats, stores, or disposes of CCR." 415 ILCS 5/3.143 (emphasis added). 40 C.F.R. § 257.53. IEPA has stated that only units that meet this definition are subject to Part 845. Transcript 41:24-42:4 (Aug. 11, 2020). In other words, only units that are "designed to hold an accumulation of CCR and liquids" are subject to this rule. But IEPA's proposed definition of "inactive CCR surface impoundment" creates confusion as to whether a unit may be regulated if it does not first meet the definition of "CCR surface impoundment," because it was not "designed to hold . . . liquids." This confusion results from the fact that, while IEPA stated that it "has done its best to mirror the language as much as possible with [Part] 257," it deleted the phrase "and liquids" from the definition of "inactive CCR surface impoundments" that appears in the CCR Rule:

Proposed 845.120	40 C.F.R. 257.53
"'Inactive CCR surface impoundment' means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains **CCR** on or after October 19, 2015 . . . ." (emphasis added)	"Inactive CCR surface impoundment means a CCR surface impoundment that no longer receives CCR on or after October 19, 2015 and still contains **both CCR and liquids** on or after October 19, 2015." (emphasis added)

By altering U.S. EPA's definition, IEPA has created uncertainty as to whether units that were not "designed to hold an accumulation of CCR **and liquids**" as of the date of the CCR Rule can nonetheless be regulated under Part 845 as "inactive CCR surface impoundments." If they can, than IEPA has expanded the scope of Part 845 beyond the CCR Rule, and, more importantly, beyond the statutory mandate, by regulating units that do not fit the legislature's definition of "CCR surface impoundment." As Dynegy's expert Dr. Lisa Bradley has testified, units that contain CCR but do not impound liquid do not pose the type of risks that the CCR Rule sought to mitigate. Bradley Prefiled Testimony at 31, Hrg. Ex. 23.

IEPA has provided only one justification for its change—to ensure that units do not simply de-water, without completing a full closure in accordance with Part 845. Transcript 56:1-17 (Aug. 11, 2020). But that result would not be possible under proposed Part 845. Under the definition of "CCR surface impoundment" that the Illinois legislature adopted, and the permitting program proposed by IEPA, units that begin closure under Part 845 must complete closure and post-closure care. A unit that de-waters, without completing closure, would risk a violation of its Part 845 permits, as well as a number of the substantive provisions of proposed Part 845. Thus, no revision to the definition of "inactive CCR surface impoundment" is required to ameliorate IEPA's purported concern—Part 845 will ensure that closure and post-closure care are completed for all units that are subject to the rule.

Therefore, to avoid confusion and ensure that Part 845 is consistent with the Board's legislative mandate, the Board should revise the definition of "Inactive CCR surface impoundment" to conform Part 845 with the CCR Rule and the definition of "CCR surface impoundment"[4]:

> **Section 845.120:**
>
> "Inactive CCR surface impoundment" means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains both CCR and liquids on or after October 19, 2015 . . . .

---

[4] Additionally, Dynegy supports Ameren's suggestion that Part 845 specifically exclude units that ceased receiving waste before October 21, 1976—the effective date of the Resource Conservation and Recovery Act (RCRA). Prefiled Testimony of Gary King at 21 – 22 (Aug. 27, 2020), Hrg. Ex. 55.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 17

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
)
STANDARDS FOR THE DISPOSAL OF) **R20-19**
COAL COMBUSTION RESIDUALS) **(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:)
PROPOSED NEW 35 ILL. ADM. CODE 845)

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board **Dynegy's Prefiled Testimony**, copies of which are herewith served upon you.

Respectfully submitted,

/s/ Ryan C. Granholm
Ryan C. Granholm

Dated: August 27, 2020

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	**)**	
	)	
	)	
STANDARDS FOR THE DISPOSAL OF	**)**	**R20-19**
COAL COMBUSTION RESIDUALS	**)**	**(Rulemaking – Land)**
IN SURFACE IMPOUNDMENTS:	**)**	
PROPOSED NEW 35 ILL. ADM. CODE 845	**)**	

Dynegy's Prefiled Testimony

1. Prefiled Testimony of Cynthia Vodopivec, Vice President, Environmental Health and Safety, Dynegy Midwest Generation, LLC & IPH, LLC
2. Prefiled Testimony of Lisa Bradley, Ph.D., DABT, Principal Toxicologist, Haley & Aldrich, Inc.
3. Prefiled Testimony of Melinda Hahn, Ph.D, Senior Managing Consultant, Ramboll
4. Prefiled Testimony of David Hagen, Principal Consultant, Haley & Alrich, Inc.
5. Prefiled Testimony of Andrew Bittner, P.E., Principal, Gradient
6. Prefiled Testimony of Mark Rokoff, P.E., Senior Vice President, AECOM
7. Prefiled Testimony of Rudolph Bonaparte, Ph.D, P.E., NAE, Senior Principal, Geosyntec Consultants, Inc.

Respectfully submitted,

/s/ *Ryan C. Granholm*

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Testimony 1:

Cynthia Vodopivec

Dynegy recommends that Part 845 account for the factual and regulatory context—described above—upon which the proposed new rules will be imposed. Specifically, the Board should recognize that many CCR surface impoundments in Illinois are already in the process of, or have already achieved, IEPA-approved closure. Further, under the CCR Rule, all CCR surface impoundments in Illinois are already subject to requirements for groundwater monitoring, assessment of corrective measures, and closure. As explained further in Part V of my testimony and in the testimony provided by Dynegy's experts, Dynegy urges the Board to adhere as closely as possible to the CCR Rule, to avoid creating unnecessary or impracticable requirements and ensure that Part 845 is not only protective of human health and the environment, but also technically feasible and economically reasonable.

IV. The Joppa West Ash Pond is Not a "CCR Surface Impoundment."

Before turning to the specific requirements of IEPA's Part 845 proposal, I will provide one comment regarding the scope of the proposed rule. As explained in greater detail below, in P.A. 101-0171, the Illinois Legislature adopted the exact same definition of "CCR surface impoundment" as used in the federal CCR Rule, clearly intending the scope of the Illinois CCR program to be identical to that of the federal rule. However, applying this definition, IEPA has identified the West Ash Pond at Dynegy's Joppa Steam Generating Plant as being subject to Part 845, despite that unit not being subject to the CCR Rule. IEPA's interpretation is contrary to the statutory language and should be rejected.

As amended by P.A. 101-0171, the Illinois Environmental Protection Act ("Act"), uses the exact same definition of "CCR surface impoundment" as is found in the CCR Rule: "a natural topographic depression, man-made excavation, or diked area, which *is designed to hold an accumulation of CCR and liquids*, and the unit treats, stores, or disposes of CCR." 415 ILCS 5/3.143 (emphasis added); 40 C.F.R. § 257.53 (emphasis added). Crucially, the Illinois

Legislature, like the U.S. EPA, chose to use present tense language—a regulated unit is one that "*is* designed to hold an accumulation of CCR and liquids. . . ." (emphasis added). Therefore, units that were not designed to hold CCR and liquids at the time the definitions were adopted are not regulated.

U.S. EPA explained in the preamble to the CCR Rule that while it chose to regulate "inactive" surface impoundments (those that contain *both* CCR *and* water, but no longer receive CCR), it chose not to regulate "closed" surface impoundments because they are "capped or otherwise maintained" and *no longer contain water*, although they may continue to contain CCR. 80 Fed. Reg. at 21,343. In other words, it chose not to regulate units that were no longer designed to hold an accumulation of liquids. The CCR Rule, U.S. EPA explained, was designed to address units that pose the highest level of risk: "units that contain a large amount of CCR managed with water, under a hydraulic head that promotes the rapid leaching of contaminants." *Id.* at 21,357. Accordingly, U.S. EPA decided not to "impose any requirements on any CCR surface impoundments that have in fact 'closed' before the rule's effective date [October 19, 2015]—i.e., those that no longer contain water and can no longer impound liquid." *Id.* at 21,343. The concept of hydraulic head as the greatest source of risk of contaminant leaching is discussed further in the pre-filed testimony of Dynegy's experts Dr. Lisa Bradley and David Hagen.

Dynegy encourages the Board to adhere to the plain language of the Act, which, in light of the explanation provided in the CCR Rule, establishes that units that were "capped or otherwise maintained" as of the effective date of P.A. 101-0171—*i.e.* those that did not contain water and could no longer impound liquid prior to June 30, 2019—are not subject to Part 845. One such unit—the only unit of this type owned by Dynegy in Illinois—is the West Ash Pond at Dynegy's Joppa Steam Generating Plant, which IEPA has identified as a CCR surface impoundment. This unit has not received new CCR since the 1970s. Dynegy's records show that the unit was closed in the 1970s, at which time it was graded to direct precipitation off of the unit into drainage ditches. Over the decades, this 100 acre unit has accumulated soil and become heavily vegetated. Below are photos of the West Ash Pond as of June 2020, showing the thick vegetation, including large trees with trunk diameters of more than 18 inches.

<u>Photo 1</u>:

Photo 2:

Due to the grading, soil accumulation, and vegetation, the Joppa West Ash Pond was not designed to impound liquids as of the effective date of the CCR Rule (October. 19, 2015), nor was it as of the date that P.A.101-0171 was adopted (July 30, 2019). Therefore, Part 845, like the CCR Rule, does not apply. Because the unit's design was modified so that it is no longer impounding liquids, it is best characterized as "capped or otherwise maintained" as of October 19, 2015—a type of unit that U.S. EPA has acknowledged poses a low risk of leaching contaminants to the environment.

It is unnecessary to regulate the Joppa West Ash Pond under Part 845, particularly because doing so could mean clearing nearly 100 acres of trees and heavy vegetation in order to re-close the unit. Construction could last five years or more, potentially consuming large amounts of diesel fuel for dump trucks and other construction equipment both on and off site. Re-closure would therefore result in no environment benefit, could create adverse environmental effects, and would cost millions of dollars. Other existing regulatory programs, such as the Act's general prohibition against water pollution and the groundwater quality standards provided by 35 Ill. Adm. Code Part 620 are adequate to guard against any residual risks posed by closed units like Joppa West.

V. **IEPA's Part 845 Proposal Significantly Exceeds the Requirements of the CCR Rule, Imposing Unnecessary Costs on Owners and Operators.**

As noted in IEPA's Statement of Reasons, in accordance with Public Act 101-0171, one of the Agency's purposes in proposing Part 845 was to "adopt the federal CCR rules in Illinois and obtain federal approval of Illinois' CCR surface impoundment program." R20-19, IEPA's Statement of Reasons at 10 (Mar. 30, 2020). In order to gain federal approval, Part 845 must be "at least as stringent" as the federal rules. *Id.* at 6 (citing the Water Infrastructure Improvements for the Nation Act, P.L. No 114-322, 42 U.S.C. § 6945(d)(1)(B)).

Dynegy supports IEPA's goal of obtaining federal approval for Part 845 under the WIIN Act. But, as outlined below (and in the testimony of Dynegy's expert witnesses), rather than merely "adopt[ing] the federal rules in Illinois" IEPA's proposal adds myriad new requirements, making Part 845 *substantially* and *unnecessarily* more restrictive than the CCR Rule. In fact, Attachment A to my testimony identifies at least 29 ways in which the requirements of Part 845 exceed those of the CCR Rule, a number of which are outlined further below. These additional requirements could carry significant costs for owners and operators of CCR surface impoundments. The Board should therefore accept the more restrictive requirements that IEPA has proposed *only* where clear evidence has been presented that such requirements will lead to meaningful environmental benefits. With this framework in mind, Dynegy recommends a number of revisions designed to reduce unnecessary costs and the compliance burden associated with IEPA's proposal, without compromising its protectiveness.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 18

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
) No. R20-19
) (Rulemaking-Land)
Standards for the Disposal)
of Coal Combustion)
Residuals in Surface)
Impoundments: Proposed new)
35 Ill. Adm. Code 845)

REPORT OF THE PROCEEDINGS held in the above entitled cause before Hearing Officer Vanessa Horton, called by the Illinois Pollution Control Board, taken by Steven Brickey, CSR, RMR, for the State of Illinois, 1021 North Grand Avenue East, Springfield, Illinois, on the 11th day of August, 2020, commencing at the hour of 9:03 a.m.

MR. BONEBRAKE: In the units -- CCR units that are subject to the requirements of proposed Part 845, are they identified in Subsection's B and C of 845.100?

MR. DUNAWAY: Lynn Dunaway. Those CCR surface impoundments are identified in 100(b), (C) and (D).

MR. BONEBRAKE: I'm sorry. Did you say (D) as well?

MR. DUNAWAY: Yes.

MR. BONEBRAKE: Okay. Thank you. Are there any CCR units other than those identified in Subsection's B, C and D of 845.100 that would be subject to any requirement under Part 845 as proposed?

MR. DUNAWAY: Lynn Dunaway. No.

MR. BONEBRAKE: Let's move first to Subsection B. Subsection B refers to new and existing CCR surface impoundments. Subsection C refers to inactive CCR surface impoundments and Subsection D refers to inactive CCR surface impoundments.

So all three subsections refer to CCR surface impoundments. So is it correct

MR. BONEBRAKE: So is it correct that the Illinois CCR Act in proposed Part 845 defines CCR surface impoundment in identical ways?

MR. DUNAWAY: Lynn Dunaway. Yes.

MR. BONEBRAKE: And you are familiar with the federal CCR rule Part 257, which is the driver for this rulemaking and is it correct that that Part 257 also defines the term CCR surface impoundment?

MR. DUNAWAY: Lynn Dunaway. Yes.

MR. BONEBRAKE: And does Part 257 define surface impoundment in a manner identical to the definition included in proposed Part 845, Section 120?

MR. DUNAWAY: Lynn Dunaway. Yes.

MR. BONEBRAKE: So is it IEPA's intent that its proposed Part 845 rules, like the Illinois CCR Act, will define CCR surface impoundments all in the same way?

MR. DUNAWAY: Lynn Dunaway. All CCR surface impoundments will be defined the same way.

MR. BONEBRAKE: And is it also correct then that IEPA's view is that the federal rules in Part 257 and the proposed state rules in

Part 845 will apply to the same CCR surface impoundments?

MR. DUNAWAY: Lynn Dunaway. Section 22.59 of the act identifies two types of CCR surface impoundments and those are existing and those are new ones. Existing ones under 22.59 of the act is any CCR surface impoundment created after the executive date of the act and new ones are any created after the --

THE COURT REPORTER: Created what?

HEARING OFFICER HORTON: Would you repeat that, just the last part. Create what?

MR. DUNAWAY: New -- new CCR surface impoundments or any CCR surface impoundment created after the executive date of 22.59 of the act.

MR. BONEBRAKE: I think my question was a little different in that my question was is Part 845 intended to apply to the same ponds that are subject to requirements under Part 257 given that they both define CCR surface impoundments in an identical fashion?

MR. DUNAWAY: Lynn Dunaway. In the Agency's opinion, they will be the same ones.

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 19

ILLINOIS POLLUTION CONTROL BOARD
February 4, 2021

IN THE MATTER OF:	)	
	)	
STANDARDS FOR THE DISPOSAL OF	)	R20-19
COAL COMBUSTION RESIDUALS IN	)	(Rulemaking - Land)
SURFACE IMPOUNDMENTS: PROPOSED	)	
NEW 35 ILL. ADM. CODE 845	)	

Proposed Rule. Second Notice.

OPINION AND ORDER OF THE BOARD (by B.F. Currie):

On March 30, 2020, the Illinois Environmental Protection Agency (IEPA or Agency) proposed that the Board adopt new rules entitled "Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments." On final adoption, the new rules will govern the disposal of coal combustion residual or "CCR," commonly called "coal ash," which is generated by coal-fired power plants. These rules—to be housed in new Part 845 of the Illinois Administrative Code's Title 35—will establish a comprehensive State permitting program to regulate all aspects of CCR surface impoundments, including location, design, construction, operation, closure, post-closure, financial assurance, and remediation. Among the program's primary goals is protecting groundwater from contamination by CCR pollutants leaking from surface impoundments. The Board today proposes the rules for second-notice review by the Joint Committee on Administrative Rules (JCAR).

In 2019, the General Assembly passed and Governor JB Pritzker signed into law Public Act 101-171, the Coal Ash Pollution Prevention Act, which directly addressed CCR surface impoundments. The legislation added Section 22.59 to the Illinois Environmental Protection Act (Act), 415 ILCS 5/22.59, mandating this rulemaking. In Section 22.59, the General Assembly found that "CCR generated by the electric generating industry has caused groundwater contamination and other forms of pollution at active and inactive plants throughout this State" and that "environmental laws should be supplemented to ensure consistent, responsible regulation of all existing CCR surface impoundments." 415 ILCS 22.59(a)(3), (a)(4). The General Assembly additionally found that:

> Meaningful participation of State residents, especially vulnerable populations who may be affected by regulatory actions, is critical to ensure that environmental justice considerations are incorporated in the development of, decision-making related to, and implementation of environmental laws and rulemaking that protects and improves the well-being of communities in this State that bear disproportionate burdens imposed by environmental pollution. 415 ILCS 5/22.59(a)(5).

To aid in addressing these concerns, Section 22.59 requires that IEPA propose and the Board adopt new rules on CCR surface impoundments. 415 ILCS 5/22.59(g). Under Section 22.59,

> "De minimis unit" means any surface impoundment, including but not limited to process water or cooling water ponds, that only received CCR incidentally and does not contain an amount of CCR and liquid presenting a reasonable probability of adverse effects on human health or the environment. De minimis surface impoundments are not CCR surface impoundments. PC 126 at 16.

IEPA objects to this proposed definition, rejecting Dynegy's contention that USEPA's risk assessment makes an exemption for de minimis units. PC 129 at 5. Noting that Part 257 does not define "de minimis," IEPA says, "USEPA has made no determinations whether any surface impoundment contains only de-minimis amounts of CCR." *Id.* This is problematic, argues IEPA, as creating a definition has the potential for making proposed Part 845 less protective than the federal rule: "Any definition of de-minimis has the potential of being less protective or comprehensive, because USEPA has failed to define the meaning of de-minimis and does not currently operate a permit program, pursuant to which determinations of de-minimis might be made." *Id.*

If the Board decides to add a "de minimis unit" definition, IEPA suggests following the standard of no "reasonable probability of adverse effects" found in RCRA. PC 129 at 5. In addition, IEPA explains that past operational practices must be considered in determining whether a unit is de minimis. *Id.* at 6. IEPA opposes any definition of de minimis unit that "requires the CCR present to be 'incidental' since how the CCR came to be present in the impoundment is insignificant compared to the fact that the CCR is there." *Id.* IEPA therefore proposes the following alternative definition:

> "De minimis unit" means any surface impoundment, including, but not limited to process water or cooling water ponds, which has not in the past and does not currently contain an amount of CCR presenting a reasonable probability of adverse effects on human health or the environment as determined by the Agency. De minimis surface impoundments are not CCR surface impoundments. *Id.* at 7.

Board Findings. The Board shares IEPA's concerns about a "de minimis" definition. As USEPA uses no definition, the Board agrees that not creating a new definition for these rules would be more protective of human health and the environment. Regulatory relief mechanisms are available to owners and operators when they disagree with an IEPA determination concerning whether a unit is a CCR surface impoundment. In those instances, an owner or operator may seek an adjusted standard or a variance from the Board. Although the unit may contain a minimal amount of CCR, it is still the duty of IEPA and the Board to protect the environment and human health from CCR's deleterious effects. In addition, IEPA has asserted that it will consider past operational practices of facilities in determining whether the unit can be considered a CCR surface impoundment:

> The Agency does believe that past operational practices should have a bearing on whether an impoundment can be considered de-minimis. If an impoundment was operated for decades with a significant amount of CCR present, and then most of the CCR was removed so that currently there is truly de-minimis amount of CCR

> present, the impacts of past operations, especially in unlined impoundments, is consequential. PC 129 at 6.

The Board agrees that adding a definition for "de minimis unit" would risk making Illinois' rules less comprehensive than USEPA's and leaving genuine environmental concerns unaddressed and therefore denies Dynegy's request.

Changing the Definition of "Inactive CCR Surface Impoundment." Dynegy proposes changes to the definition of "inactive CCR surface impoundment": "'Inactive surface impoundment' means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains both CCR and liquids on or after October 19, 2015…" PC 126 at 9. PC 126 at 7. The definition in proposed Section 845.120 differs from the federal definition in 40 C.F.R. 257.53 by omitting the reference to containing "CCR and liquids." *Id.* at 8. Dynegy argues that this omission "expanded the scope of Part 845 beyond the CCR Rule, and, more importantly, beyond the statutory mandate, by regulating units that do not fit the legislature's definition of 'CCR surface impoundment.'" *Id.* Dynegy proposes revising the definition to conform with that used in Part 257, arguing that "IEPA has created confusion as to whether units that did not contain liquids as of the date of the CCR Rule became effective may be regulated under Part 845." *Id.* at 7, 9.

IEPA opposes conforming the definition with that in Part 257. PC 129 at 7. IEPA says that in its experience, some unlined CCR surface impoundments have leaked to the point that the CCR became dry. PC 120 at 35. In drafting the definition, IEPA therefore left out the term "liquids": "experience has shown a cover system is needed to control potential effects to health and the environment to the maximum extent possible." *Id.* For support, IEPA relies on USEPA's position that simply because water has leaked from the impoundment does not mean it should not be considered an inactive CCR surface impoundment:

> USEPA clearly states its position that inactive CCR surface impoundments require regulation and the only exceptions are inactive CCR surface impounds that are completely dewatered and have a cap that is consistent with Part 257. Given this position by USEPA, it appears the definition of '"inactive CCR surface impoundment" in Part 257.53 is not intended to include CCR surface impoundments that have no liquids simply because the liquids have leaked into the environment. PC 129 at 34.

Dynegy argues that IEPA has misinterpreted the preamble to USEPA's Part 257 by omitting the phrase "and liquids" from the definition. PC 137 at 22. Saying that the definition as proposed by IEPA would create an impossible scenario, Dynegy points to the preamble of Part 257. *Id.* Dynegy argues that the preamble identified a subset of units that qualified as "inactive CCR surface impoundments" but are not subject to all CCR Rule requirements because they were capped and dewatered within three years of the publication of the Rule. *Id.* In Dynegy's view, the USEPA preamble is addressing exceptions from the applicable requirements rather than broadening the definition to include units that do not contain liquids. *Id.* at 22-23.

IEPA opposes Dynegy's proposed changes to this definition, asserting that "an impoundment should not avoid regulation under Part 845 simply because the liquids in the impoundment have already leaked into the environment or have been removed in preparation for closure." PC 129 at 5, 6. IEPA argues that including "and liquids" could allow a surface impoundment to escape regulation under Part 845 if the unit currently did not have liquids. *Id.* Additionally, IEPA argues, "the presence or absence of liquids has no bearing on the amount of CCR in a surface impoundment." *Id.* at 6.

Board Findings. At issue is whether the inactive surface impoundment was "designed to hold" CCR and liquids, but still contains CCR," or "designed to hold CCR and liquids, but contains both CCR and liquids" on or after the proposed cutoff date of October 19, 2015. The Board agrees with the former intent, which is reflected in IEPA's proposed definition.

> "Inactive CCR surface impoundment" means a CCR surface impoundment in which CCR was placed before but not after October 19, 2015 and still contains CCR on or after October 19, 2015. Inactive CCR surface impoundments may be located at an active facility or inactive facility. 35 Ill. Adm. Code 845.120.

The Board notes that for an impoundment to be an inactive surface impoundment, first it must be a *CCR surface impoundment*, which is defined in Section 845.120 as being designed to "hold CCR and liquid." The next condition is that CCR should have been placed in the impoundment before but not after October 19, 2015 and still contains CCR on or after October 19, 2015. *See* 35 Ill. Adm. Code 845.120. Thus, the Board finds that the proposed definition of Inactive CCR surface impoundment does not expand the scope of the regulations as argued by Dynegy. Further, the Board finds that the definition is consistent with the federal regulations and provides clarity on the unintended consequence of excluding CCR surface impoundments containing CCR that may have leaked or were drained before the cutoff date. Therefore, the Board declines to make the revisions proposed by Dynegy to the definition of inactive surface impoundment.

Changing the Definition of "Inactive Closed CCR Surface Impoundment." Ameren requests that the definition of "inactive Closed CCR surface impoundment" be modified to replace "October 19, 2015" with "the effective date of this Part." PC 128 at 5. At first notice, the proposed definition read:

> "Inactive Closed CCR surface impoundment" means an inactive CCR surface impoundment that completed closure before October 19, 2015 with an Agency-approved closure plan. Proposed Section 845.120.

Ameren argues that setting October 19, 2015, as the cutoff for completion of closure is arbitrary and capricious, and requests that the Board consider site-specific work undertaken at Ameren plants to close surface impoundments. PC 128 at 17.

IEPA and the Attorney General's Office oppose deviating from the general applicability of the rules. PC 120 at 50-58, PC123 at 4. In drafting the rules that comprise Part 845, IEPA explains that it had to be mindful of the ultimate need that the rules would have to be approved

Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 20

OFFICE OF THE ATTORNEY GENERAL
STATE OF ILLINOIS

KWAME RAOUL
ATTORNEY GENERAL

April 7, 2021

Kim Schultz
Executive Director
Joint Committee on Administrative Rules
700 Stratton Building
Springfield, IL 62706
jcar@ilga.gov

Dear Director Schultz:

We are writing to further express the opposition of the Office of the Attorney General ("Office" or "AGO") to Ameren's proposed modifications of the Illinois Pollution Control Board's ("Board") Second Notice Proposed Regulations for Standards for the Disposal of Coal Combustion Residuals ("CCR") in Surface Impoundments (35 Ill. Adm. Code 845) ("Part 845"). Ameren's proposed modifications, previously submitted to the Joint Committee on Administrative Rules ("JCAR") and filed with the Board on March 30, 2021, are attached hereto as Exhibit A. These comments supplement our earlier comment letter, sent to you on March 2, 2021, and attached hereto as Exhibit B. Specifically, these comments address Ameren's unfounded legal argument that application of Part 845 to its closed impoundments would constitute an impermissible retroactive application of Section 22.59 of the Illinois Environmental Protection Act ("Act"), 415 ILCS 5/22.59.[1] To the contrary, Ameren's proposed modifications would violate the Act's plain language.

The "primary objective in construing a statute is to ascertain and give effect to the intent of the legislature, bearing in mind that the best evidence of such intent is the statutory language, given its plain and ordinary meaning." *People v. Eppinger*, 2013 IL 114121, ¶ 21. "In addition to the statutory language, legislative intent can be ascertained from consideration of the statute in its entirety, its nature and object, and the consequences of construing it one way or the other." *Id.*

These principles extend to issues of retroactivity. A statute may operate retroactively if that is what the General Assembly intended. *Landgraf v. USI Film Products*, 511 U.S. 244, 280 (1994); *Commonwealth Edison Co. v. Will Cty. Collector*, 196 Ill. 2d 27, 39 (2001) (adopting *Landgraf*

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[1] Section 22.59 of the Environmental Protection Act was created by Public Act 101-171, § 5, and became effective on July 30, 2019.

The only way for the Board to ensure that Part 845 is as "comprehensive and protective" as the federal regulations—as is plainly required by Section 22.59(g)(1) of the Act—is to reject Ameren's proposed modifications, and to adopt Part 845 as proposed at second notice.

2. Applying Part 845 to Ameren's Impoundments is Not Retroactive, Let Alone Impermissibly So.

Ameren has argued that Part 845 should not be fully applied to its closed impoundments because it would have a retroactive impact. Part 845's **prospective** requirements for monitoring presently-contaminated groundwater, and providing appropriate post-closure care to impoundments closed in place, are not retroactive in effect. Moreover, even if Part 845's requirements were considered retroactive as to previously-closed impoundments, they would be permissible because the General Assembly's clear intent was that the State's regulations have at least the same temporal scope as the federal regulations. *See People ex rel. Madigan v. J.T. Einoder, Inc.*, 2015 IL 117193, ¶ 29.

First, application of Part 845 to Ameren's closed impoundments is not retroactive. "An amended statute will be deemed to have retroactive impact if application of the new statute would impair rights a party possessed when he acted, increase a party's liability for past conduct, or impose new duties with respect to transactions already completed." *Id.* at ¶ 30. The Part 845 regulations do not impair any rights of Ameren's, because no party has a right to maintain groundwater contaminated by coal ash constituents from inadequately-lined impoundments. *See Tri-County Landfill Co. v. Illinois Pollution Control Bd.*, 41 Ill. App. 3d 249, 257 (2d Dist. 1976) ("No one even in the pursuit of an otherwise lawful business ever acquires a vested right to create or maintain a nuisance in connection therewith"). The regulations do not impose any liability for Ameren's past conduct; rather, liability would be imposed only for a failure to comply with the regulations going forward. The regulations do not impose any new duties with respect to a completed "transaction" because, as demonstrated by the scope of requirements under the federal Part 257 regulations, the "transactions" here are not completed until all contaminated groundwater has met applicable groundwater quality standards.

Ameren has focused on "closure" as ending regulatory obligations for its impoundments. This is wrong factually and legally. Simply closing an impoundment by capping in place, or removing CCR from an impoundment, does not by itself immediately address already-contaminated groundwater. Neither does it fulfill all the requirements of the federal Part 257 regulations.

Second, even if applying Part 845 to Ameren's closed impoundments were considered retroactive, it would not be impermissible. It would be required. The presumption against retroactivity in *Landgraf* and the Illinois cases that follow it is just that—a presumption of legislative intent. On the other hand, "if the legislature has clearly indicated the temporal reach of the amended statute, that expression of legislative intent must be given effect . . . ." *Einoder*, 2015 IL 117193, ¶ 29.

As discussed above, the General Assembly in Section 22.59(g)(1) clearly expressed its intent that the Board's regulations have the same temporal scope as the federal Part 257 regulations. That means that any CCR surface impoundment in existence as of October 19, 2015 must be fully regulated under Part 845. Ameren's proposed modifications to remove that date from Part 845 must be rejected.

Sincerely,

Andrew Armstrong

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Petition of Electric Energy, Inc. for an Adjusted Standard under 35 Ill. Admin. Code Part 845

EXHIBIT 21

NATIONAL ARCHIVES AND RECORDS ADMINISTRATION
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FEDERAL REGISTER

Vol. 80 Friday,
No. 74 April 17, 2015

Part II

Environmental Protection Agency

40 CFR Parts 257 and 261
Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 257 and 261

[EPA–HQ–RCRA–2009–0640; FRL–9919–44–OSWER]

RIN–2050–AE81

Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA or the Agency) is publishing a final rule to regulate the disposal of coal combustion residuals (CCR) as solid waste under subtitle D of the Resource Conservation and Recovery Act (RCRA). The available information demonstrates that the risks posed to human health and the environment by certain CCR management units warrant regulatory controls. EPA is finalizing national minimum criteria for existing and new CCR landfills and existing and new CCR surface impoundments and all lateral expansions consisting of location restrictions, design and operating criteria, groundwater monitoring and corrective action, closure requirements and post closure care, and recordkeeping, notification, and internet posting requirements. The rule requires any existing unlined CCR surface impoundment that is contaminating groundwater above a regulated constituent's groundwater protection standard to stop receiving CCR and either retrofit or close, except in limited circumstances. It also requires the closure of any CCR landfill or CCR surface impoundment that cannot meet the applicable performance criteria for location restrictions or structural integrity. Finally, those CCR surface impoundments that do not receive CCR after the effective date of the rule, but still contain water and CCR will be subject to all applicable regulatory requirements, unless the owner or operator of the facility dewaters and installs a final cover system on these inactive units no later than three years from publication of the rule. EPA is deferring its final decision on the Bevill Regulatory Determination because of regulatory and technical uncertainties that cannot be resolved at this time.

DATES: This final rule is effective on October 14, 2015.

ADDRESSES: EPA has established three dockets for this regulatory action under Docket ID No. EPA–HQ–RCRA–2009–0640, Docket ID No. EPA–HQ–RCRA–2011–0392, and Docket ID No. EPA–HQ–RCRA–2012–0028. All documents in these dockets are available at *http://www.regulations.gov*. Although listed in the index, some information is not publicly available, *e.g.*, Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the OSWER Docket, EPA/DC, WJC West Building, Room 3334, 1301 Constitution Ave. NW., Washington, DC 20460. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the OSWER Docket is 202–566–0276.

FOR FURTHER INFORMATION CONTACT: For questions on technical issues: Alexander Livnat, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5304P; telephone number: (703) 308–7251; fax number: (703) 605–0595; email address: *livnat.alexander@epa.gov*, or Steve Souders, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5304P; telephone number: (703) 308–8431; fax number: (703) 605–0595; email address: *souders.steve@epa.gov*. For questions on the regulatory impact analysis: Richard Benware, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5305P; telephone number: (703) 308–0436; fax number: (703) 308–7904; email address: *benware.richard@epa.gov*. For questions on the risk assessment: Jason Mills, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5305P; telephone number: (703) 305–9091; fax number: (703) 308–7904; email address: *mills.jason@epa.gov*.

For more information on this rulemaking please visit *http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/index.htm*.

SUPPLEMENTARY INFORMATION:

A. Does this action apply to me?

This rule applies to all coal combustion residuals (CCR) generated by electric utilities and independent power producers that fall within the North American Industry Classification System (NAICS) code 221112 and may affect the following entities: Electric utility facilities and independent power producers that fall under the NAICS code 221112. The industry sector(s) identified above may not be exhaustive; other types of entities not listed could also be affected. The Agency's aim is to provide a guide for readers regarding those entities that potentially could be affected by this action. To determine whether your facility, company, business, organization, etc., is affected by this action, you should refer to the applicability criteria discussed in Unit VI.A. of this document If you have any questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. What actions are not addressed in this rule?

This rule does not address the placement of CCR in coal mines. The U.S. Department of Interior (DOI) and, as necessary, EPA will address the management of CCR in minefills in separate regulatory action(s), consistent with the approach recommended by the National Academy of Sciences, recognizing the expertise of DOI's Office of Surface Mining Reclamation and Enforcement in this area. See Unit VI of this document for further details. This rule does not regulate practices that meet the definition of a beneficial use of CCR. Beneficial uses that occur after the effective date of the rule need to determine if they comply with the criteria contained in the definition of ''beneficial use of CCRs.'' This rule does not affect past beneficial uses (*i.e.*, uses completed before the effective date of the rule.) See Unit VI of this document for further details on proposed clarifications of beneficial use. Furthermore, CCR from non-utility boilers burning coal are also not addressed in this final rule. EPA will decide on an appropriate action for these wastes through a separate rulemaking effort. See Unit IV of this document for further details. Finally, this rule does not apply to municipal solid waste landfills (MSWLFs) that receive CCR for disposal or use as daily cover.

C. The Contents of This Preamble Are Listed in the Following Outline

substantial risks associated with currently operating CCR surface impoundments, *i.e.,* the potential for leachate and other releases to contaminate groundwater and the potential for catastrophic releases from structural failures, were not measurably different than the risks associated with ''inactive'' CCR surface impoundments that continued to impound liquid, even though the facility had ceased to place additional wastes in the unit. EPA noted as well that the risks are primarily driven by the older existing units, which are generally unlined.

In the section of the preamble discussing the subtitle D option, EPA did not expressly highlight the application of the rule to inactive CCR surface impoundments, but generally explained that EPA's approach to developing the proposed subtitle D requirements for surface impoundments (which are not addressed by the part 258 regulations that served as the model for the proposed landfill requirements) was to seek to be consistent with the technical requirements developed under the subtitle C option. (See 75 FR 35193.) (''In addition, EPA considered that many of the technical requirements that EPA developed to specifically address the risks from the disposal of CCR as part of the subtitle C alternative would be equally justified under a RCRA subtitle D regime . . . The factual record—*i.e.,* the risk analysis and the damage cases—supporting such requirements is the same, irrespective of the statutory authority under which the Agency is operating . . . Thus several of the provisions EPA is proposing under RCRA subtitle D either correspond to the provisions EPA is proposing to establish for RCRA subtitle C requirement. These provisions include the following regulatory provisions specific to CCR that EPA is proposing to establish: *Scope and applicability (i.e., who will be subject to the rule criteria/requirements)* . . .'') (emphasis added).

EPA received numerous comments on this aspect of the proposal. On the whole, the comments were focused on EPA's legal authority under subtitle C to regulate inactive and closed units, as well as inactive and closed facilities. One group of commenters, however, specifically criticized the proposed subtitle D regulation on the grounds that it failed to address the risks from inactive CCR surface impoundments. The majority of commenters, however, argued that RCRA does not authorize EPA to regulate inactive or closed surface impoundments. These commenters focused on two primary arguments: first, that RCRA's definition of ''disposal'' cannot be interpreted to include ''passive migration'' based on the plain language of the statute, and second, that such an interpretation conflicted with court decisions in several circuits, holding that under CERCLA ''disposal'' does not include passive leaking or the migration of contaminants.

In support of their first argument, commenters argued that the plain language of RCRA demonstrates that the requirements are ''prospective in nature'' and thus cannot be interpreted to apply to past activities, *i.e.,* the past disposals in inactive CCR units. They also argued that the absence of the word ''leaching'' from the definition of ''disposal'' clearly indicates that Congress did not intend to cover passive leaking or migration from CCR units. The commenters also selectively quoted portions of past EPA statements, claiming that these demonstrated that EPA had conclusively interpreted RCRA to preclude jurisdiction over inactive units and facilities. In particular, they pointed to EPA's decision in 1980 not to require permits for closed or inactive facilities.

Commenters cited several cases to support their second claim. These include *Carson Harbor Vill.* v. *Unocal Corp.,* 270 F.3d 863 (9th Cir. 2001); *United States* v. *150 Acres of Land,* 204 F.3d 698, 706 (2000); *ABB Industrial Systems* v. *Prime Technology,* 120 F.3d 351, 358 (2d Cir. 1997); *United States* v. *CMDG Realty Co.,* 96 F.3d 706, 711 (3rd Cir. 1996); *Joslyn Mfg. Co.* v. *Koppers Co.,* 40 F.3d 750, 762 (5th Cir. 1994); *Delaney* v. *Town of Carmel,* 55 F. Supp. 2d 237, 256 (S.D.N.Y. 1999); *see also Interfaith Cmty. Org.* v. *Honey-Well Intl Inc.,* 263 F. Supp. 2d 796, 846 n.10 (D.N.J. 2003). The commenters acknowledged that these cases were all decided under CERCLA, but claim that the cases are all equally dispositive with respect to RCRA's definition of disposal because CERCLA specifically incorporates by reference RCRA's statutory definition of disposal.

As an initial matter, it is important to correct certain misunderstandings contained throughout a number of the comments. First, EPA did propose to include inactive units under the subtitle D alternative. EPA clearly signaled its intent to cover the same universe of units and facilities covered under the subtitle C proposal. EPA did not include a corresponding discussion in its explanation of the subtitle D alternative because application of the criteria to inactive units did not represent such a significant departure from EPA's past practice or interpretation. As discussed in more detail below, the original subtitle D regulations applied to all existing disposal units. See 40 CFR 257.1(a)(1)–(2), (c) and 43 FR 4942–4943, 4944.

Second, several commenters criticized EPA's purported proposal to cover both ''closed'' and ''inactive'' surface impoundments, using the terms interchangeably. These same commenters also refer to both ''inactive facilities'' and ''inactive units.'' These are all different concepts, and EPA clearly distinguished between them.

EPA proposed to regulate only ''inactive'' surface impoundments that had not completed closure of the surface impoundment before the effective date. ''Inactive'' surface impoundments are those that contain both CCR and water, but no longer receive additional wastes. By contrast, a ''closed'' surface impoundment would no longer contain water, although it may continue to contain CCR (or other wastes), and would be capped or otherwise maintained. There is little difference between the potential risks of an active and inactive surface impoundment; both can leak into groundwater, and both are subject to structural failures that release the wastes into the environment, including catastrophic failures leading to massive releases that threaten both human health and the environment. This is clearly demonstrated by the recent spill in the Dan River in North Carolina, which occurred as the result of a structural failure at an inactive surface impoundment. Similarly, as demonstrated by the discovery of additional damage cases upon the recent installation of groundwater monitoring systems at existing CCR surface impoundments in Michigan and Illinois, many existing CCR surface impoundments are currently leaking, albeit currently undetected. These are the risks the disposal rule specifically seeks to address, and there is no logical basis for distinguishing between units that present the same risks.

EPA did not propose to require ''closed'' surface impoundments to ''reclose.'' Nor did EPA intend, as the same commenters claim, that ''literally hundreds of previously closed . . . surface impoundments—many of which were properly closed decades ago under state solid waste programs, have changed owners, and now have structures built on top of them—would be considered active CCR units.'' Accordingly, the final rule does not impose any requirements on any CCR surface impoundments that have in fact ''closed'' before the rule's effective date—*i.e.,* those that no longer contain water and can no longer impound liquid.

2. Definition of CCR Surface Impoundment

EPA proposed to define a CCR surface impoundment to mean a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials) which is designed to hold an accumulation of CCR containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds and lagoons. CCR surface impoundments are used to receive CCR that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

The Agency received many comments on the proposed definition of CCR surface impoundment. The majority of commenters argued that the definition was overly broad and would inappropriately capture surface impoundments that are not designed to hold an accumulation of CCR. Commenters were concerned that the proposed definition could be interpreted to include downstream secondary and tertiary surface impoundments, such as polishing, cooling, wastewater and holding ponds that receive only de minimis amounts of CCR. Commenters reasoned that these types of units in no practical or technical sense could be described as units ''used to receive CCR that has been sluiced.''

Other commenters raised concern that the definition did not differentiate between temporary and permanent surface impoundments. Commenters stated that many facilities rely on short-term processing and storage before moving CCR off-site for beneficial use or permanent disposal and that these units should not be required to comply with all of the technical criteria required for more permanent disposal impoundments.

Upon further evaluation of the comments, the Agency has amended the definition of CCR surface impoundment to clarify the types of units that are covered by the rule. After reviewing the comments, EPA reviewed the risk assessment and the damage cases to determine the characteristics of the surface impoundments that are the source of the risks the rule seeks to address. Specifically, these are units that contain a large amount of CCR managed with water, under a hydraulic head that promotes the rapid leaching of contaminants. These risks do not differ materially according to the management activity (*i.e.,* whether it was ''treatment,'' ''storage'' or ''disposal'') that occurred in the unit, or whether the facility someday intended to divert the CCR to beneficial use. However, EPA agrees with commenters that units containing only truly ''de minimis'' levels of CCR are unlikely to present the significant risks this rule is intended to address.

EPA has therefore revised the definition to provide that a CCR surface impoundment as defined in this rule must meet three criteria: (1) The unit is a natural topographic depression, man-made excavation or diked area; (2) the unit is designed to hold an accumulation of CCR and liquid; and (3) the unit treats, stores or disposes of CCR. These criteria correspond to the units that are the source of the significant risks covered by this rule, and are consistent with the proposed rule. EPA agrees with commenters that relying solely on the criterion from the proposed rule that the unit be designed to accumulate CCR could inadvertently capture units that present significantly lower risks, such as process water or cooling water ponds, because, although they will accumulate any trace amounts of CCR that are present, they will not contain the significant quantities that give rise to the risks modeled in EPA's assessment. By contrast, units that are designed to hold an accumulation of CCR and in which treatment, storage, or disposal occurs will contain substantial amounts of CCR and consequently are a potentially significant source of contaminants. However, EPA disagrees that impoundments used for ''short-term processing and storage'' should not be required to comply with all of the technical criteria applicable to CCR surface impoundments. By ''short-term,'' the commenters mean that some portion of the CCR is removed from the unit; however, in EPA's experience these units are never completely dredged free of CCR. But however much is present at any given time, over the lifetime of these ''temporary'' units, large quantities of CCR impounded with water under a hydraulic head will be managed for extended periods of time. This gives rise to the conditions that both promote the leaching of contaminants from the CCR and are responsible for the static and dynamic loadings that create the potential for structural instability. These units therefore pose the same risks of releases due to structural instability and of leachate contaminating ground or surface water as the units in which CCR are ''permanently'' disposed.

The final definition makes extremely clear the impoundments that are covered by the rule, so an owner or operator will be able to easily discern whether a particular unit is a CCR surface impoundment. CCR surface impoundments do not include units generally referred to as cooling water ponds, process water ponds, wastewater treatment ponds, storm water holding ponds, or aeration ponds. These units are not designed to hold an accumulation of CCR, and in fact, do not generally contain significant amounts of CCR. Treatment, storage, or disposal of accumulated CCR also does not occur in these units. Conversely, a constructed primary settling pond that receives sluiced CCR directly from the electric utility would meet the definition of a CCR surface impoundment because it meets all three criteria of the definition: It is a man-made excavation and it is designed to hold an accumulation of CCR (*i.e.,* directly sluiced CCR). It also engages in the treatment of CCR through its settling operation. The CCR may be subsequently dredged for disposal or beneficial use elsewhere, or it may be permanently disposed within the unit. Similarly, secondary or tertiary impoundments that receive wet CCR or liquid with significant amounts of CCR from a preceding impoundment (*i.e.,* from a primary impoundment in the case of a secondary impoundment, or from a secondary impoundment in the case of a tertiary impoundment), even if they are ultimately dredged for land disposal elsewhere are also considered CCR surface impoundments and are covered by the rule. To illustrate further, consider a diked area in which wet CCR is accumulated for future transport to a CCR landfill or beneficial use. The unit is accumulating CCR, while allowing for the evaporation or removal of liquid (no free liquids) to facilitate transport to a CCR landfill or for beneficial use. In this instance, the unit again meets all three definition criteria, it is a diked area (*i.e.,* there is an embankment), it is accumulating CCR for ultimate disposal or beneficial use; and it is removing any free liquids, (*i.e.,* treatment). As such, this unit would meet the definition of CCR surface impoundment. In all of these examples significant quantities of CCR are impounded with water under a hydraulic head that will be managed for extended periods of time. This gives rise to the conditions that both promote the leaching of contaminants from the CCR and are responsible for the static and dynamic loadings that create the potential for structural instability. These units therefore all pose the same risks of